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WHO: The Office of the Federal Register.

WHAT: Free public briefings (approximately 3 hours) to present:

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2. The relationship between the Federal Register and Code of Federal Regulations.
3. The important elements of typical Federal Register documents.
4. An introduction to the finding aids of the FR/CFR system.

WHY: To provide the public with access to information necessary to research Federal agency regulations which directly affect them. There will be no discussion of specific agency regulations.

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Rules and Regulations

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This section of the FEDERAL REGISTER contains regulatory documents having general applicability and legal effect, most of which are keyed to and codified in the Code of Federal Regulations, which is published under 50 titles pursuant to 44 U.S.C. 1510.
The Code of Federal Regulations is sold by the Superintendent of Documents. Prices of new books are listed in the first FEDERAL REGISTER issue of each week.

OFFICE OF PERSONNEL MANAGEMENT

5 CFR Parts 307 and 316

Veterans Readjustment Appointments; Temporary and Term Employment

AGENCY: Office of Personnel Management.

ACTION: Final regulations.

SUMMARY: The Office of Personnel Management (OPM) is amending its regulations on the Veterans Readjustment Appointment (VRA) Program to incorporate statutory changes. The statutory authority for the VRA program as cited in the "Veterans' Benefits Improvement Act of 1984" expired on September 30, 1986. On October 28, 1986, the President signed into law the "Veterans' Benefits Improvement and Health-Care Authorization Act of 1986," extending the law through December 31, 1989. These regulations would allow agencies to use the VRA authority through December 31, 1989.

DATE: July 7, 1988.

FOR FURTHER INFORMATION CONTACT: Don Smith, (202) 632-0643.

SUPPLEMENTARY INFORMATION: On April 30, 1987, the Office of Personnel Management (OPM) published (at 52 FR 15730) proposed regulations to amend 5 CFR Parts 307 and 316 to incorporate statutory changes (Pub. L. 99-576) to the Veterans Readjustment Appointment (VRA) program and to delete unnecessary paragraphs. We received comments from three Federal agency representatives, three Federal employees unions, and two individuals. Key aspects of the proposal are summarized below along with a discussion of the more significant comments received on the regulations and OPM's decision.

Key Provisions

—Extends the current statutory authority for the VRA authority through December 31, 1989.
—Revises Part 307 to include only the basic requirements of law and eliminates language which properly belongs in the Federal Personnel Manual (FPM).
—Amends 5 CFR 316.302(c) and 316.402(b)(4) to delete unnecessary language.

Comments Received

—Two agencies suggested deleting the training agreement required by OPM regulations and guidance. They felt the training agreement is cumbersome to administer and in many instances training is not needed for the position to be filled. Training is an essential component of the basic law that established the VRA authority; therefore, we are unable to comply with this suggestion.
—One agency suggested that OPM waive the educational limit for temporary VRA eligibles who obtain education in excess of 14 years during a temporary appointment for VRA eligibles. OPM does not have the authority to waive this educational limitation because it is established by law.
—One agency and a Federal employees union disagreed with OPM's decision to delete information that is also published in its Federal Personnel Manual. We believe the deleted information more properly belongs in the Federal Personnel Manual and access to this information is readily available to the public.

E.O. 12291, Federal Regulation

I have determined that this is not a major rule as defined by section 1(b) of E.O. 12291, Federal Regulation.

Regulatory Flexibility Act

I certify that these regulations will not have a significant economic impact on a substantial number of small entities because they affect only Federal employees.

List of Subjects in 5 CFR Parts 307 and 316

Government employees, Veterans.

U.S. Office of Personnel Management.
Constance Horner,
Director.

Accordingly, OPM amends Parts 307 and 316 of Title 5, Code of Federal Regulations, as follows:

PART 307—VETERANS READJUSTMENT APPOINTMENTS

1. The authority citation for Part 307 continues to read as follows:

Authority: 5 U.S.C. 3301, 3302; E.O. 11521, 3 CFR 1970 Comp. p. 912, 38 U.S.C. 2014.

2. Sections 307.102 and 307.103 are revised to read as follows:

§ 307.102 Coverage and general responsibilities.

(a) Federal agencies have the responsibility to provide the maximum of employment and job advancement opportunities to qualified disabled veterans and Vietnam era veterans.

(b) The Office of Personnel Management (OPM) will prescribe instructions and guidance for implementing the Veterans Readjustment Appointment Program through the Federal Personnel Manual (FPM) system.

(c) The current statutory authority for the program extends through December 31, 1989.

§ 307.103 Appointing authority.

An agency may appoint any veteran who meets the basic veterans readjustment eligibility requirements provided by law.

§§ 307.104 through 307.107 [Removed]

3. Sections 307.104 through 307.107 are removed.

PART 316—TEMPORARY AND TERM EMPLOYMENT

4. The authority citation for Part 316 is revised to read as set forth below:

Authority: 5 U.S.C. 3301 and 3302, and E.O. 10577 (3 CFR 1954–1958 Comp., p.218); Section 316.302 also issued under 5 U.S.C. 3304(c), 38 U.S.C. 2014, and E.O. 12362, as revised by E.O. 12585; Section 316.402 also issued under 5 U.S.C. 3304(c) and 3312, 22 U.S.C. 2506 (93 Stat. 371), E.O. 12137, 38 U.S.C. 2014, and E.O. 12362, as revised by E.O. 12585.

5. Section 316.302 is amended by revising paragraph (c)(2) to read as follows:

§ 316.302 Selection of term employees.

* * * * *

(c) * * *

(2) Any veteran who meets the qualifications for a veterans readjustment appointment is eligible for employment under this paragraph. The Office will prescribe instructions and guidance in FPM Chapter 316 on implementing term employment for veterans readjustment appointment eligibles.

* * * * *

6. Section 316.402 is amended by revising paragraph (b)(4) to read as follows:

§ 316.402 Authorities for temporary appointments.

* * * * *

(b) * * *

(4) Any veteran who meets the qualifications for a veterans readjustment appointment is eligible for employment under this paragraph. The Office will prescribe instructions and guidance in FPM Chapter 316 on temporary limited employment for veterans readjustment appointment eligibles.

* * * * *

[FR Doc. 88-12761 Filed 6-6-88; 8:45 am]
BILLING CODE 6325-01-M

FEDERAL RESERVE SYSTEM

12 CFR Part 208

[Regulation H; Docket No. R-0615]

Agricultural Loan Loss Amortization

AGENCY: Board of Governors of the Federal Reserve System.

ACTION: Final rule.

SUMMARY: This regulation implements Title VIII of the Competitive Equality Banking Act of 1987 ("CEBA") which permits state member agricultural banks to amortize losses on qualified agricultural loans. The regulation describes the procedures and standards applicable to state member banks desiring to amortize losses under that statute. It also describes the manner in which such amortizations are to be done. Title VIII of CEBA required regulations implementing Title VIII to be issued not more than 90 days after enactment, that is, by November 9, 1987. Therefore, the Board initially published the rule as a final rule effective November 9, 1987, and provided for reporting on the Call Report beginning December 31, 1987, but allowed interested parties to comment through December 3, 1987 (52 FR 42087; November 3, 1987). The comment period was extended and closed on January 8, 1988 (52 FR 46984; December 11, 1987).

After consideration of comments received, the Board is making one substantive change and several technical changes to the rule. The substantive change would allow eligible state member banks to amortize over a period of up to seven years losses on reappraisal or sale of real or personal property that was acquired in connection with a qualified agricultural loan and that the bank owned on January 1, 1983, or subsequently acquires prior to January 1, 1992. Under the initial rule, such property had to be currently owned. The technical changes clarify the regulatory definition of "qualified agricultural loan" and add a definition for "agriculturally-related other property."

EFFECTIVE DATE: The rule is retroactively effective to November 9, 1987.

FOR FURTHER INFORMATION CONTACT: Rhoger H Pugh, Manager (202) 728-5883, Stanley B. Rediger, Senior Financial Analyst (202) 452-2629, Division of Banking Supervision and Regulation; Helen Lewis (202) 452-3490, Economist, Financial Reports Section, Division of Research and Statistics; or John Harry Jorgenson, Senior Attorney (202) 452-3778, Legal Division; Board of Governors of the Federal Reserve System, Washington, DC 20551. For the hearing impaired ONLY, Telecommunications Device for the Deaf, Earnestine Hill or Dorothea Thompson, (202) 452-3544.

SUPPLEMENTARY INFORMATION: Title VIII of the Competitive Equality Banking Act of 1987 ("CEBA") permits an agricultural bank to amortize: (1) Losses on qualified agricultural loans shown on its annual financial statement for any year between December 31, 1983, and January 1, 1992; and (2) losses suffered as the result of an appraisal of agriculturally related other property between January 1, 1983, and January 1, 1992.

Title VIII of the CEBA also required that the federal banking agencies issue implementing regulations no later than 90 days after the effective date of the Act (that is, no later than November 9, 1987). In order to comply with this requirement, the Board initially published this rule as a final rule effective November 9, 1987, and provided for reporting on the Call Report beginning December 31, 1987, but allowed interested parties to comment through December 3, 1987 (52 FR 42087; November 3, 1987). The comment period was extended and closed on January 8, 1988 (52 FR 46984; December 11, 1987). The Office of the Comptroller of the Currency ("OCC") and the Federal Deposit Insurance Corporation ("FDIC") proposed substantially identical regulations containing only technical variations necessary to accommodate their own regulatory and organizational systems and requested comments on their rules as well. The standards to be applied by the Board, the OCC, and the FDIC are the same, however.

After consideration of the comments it received, the Board is making one substantive change and several technical changes to the rule. The substantive change would allow eligible state member banks to amortize over a period of up to seven years losses on reappraisal or sale of real or personal property that was acquired in connection with a qualified agricultural loan and that the bank owned on January 1, 1983, or subsequently acquires prior to January 1, 1992. Under the initial rule, such property had to be owned on November 9, 1987, to qualify. This amendment is retroactively effective to November 9, 1987. The technical changes amend the definition of "qualified agricultural loan" to clarify that the Board intends to construe the phrase broadly and add a definition of "agriculturally-related other property" to clarify the treatment of losses due to reappraisals and sales of such property.

The statute allows amortization for agricultural loan losses that would be reflected on annual financial statements for 1984-1991. It also allows amortization for losses resulting from reappraisals on real or personal property acquired in connection with making an agricultural loan that the bank would otherwise be required to show on its annual financial statements. To ensure that losses due to reappraisals are treated comparably to loan losses, the regulation requires that losses from reappraisals that the bank would be required to reflect on financial statements for 1983-1991 will be allowed a seven year amortization period in the same manner as agricultural loan losses generally, i.e., they must be fully amortized by 1998. For the same reason, the regulation provides that losses resulting from reappraisals after 1991 are not eligible for amortization.

Discussion of Comments Received

Sixteen commenters submitted twenty-one comments on the Board's rule. Seventeen comments addressed the substance of the rule, and the remaining four comments concerned the extension of the original comment period. Comments were received from six banks, four banking trade associations (two national and two state-level), four

Reserve Banks, one law firm, and the Financial Accounting Standards Board ("FASB"). Additionally, Board staff and FDIC staff met with representatives of the two national trade associations commenting (the American Bankers Association ("ABA") and the Independent Bankers Association of America ("IBAA")) on December 11, 1987, after the associations asked for clarification of the rule as published. Subsequent to the meeting, the IBAA and the ABA each submitted a substantive written comment on the rule.

General Comments

Four banks submitted comments supporting the rule, and three of these suggested that the Board liberalize certain of its provisions. A fifth bank opposed the rule because it does not believe it is prudent to give special treatment to classes of loans when such treatment results in false statements of available capital. Four trade associations (two state and two federal) submitted written comments generally supporting the rule and suggesting changes to it. Four Federal Reserve banks commented favorably on the rule although several expressed reservations about the advisability of the statutory program itself and asked about administrative procedures. The comment from the law firm favoring the proposal was extensively paraphrased in one of the bank comments favoring the proposal and suggesting substantive changes to the portion of the rule concerning amortization of losses related to real estate sales or reappraisals.

Specific Comments

The FASB Comment. The FASB comment criticized the practice established by Title VIII of the CEBA of allowing banks to amortize loan losses rather than recognizing the losses when they are taken. It voiced a concern over yet another difference between regulatory reporting standards and generally accepted accounting principals and believes such differences only serve to confuse and mislead shareholders and financial analysts. The FASB comment suggested that agricultural loan problems could be treated more effectively by modifying the regulatory prescriptions of acceptable capital rather than adding lines to regulator financial statements. Regardless of whether the Board agrees with the FASB approach, Title VIII of the CEBA explicitly requires the approach embodied in the rule.

Definition of "agricultural bank." Section 208.15(a)(1) defines an agricultural bank as any bank: (A) With FDIC insured deposits; (B) located in an area of the country with an economy dependent on agriculture; (C) with total assets of $100 million or less; and (D) with at least 25 percent of its total loans in qualified agricultural loans or with less than 25 percent of its total loans in qualified agricultural loans but which the Board, appropriate Reserve Bank, or state regulator still recommends to the FDIC as eligible.

The definition of an agricultural bank includes the statutory requirement that the bank have total assets of $100 million or less. Comments were received suggesting that the regulators clarify what happens if a bank is approved for loss deferral and subsequently exceeds the size limitation. While Congress did not intend for banks larger than $100 million in assets to defer loan losses under the program, it is of little value to a member bank to defer a loss one year if it must reverse that deferral the next year because it grows to over $100 million in assets. Therefore, the Board expects a member bank to meet the definition of an agricultural bank, including the size limitation, upon initial application and as of every quarter end that new agricultural loan losses are to be deferred. Once admitted to the program, any loss which was properly deferred will be allowed to amortized according to the regulation regardless of the bank's size, but new losses can be amortized only if the bank has assets of less than $100 million.

On the other hand, the Board does not intend to allow member banks to bypass the application/review process through a merger with another bank which has already received program approval. Conversely, the merger of two banks which are both in the program could result in a participating bank with over $100 million in assets. Because mergers are not expected to be frequent, the status of loss deferral subsequent to a merger will be determined on a case-by-case basis. State member banks should discuss their loss deferral status with their Reserve Bank.

One bank and the IBAA urged that the Federal Reserve be liberal when it determines whether a bank meets the 25 percent test because prudent banks may have charged off substantial amounts of such loans but, due to the depressed agricultural economy, may not have been able to replace such loans with new agricultural loans. The bank commenting suggested using a pre-charge-off measure of agricultural loan values to prevent failure to qualify because of the depressed value of collateral or the smaller size of loans made to the depressed agricultural sector. The IBAA suggested that a bank should satisfy the test if at any time since December 31, 1983, it met the test.

The Board does not believe such a change is necessary as the rule does not establish the 25 percent test as an absolute requirement. Thus, factors such as depressed collateral value or lack of prudent agricultural lending opportunities will be considered when applications for loan loss amortization are reviewed to ensure that this arbitrary limit alone is not the reason a bank cannot participate. Further, Title VIII of CEBA was directed toward banks with a continuing commitment to agriculture, and given the broad definition of "agricultural loan" in the regulation, a bank otherwise qualifying under the program should have no difficulty satisfying this test.

Some commenters also urged that the Board list specific criteria to identify agricultural areas. As it did when considering the initial rule, the Board concluded that the normal means of identifying agricultural areas—income levels, revenue flows, acreage in production—are abnormally depressed due to the current state of the agricultural economy. Furthermore, adopting a list of acceptable counties or geographic regions might leave the erroneous impression that a bank located outside such an arbitrary area could not qualify even though it might otherwise qualify as an "agricultural bank," just as the relatively low level of farm income compared to other income might artificially mask local areas that traditional are dependent upon agriculture but currently have a depressed level of income from agriculture. Consequently, each application should include a description of the bank's location, dominant lines of commerce in its service area, and any other information the bank believes will support the contention that it is located in an agricultural area.

Definition of "qualified agricultural loan." Under section 801 of Title VIII of the CEBA,

> The term "qualified agricultural loan" means a loan made to finance the production of agricultural products or livestock in the United States, a loan secured by farmland or farm machinery, or such other category of loans as the appropriate Federal banking agency may deem eligible.

Section 208.15(a)(2) of the Board's rule defines a qualified agricultural loan to include any loan qualifying as "loans to finance agricultural production and other loans to farmers" or as "loans secured by farm land" for purposes of Schedule RC–C of the FFIEC

Consolidated Report of Condition. The definition also includes other loans and leases that the applying bank proves to be sufficiently related to agriculture to qualify in the opinion of the bank's Reserve Bank.

These Call Report definitions are virtually identical to those contained in Title VIII of the CEBA but are more comprehensive and permit the agencies to use the Call Reports as the predominant monitoring device for the amortization program. Therefore, the Board initially saw no reason to repeat the definition in the statute when the regulatory definition was of a more descriptive nature and referred to Call Report terms with which member banks are familiar. Additionally, as suggested by Title VIII of the CEBA, the Board retained discretion to deem other types of loans and leases to be "qualified" and to recommend them to the FDIC as eligible if the requesting bank demonstrates those assets to be sufficiently related to agriculture.

Three banks and three trade associations commented on this provision. One bank suggested that the regulation treat any loan made by an agricultural bank as an agricultural loan because such banks as a practical matter only make agricultural and agriculturally-related loans. Another bank suggested that loans to farm equipment suppliers be specifically mentioned in the rule. The Independent Bankers Association of Minnesota and the third bank noted that the statute mentions farm machinery loans specifically while the rule does not and suggested that the rule include this category of loans. The third bank and the three trade associations suggest that the Board provide examples of others types of loans that would be considered as agriculturally-related loans.

In order to clarify that the regulatory definition of "qualified agricultural loan" is as broad as the statutory definition and is not intended to limit the types of loans which a member bank may include in an application, the statutory phrases referring to farm machinery loans will be added to the regulatory definition. Member banks should refer to the "Line Item Instructions for the Consolidated Report of Condition ("Call Report")" for Schedule RC–C for an indication of the other types of loans that will be considered as qualifying for amortization. For example, qualified agricultural loans would include loans reported under line item 1(b)—loans secured by farmland (land known to be used or usable for agricultural purposes, such as crop and stock production, grazing or pasture land, whether tillable or not and whether wooded or not). Similarly, loans reported under line item 3 would qualify. Such loans would include loans to finance agricultural production (such as for growing or sorting crops, or breeding, raising, fattening, or marketing livestock), or for purchases of farm machinery, equipment, or implements. Consistent with the congressional intent, the definitions on the Call Report are not necessarily exclusive descriptions of eligible loans. If a member bank believes that a loan was made for an agricultural purpose, it may apply to amortize it even though the loan was not reported on the Call Report as an agricultural loan. A determination will be made on a case-by-case basis on whether each loan qualifies.

Amortization. Section 208.15(b)(2) provides that amortization of each qualified agricultural loan shall be computed over a period not to exceed seven years on a quarterly, straight-line basis commencing with the first quarter after the loan was or is charged off so that each loan is fully amortized not later than December 31, 1988. Thus, loans written off in accounting periods ending prior to the adoption of the rule can be amortized *pro rata* beginning with the Call Report for December 31, 1987.

Two state trade associations, the IBAA, and one bank believe that the bank, rather than the Federal Reserve, should decide whether the full seven year amortization period will be used. The IBAA also believes that adopting the *pro rata* treatment of loans written down prior to adoption of the rule unfairly penalizes banks that were diligent in adjusting their assets.

Under the initial rule, a bank that wishes to use an amortization schedule shorter than the maximum seven years is free to apply to do so. The rule anticipates that a seven year schedule will be the normal schedule but does not require its use. The decision to permit the use of a shorter amortization period will depend upon the applicant bank's financial position and is not likely to require consideration of any extraordinary issues.

With regard to adopting a *pro rata* treatment of loans written down prior to adoption of the rule, the Board does not believe it unfairly penalizes banks that were diligent in adjusting their assets. Accepted banking practice and Call Report instructions require member banks to record a loss in the period it becomes apparent.

Losses due to real estate sales or reappraisals. Section 208.15(b)(1)(ii) allows a bank to amortize any loss reflected in its financial statements resulting from a reappraisal or sale of real or personal property it acquired in connection with a qualified agricultural loan and that it owned on January 1, 1983, and still held on November 9, 1987, and of any additional property acquired on or before December 31, 1998.

A law firm and a bank submitting substantially similar letters, the Independent Bankers of Minnesota, and the IBAA objected to the requirement that such property had to be held on November 9, 1987, in order for any such losses to be eligible for amortizing. Comments pointed out that neither the statute nor its legislative history explicitly calls for ownership of such property on the effective date of the regulation and suggested that better reference dates might be the date the loss was actually recognized or the date the legislation was introduced, passed both houses of Congress, or was signed. The Independent Bankers of Minnesota suggested that any loss on such property be treated in the same manner as the loss on the loan it secured, that is, amortization should be allowed at least beginning with the date the loss was recognized so long as the loss is otherwise an eligible loss.

One of the reasons Congress authorized in Title VIII of CEBA the deferral of reappraisal losses was to remove the accounting pressure to sell such property into already weak markets. This is not a factor if the property has already been sold. In addition, unlike unsold property, charged-off loans still evidence a legal obligation to pay which might still have some value. With regard to losses resulting from sales, Congress did not mention deferral at all. Losses on sales were authorized in the regulation merely to make unnecessary the expense of a reappraisal immediately before a sale solely to allow the economic loss to qualify for deferral as a loss on reappraisal rather than be recognized as a loss on a sale. For these reasons, the initial rule did not provide for amortization of losses from reappraised or sold property not owned on or after November 9, 1987.

After consultation among the federal banking regulatory agency staffs, reconsideration of the initial rule, and consideration of pending applications and the comments received, the Board concluded that requiring real property to be owned on or after November 9, 1987, does not necessarily accomplish the goal Congress sought to achieve (that is, avoiding the forced sale of real property into depressed markets simply to qualify

the losses on such a sale for amortization under the program). Thus, the rule is being amended retroactively to November 9, 1987, to remove this requirement. This change represents the only substantive change to the rule.

In need of capital. Title VIII of the CEBA provides that a bank must be in need of capital restoration. The legislative history of the provision indicates that Congress intended that only banks with capital in need of restoration be permitted to amortize losses. Further, it intended that only banks with reasonable prospects for survival be permitted to amortize losses. Section 208.15(d)(2) of the rule provides that the current capital of a bank wishing to amortize qualifying loans must be in need of restoration although the bank remains an economically viable, fundamentally sound institution.

Two state-level trade associations believed that this section is too restrictive. Both commenters believed that any bank qualifying as an agricultural bank which has qualifying agricultural loan losses should be able to amortize those losses to restore capital to some higher level even if it is not "in need of" capital restoration for regulatory purposes. The Independent Bankers of Minnesota also stated that the requirement that a bank must be economically viable and fundamentally sound to be eligible is unnecessary. The ABA explicitly asked that the capital level after adjustment be used when measuring compliance with lending limits based on a percentage of capital.

The Board has concluded, as it did when it issued its initial rule, that no purpose would be served by allowing an otherwise insolvent institution to avoid insolvency through the use of this accounting adjustment. Whether a particular member bank is "in need of" capital restoration may depend on its particular circumstances, however. Because the Federal Reserve will make the determination of need in each case, a member bank applying to amortize agricultural loans should include a statement as to why it is "in need of" capital restoration.

There remains the question of removing a bank from the program once it has recovered financially. As a matter of administrative practice, the Board does not intend to remove such a bank from the program so long as the bank continues to meet the conditions on acceptance prescribed in the regulation. Therefore, once a loan loss has been deferred, a bank will have the option to continue to amortize it over the period provided for in the regulation. However, once the bank has recovered sufficiently so that it no longer meets eligibility requirements because it no longer is "in need of" capital restoration, no new deferral of loan losses will be permitted.

Other Issues. Several commenters suggested that the regulation clarify what would constitute evidence of fraud which would disqualify a loan from amortization. The Board decided not to attempt to list what would constitute fraud in the regulation. An indicium of fraud might include a criminal referral report, for example, but lack of such a report will not preclude excluding a loan if evidence of fraud is uncovered during the application process. Normal sources of information used to determine whether fraud is present should include information collected in the examination process as well. Using this case-by-case approach will allow an applying bank an opportunity to explain ambiguous circumstances.

The rule requires a certification by the bank's chief executive officer that there is no evidence that the loss resulted from fraud or criminal abuse. One commenter expressed concern over this requirement because no one could be absolutely certain in every case that fraud did not exist. The Board appreciates that proving without doubt that fraud does not exist in each case may be impossible. The Board believes, however, that certifying "on knowledge and belief" that fraud does not exist is acceptable.

Several commenters also suggested removing references to enforcement proceedings and to compensation levels from the regulation. The presence of such references only affirms that the program will be monitored and managed through an agreement between a participating bank and its Reserve Bank and does not create information requirements or performance obligations not already attaching through the agreement itself.

Information Collection

These amendments to the procedures and standards applicable to participation in the agricultural loan loss deferral program accordingly amend the information requirements of the proposal submitted by banks desiring to participate in the program provided for in the Report by Banks Proposing to Amortize Losses on Qualified Agricultural Loans (FR 4020; OMB No. 7100-0226). This information collection was approved by the Board under delegated authority from the Office of Management and Budget on October 28, 1987. It specifies the information required to establish and document the bank's eligibility to participate in the program including provision of details of the loans on which the bank proposes to amortize losses, of a capital restoration plan, and other necessary information. The information requirements of the FR 4020 proposal to participate are those specified to meet the requirements of the regulation and are thus now amended to reflect the changes in the regulation. No change will be required in the items collecting information on agricultural loan loss deferral on the Report of Condition and Income (FFIEC 034; OMB No. 7100-0036).

Regulatory Flexibility Act Analysis

Pursuant to section 605(b) of the Regulatory Flexibility Act (Pub. L. 96-354, 5 U.S.C. 601 *et seq.*), the Board certifies that the amendments will not have a significant economic impact on a substantial number of small entities. The amendments would not have any effect on many depository institutions, and any adverse impact on small depositories affected (which only occurs if an institution chooses to take advantage of this regulation) would likely be outweighed by the benefits bestowed by the regulation on these small depository institutions.

List of Subjects in 12 CFR Part 208

Banks, banking, State member banks, Applications, Recordkeeping, Flood insurance, Capital, Securities.

Pursuant to the Board's authority under Title VIII of the Competitive Equality Banking Act of 1987 (Pub. L. No. 100-86) and section 9 of the Federal Reserve Act, 12 U.S.C. 321 *et seq.*, the Board is amending 12 CFR Part 208 as follows:

PART 208—MEMBERSHIP OF STATE BANKING INSTITUTIONS IN THE FEDERAL RESERVE SYSTEM

1. The authority citation for 12 CFR Part 208 is revised to read as set forth below, and the authority citations following each section are removed.

Authority: Sections 9, 11, and 21 of the Federal Reserve Act (12 U.S.C. 321-338, 248, and 486, respectively); sections 4 and 13(j) of the Federal Deposit Insurance Act (12 U.S.C. 1814 and 1823(j), respectively); section 7(a) of the International Banking Act of 1978 (12 U.S.C. 3105); sections 907-910 of the International Lending Supervision Act of 1983 (12 U.S.C. 3906-3909); sections 2, 12(b), 12(g), 12(i), 15B(c)(5), 17, 17A, and 23 of the Securities Exchange Act of 1934 (15 U.S.C. 78b, 78*l*(b), 78*l*(g), 78*l*(i), 78o-4(c)(5), 78q, 78q-1, and 78w, respectively); and section 5155 of the Revised Statutes (12 U.S.C. 36) as amended by the McFadden Act of 1927.

2. Section 208.15 is amended by revising paragraphs (a)(1)(iv), (a)(2), (b)(1), (d)(3), (e)(4), (f)(1), and (f)(2)(vi)

and adding paragraph (a)(4) to read as follows:

§ 208.15 Agricultural loan loss amortization.

(a) * * *

(1) * * *

(iv) Which has:

(A) At least 25 percent of its total loans in qualified agricultural loans and agriculturally-related other property; or

(B) Less than 25 percent of its total loans in qualified agricultural loans and agriculturally-related other property but which bank the Board or the Reserve Bank in whose District the bank is located or its primary state regulator has recommended to the Federal Deposit Insurance Corporation for eligibility under this part.

(2) "Qualified agricultural loan" means:

(i) Loans qualifying as "loans to finance agricultural production and other loans to farmers" or as "loans secured by farm land" for purposes of Schedule RC–C of the FFIEC Consolidated Report of Condition or such other comparable schedule;

(ii) Loans secured by farm machinery,

(iii) Other loans that a bank proves to be sufficiently related to agriculture for classification as an agricultural loan by the Federal Reserve; and

(iv) The remaining unpaid balance of any loans, described in paragraphs (a)(2) (i), (ii) and (iii) of this section, that have been charged off since January 1, 1984, and that qualify for deferral under this section.

* * * * *

(4) "Agriculturally-related other property" means any property, real or personal, that the bank owned on January 1, 1983, and any such additional property that it acquires prior to January 1, 1992, in connection with a qualified agricultural loan. For the purposes of §§ 208.15(a)(1)(iv) and 205.15(e), the value of such property shall include the amount previously charged off as loss.

(b) * * *

(1) * * *

(i) Any loss that the bank would be required to reflect in its financial statements for any period between and including 1984 and 1991.

(ii) Any loss that the bank would be required to reflect in its financial statements for any period between and including 1983 and 1991 resulting from a reappraisal or sale of agriculturally-related other property.

* * * * *

(b) * * *

(3) There is no evidence that fraud or criminal abuse by the bank or its officers, directors, or principal shareholders led to significant losses on qualified agricultural loans or from a reappraisal or sale of agriculturally-related other property; and

* * * * *

(e) * * *

(4) The bank agrees to make a reasonable effort, consistent with safe and sound banking practices, to maintain in its loan portfolio a percentage of agricultural loans, including agriculturally-related other property, not lower than the percentage of such loans in its loan portfolio on January 1, 1986; and

* * * * *

(f) * * *

(1) A bank wishing to amortize losses on qualified agricultural loans or from reappraisal or sale of agriculturally-related other property shall submit a proposal to the appropriate Accepting Official.

(2) * * *

(vi) A list of the loans and agriculturally-related other property upon which the bank proposes to defer loss including for each such loan or property, the following information:

* * * * *

By order of the Board of Governors of the Federal Reserve System, effective June 1, 1988.

William W. Wiles,

Secretary of the Board.

[FR Doc. 88–12718 Filed 6–6–88; 8:45 am]

BILLING CODE 6210–01–M

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12 CFR Part 261

[Docket No. R–0601]

Rules Regarding Availability of Information

AGENCY: Board of Governors of the Federal Reserve System.

ACTION: Final rulemaking.

SUMMARY: The Board of Governors of the Federal Reserve System has revised its Rules Regarding Availability of Information to update procedures, which have not had a comprehensive review since 1967. This revision was published for comment on April 23, 1987. (52 FR 13458). The revised regulation includes: (1) A description of the Board's procedures in processing requests under the Freedom of Information Act ("FOIA"); (2) further delegation of authority to the Board's General Counsel to act on requests for information by law enforcement agencies and others; (3) additional provisions regarding the availability of information to federal and state financial institutions' supervisory authorities; (4) disclosure by financial institutions of examination or inspection reports to certified public accountants and attorneys employed by such institutions; and (5) notice of FOIA requests to submitters of confidential commercial or financial information, and procedures for requesting confidential treatment of such information and requests for disclosure of such information.

On April 22, 1987, the Board adopted as a final rule changes to its fee schedules pertaining to requests for Board documents pursuant to the Freedom of Information Reform Act of 1986, Pub. L. 99–570. 52 FR 15299 (April 28, 1987). Accordingly, those changes to that section (§ 261.10) were not addressed in this rulemaking.

EFFECTIVE DATE: July 11, 1988.

FOR FURTHER INFORMATION CONTACT: Stephen L. Siciliano, Special Assistant to the General Counsel for Administrative Law, Legal Division (202/452–3920); Elaine M. Boutlier, Senior Attorney, Legal Division (202/452–2418); Kenneth M. Kinoshita, Attorney, Legal Division (202/452–3721); or for the hearing impaired *only*, Telecommunications Device for the Deaf ("TDD"), Earnestine Hill or Dorothea Thompson (202/452–3544), Board of Governors of the Federal Reserve System, Washington, DC 20551.

SUPPLEMENTARY INFORMATION: The purpose of this revision of the Board's Rules Regarding Availability of Information is to set forth more clearly the procedures for requesting access to documents that are records of the Board, either under the FOIA or the Federal Reserve Act. The revision also changes certain procedures for obtaining access to documents. These provisions and changes were described in detail when comments were requested on the proposal. See 52 FR 15299 (April 23, 1987). The Board received twelve comment letters—five from Reserve Banks, two from commercial banks, four from trade associations and one from a Congressman. Of these twelve comments, seven generally supported the proposed revisions. There were no comments opposed to the proposed revisions, but one of the seven generally supportive comments and four of the remaining five comments recommended substantive changes, which have been considered by the Board. The remaining comment and part of another comment recommending substantive changes addressed issues not applicable to the proposal. Changes to the rule in response to the comments are discussed below.

A. Subpart A—General Provisions

Minor wording changes were made, but no substantive changes were made to this subpart of the proposed regulation.

B. Subpart B—Published Information and Records Available to Public; Procedures for Requests

Minor changes were made to this subpart as a result of comments made, and certain clarifications are noted.

Section 261.6(b)(5) was amended to clarify that notices received pursuant to the Change in Bank Control Act, as well as applications received pursuant to the Bank Holding Company Act, are reviewed upon receipt for separation into a public portion and a confidential portion. The public portions of these applications and notices may be released either by the Board or the appropriate Federal Reserve Bank without further review, and any request for an application or notice will be deemed to be a request for the public portions only, unless otherwise specifically noted.

The Board wishes to clarify a statement in § 261.8(a)(3), which is the exemption from disclosure for trade secrets, and confidential commercial or financial information. Section 261.8(a)(3)(ii) states that the Board may, without prior notice and to the extent it deems necessary, comment on such information in any opinion or statement issued to the public in connection with a Board action to which such information pertains. This provision is included in the regulation to ensure that the Board has the ability to fully discuss the basis for its actions on regulatory applications.[1] However, the Board's staff normally will apprise an applicant in the course of the application's process that such information may need to be disclosed in connection with the Board's action on the application. This would afford the applicant the opportunity either to revise the application or to withdraw the application prior to Board action or to address the matter further with Board staff.

Section 261.10 was adopted as a final rule in a separate action due to a statutory deadline for adoption of revised fee schedules. 52 FR 15299 (April 28, 1987). When the entire Part 261 was published for comment, § 261.10 was included in its proposed format for the convenience of the public, with the statement that the comment procedure for that section was a separate action and the comment period had already closed. Nevertheless, one comment was received regarding the fees, but it did not raise any new issues not already addressed by the Board when the fee schedule was adopted in final form. Section 261.10 was adopted in its final form by the Board on April 22, 1987, (52 FR 15299, April 28, 1987) and is included in this rulemaking for the sake of clarity and convenience.

C. Subpart C—Confidential Information Made Available to Supervised Institutions, Financial Institutions Supervisory Agencies, Law Enforcement Agencies, and Other in Certain Circumstances

Both major and minor changes were made to this subpart as a result of public comments received by the Board. In addition, certain clarifications are noted.

Section 261.11(a) was amended by deleting the last sentence of this paragraph as unnecessary in light of new § 261.11(b). The rest of § 261.11 has been clarified through reorganization and modification. Section 261.11(b) was renumbered as § 261.11(e) and simplified, and § 261.13(d) has been renumbered as § 261.11(b).

This new § 261.11(b), which concerns disclosure of confidential supervisory information by a supervised financial institution, logically should follow § 261.11(a), which concerns disclosure of confidential supervisory information to the supervised financial institution.

The Board received several comments on § 261.13(d) as proposed. These comments stated that proposed § 261.13(d) could be read to prohibit disclosure of confidential supervisory information to parent holding companies, officers, directors, and employees; that the requirement that the supervised financial institution agree to keep any confidential information provided to it confidential was unnecessary; that the requirement that the supervised financial institution consult with the appropriate Reserve Bank prior to disclosing confidential institutions to "agents" was awkward, unnecessary, and may prevent the necessary flow of information to "agents"; and that the Board should require financial institutions to make Board reports of examination available to their outside auditors.

In response to the comments, the Board amended § 261.13(d) (the new § 261.11(b)) to clarify that a supervised financial institution and its parent bank holding company may disclose confidential supervisory information to their officers, directors, and employees. The Board also eliminated the requirement that supervised financial institutions consult with a Reserve Bank prior to disclosing confidential information to "agents." The new § 261.11(b)(2) authorizes a supervised financial institution to disclose confidential supervisory information to outside legal counsel and outside auditors without consultation, subject to the following conditions, which apply to all persons and are set forth in § 261.11(g): That the confidential supervisory information be reviewed only on the premises of the supervised financial institution; that no copies of the confidential supervisory information be made; and that such persons not disclose the confidential supervisory information without the prior written approval of the Board's General Counsel.

The Board believes that it is unnecessary to make it mandatory that confidential supervisory information be provided to outside auditors. The American Institute of Certified Public Accountants ("AICPA") guidelines do not call for outside auditor access to reports of examination in all situations in which auditors may be retained to perform services for a bank, and bank management will have no practical alternative to permitting such access where it is needed and authorized.

The Board believes that outside auditors should receive access to its reports whenever they are called upon to conduct a general audit or otherwise to render a formal opinion regarding a bank's condition. The Board notes that outside auditors are sometimes retained to assist in preparation of so-called directors examinations. The Board believes that a bank's directors may permit outside auditors to review reports of examination where appropriate in such situations, but that such review by the auditors does not absolve the directors of their independent responsibility to read, understand, and respond appropriately to the Board's reports of examination, or of any responsibility they may have under applicable law regarding the directors' examination.

Section 261.11(e) was renumbered as § 261.11(g), and § 261.11(g) was simplified and renumbered as § 261.11(f).

Section 261.11(f) was renumbered as §§ 261.11(h)(1), and 261.8(d) was renumbered as § 261.11(h)(2). Section 261.11(h)(2), which concerns disclosure of confidential Report of Operations of a foreign banking organization (Form F.R. 2068) by Federal Reserve employees,

[1] As a related matter, the procedure established in § 261.17, regarding notice of a request for information to submitters of confidential information, does not apply to any determination by the Board to comment upon such information in any opinion or statement concerning a regulatory application. (See § 261.17(g)).

should logically follow new § 261.11(h)(1), which concerns disclosure of Form F.R. 2068 reports to other bank supervisory authorities.

Section 261.12(e) was eliminated as unnecessary in light of new § 261.11(e), and § 261.12 (f) through (h) were renumbered as §§ 261.12 (e) through (f).

For purposes of clarity, § 261.13(a) was amended. It originally provided that confidential supervisory information should not be disclosed "except in the most compelling circumstances." The term "compelling circumstances", which is a term of art, may be confusing to the layman. Accordingly, § 261.13(a) was revised to provide that the Board will not authorize disclosure of confidential supervisory information unless the person requesting disclosure "is able to show a substantial need for such information that outweighs the need to maintain confidentiality." The last sentence of the original § 261.13(a) was eliminated as unnecessary.

Section 261.13(b) was amended for clarity and for structural reasons. It no longer applies only to requests for disclosure of confidential supervisory information from private litigants, but has been expanded to include all requests for access to confidential supervisory information not otherwise covered by Subpart C or other portions of the regulation.

Section 261.13(b)(1) was amended to combine the original § 261.13(b)(1), which required litigants seeking documents to file a request, and original § 261.13(c), which required litigants seeking testimony to file a request. This amendment was made to simplify the regulation since both sections required litigants to follow the same procedures. Section 261.13(b)(1) was further amended by setting forth the information that a litigant must provide to the Board to justify disclosure of confidential information. This amendment was made to explain how litigants and others can make a showing of substantial need for the information that outweighs the need to maintain confidentiality required by § 261.13(c)(1)(i).

A new § 261.13(b)(2) was added. This section was drafted in response to comments received concerning proposed § 261.13(d)(3), which required financial institutions in possession of confidential supervisory information to consult with the appropriate Reserve Bank prior to disclosing such information to agents in their employ. While the Board has amended that provision to automatically allow financial institutions to disclose confidential supervisory information to outside legal counsel and outside auditors, the Board believes that there are a number of other types of agents to which the financial institutions may wish to disclose confidential supervisory information from time to time. The new § 261.13(b)(2) permits financial institutions and others to make such requests for disclosure of confidential supervisory information to the Board. The Board will consider such requests on a case by case basis.

Original § 261.13(b)(2) was renumbered as § 261.13(c) (1) and (2) and amended. The proposed § 261.13(b)(2) authorized the General Counsel to approve requests for disclosure of confidential supervisory information if the requester made a showing of "compelling circumstances that require disclosure * * *" and if the General Counsel determines that such disclosure is consistent with the regulatory responsibilities and the policies of the Board. The term "compelling circumstances" is a term of art that may be confusing to the layman. Accordingly, that provision was amended to read "has shown a substantial need for confidential supervisory information that outweighs the need to maintain confidentiality * * *."

A new § 261.13(d) was added. Section 261.13(b)(1) was originally titled "Exhaustion of administrative remedies." It did not state with sufficient clarity that it was necessary to file a request under §§ 261.13(b)(1) and 261.13(c) to exhaust administrative remedies for discovery purpose in any litigation, although this requirement was intended. Accordingly, § 261.13(d) makes clear that action under § 261.13(c) exhausts administrative remedies for discovery purposes in any litigation. Section 261.13(d) also explains that a request under § 261.9 (which implements FOIA) does not exhaust administrative remedies for discovery purposes in litigation and that it is not necessary to file a request under § 261.9 for that purpose. This provision was added because the standards for determining whether to release confidential supervisory information differ under FOIA from the factors to be considered for discovery in litigation.

Original § 261.13(c) has been incorporated into new § 261.13(b)(1), and original § 261.13(d) has been incorporated into new § 261.11(b) and § 261.13(b)(2). These amendments are described above. Section § 261.13(e) has been amended to reflect the changes made to § 261.13.

Minor wording changes have been made to § 261.14 for the sake of clarity.

D. Requests for Confidential Treatment

After the proposed regulation was published for comment, the President issued Executive Order No. 12600 (June 23, 1987), which requires executive agencies to establish procedures to notify submitters of confidential financial and commercial information of any requests for access to such information. The Executive Order is similar in substance to the proposed § 261.17, which has now been modified to reflect the provisions of the Executive Order. These modifications will ensure uniformity in treatment of submitters of confidential commercial or financial information.

One such modification provides in § 261.17(a)(1) that a designation of confidentiality by a submitter will expire after ten years. Another modification, in § 261.17(a)(2), gives the Secretary the discretion to notify a submitter who has not requested confidential treatment of his information of a request for access, if the Secretary has a reasonable expectation of substantial competitive harm upon disclosure. This standard of "reasonable expectation of competitive harm" replaces the proposed regulation's standard of "deemed confidential under 5 U.S.C. 552(b)(4)." A further modification provides, in § 261.17(d), that when the Secretary notifies a submitter of a determination to release the information despite written objections by the submitter to such disclosure, the Secretary will provide a written explanation of why the submitter's objections were not sustained. The final change in § 261.17(e) concerns the exceptions under which the Secretary need not notify the submitter of a request for confidential information. This change replaces the exception for a claim of confidentiality that "is deemed to be insubstantial" with the exception used in the Executive Order—that the submitter's designation as confidential is "obviously frivolous." This change will not adversely affect the rights of submitters since, to the extent "deemed to be insubstantial" differ from "obviously frivolous," the latter formulation is seen as defining the Secretary's discretion more narrowly then the originally proposed formulation.

These changes will ensure consistency of the Board's regulation with those used by other agencies and will avoid confusion on the part of requesters and submitters of information.

Regulatory Flexibility Act Analysis

Pursuant to section 605(b) of the Regulatory Flexibility Act (Pub. L. No. 96-354, 5 U.S.C. 601 *et seq.*), the Board certifies that the proposed amendment will not have a significant economic impact on a substantial number of small entities. The amendment is a change to agency procedures and practice and does not have a particular effect on small entities.

List of Subjects in 12 CFR Part 261

Freedom of Information Act, Federal Reserve System.

For the reasons set out in this notice, and pursuant to the Freedom of Information Act (5 U.S.C. 552), and the Board's authority under section 9 of the Federal Reserve Act (12 U.S.C. 321 *et seq.*) and under section 5 of the Bank Holding Company (12 U.S.C. 1844) to exercise general supervision of and to examine state member banks and bank holding companies, and section 11(k) of the Federal Reserve Act (12 U.S.C. 248(k)) to delegate functions to members and employees of the Board and to the Reserve Banks, the Board revises its Rules Regarding Availability of Information, 12 CFR Part 261 as follows:

PART 261—RULES REGARDING AVAILABILITY OF INFORMATION

Authority: 5 U.S.C. 552, 12 U.S.C. 248(k), 321, and 1844.

Subpart A—General Provisions

§ 261.1 Authority, purpose, and scope.

(a) *Authority.* This regulation is issued by the Board of Governors of the Federal Reserve System (the "Board") pursuant to 12 U.S.C. 248(i) and (k) and 5 U.S.C. 552.

(b) *Purpose.* This regulation sets forth the kinds of information made available to the public, the rules of procedure for obtaining documents and records, and the rules of procedure with respect to confidential information.

(c) *Scope.* (1) Subpart A contains general provisions and definitions of terms used in this regulation.

(2) Subpart B implements the Freedom of Information Act (5 U.S.C. 552) and explains:

(i) The kinds of information the Board regularly publishes;

(ii) The types of records made available to the public upon request;

(iii) The kinds of information exempt from disclosure or subject to deferred availability; and

(iv) The procedures for obtaining information and for processing information requests.

(3) Subpart C sets forth:

(i) The kinds of confidential information made available to supervised institutions, supervisory agencies, law enforcement agencies, and others in certain circumstances;

(ii) The procedures for disclosure;

(iii) The procedures for processing law enforcement requests; and

(iv) The procedures with respect to subpoenas, orders compelling production, and other process.

(4) Subpart D contains the procedures relating to requests for confidential treatment of documents and information.

§ 261.2 Definitions.

For purposes of this regulation:

(a) "Board's official files" means the Board's central records.

(b) "Confidential supervisory information" means cease and desist orders, suspension or removal orders, or other orders or actions under the Financial Institutions Supervisory Act of 1966, as amended, the Bank Holding Company Act of 1956, as amended, or the Federal Reserve Act of 1913, as amended; reports of examination and inspection, confidential operating and condition reports, and any information derived from, related to, or contained in them. "Confidential supervisory information" may consist of documents prepared by, on behalf of, or for the use of the Board, a Reserve Bank, a Federal or state financial institutions supervisory agency, or a bank or bank holding company.

(c) "Information of the Board" means all information coming into the possession of the Board, any Board member, any Federal Reserve Bank, or any officer, employee, or agent of the Board or of any Federal Reserve Bank, in the performance of functions for or on behalf of the Board, including functions delegated by the Board pursuant to Part 265 of this chapter.

(d) (1) "Records of the Board" includes applications, rules, statements, opinions, orders, memoranda, letters, reports, accounts, and other written material, as well as magnetic tapes, computer printouts of information obtained through use of existing computer programs, maps, photographs, and other materials in nonwritten or machine readable form that are under the control of the Board, that contain information of the Board, and that:

(i) Constitute part of the Board's official files; or

(ii) Are maintained for administrative reasons in the regular course of business in official files in any division or office of the Board or any Federal Reserve Bank in connection with the transaction of any official business.

(2) "Records of the Board" does not include:

(i) Handwritten notes; personal files of Board members and employees; tangible exhibits, formulas, designs, or other items of valuable intellectual property; extra copies of documents and library and museum materials kept solely for reference or exhibition purposes; unaltered publications otherwise available to the public in Board publications, libraries, or established distribution systems;

(ii) Documents, including lists, and other material not in existence or not in the Board's possession or control on the date a request for records is received;

(iii) Documents no longer in the possession of the Board which have been disposed of in accordance with law;

(iv) Copies of transcripts provided to the Board under any reporting service contract and that may be obtained directly from the contractor;

(v) Documents of other agencies made available to the Board on a confidential basis by such agencies;

(vi) Documents that are not the property of the Board and which have been made available to the Board on a temporary or otherwise limited basis with its consent.

(e) (1) "Report of examination" means the report prepared by the Board concerning its examination of a state member bank of the Federal Reserve System, and includes reports of inspection of bank holding companies, U.S. branches or agencies of foreign banks, and other institutions examined by the Federal Reserve System. Such reports may be prepared either solely by the Board or jointly by the Board and an appropriate state bank supervisory agency.

(2) "Reports of examination" may include reports of examination of other financial institutions prepared and provided to the Federal Reserve System by other Federal and state financial institution supervisory agencies.

(f) "Report of inspection" means the report prepared by the Board concerning its inspection of a bank holding company and its bank and nonbank subsidiaries.

(g) (1) "Search" means a reasonable search of the Board's official files and any other files containing Board records as seem reasonably likely in the particular circumstances to contain documents of the kind requested. Searches may be done manually or by computer using existing programming. For purposes of computing fees under § 261.10 of this regulation, search time includes all time spent looking for material that is responsive to a request, including line-by-line identification of material within documents. Such activity is distinct from "review" of material to determine whether the material is exempt from disclosure.

(2) "Search" does not mean or include:

(i) Research;

(ii) Creation of any information or data retrieval program or system;

(iii) Extensive modification of an existing program or system;

(iv) Creation of any document, or any other activity that involves creative processes rather than simply retrieval of existing documents.

§ 261.3 Custodian of records; certification; service; alternative authority.

(a) *Custodian of records.* The Secretary of the Board is the official custodian of all records of the Board, including all records that are in the possession or control of the Board, any Federal Reserve Bank, or any Board or Reserve Bank employee.

(b) *Certification of record.* The Secretary may certify the authenticity of any record of the Board, or of any copy of such record, for any purpose, and for or before any duly constituted Federal or state court, tribunal, or agency.

(c) *Service of subpoenas or other process.* Subpoenas or other judicial or administrative process demanding access to records of the Board shall be addressed to and served upon the Secretary of the Board at the Board's offices in Washington, DC 20551.

(d) *Alternative authority*—(1) *Secretary of the Board.* Any action or determination required or permitted by this regulation to be done by the Secretary of the Board may be done by an Associate Secretary or other responsible employee of the Board who has been duly designated for this purpose by the Secretary.

(2) *General Counsel.* Any action or determination required or permitted by this regulation to be done by the General Counsel may, in the General Counsel's absence, be done by a deputy or associate general counsel or other attorney of the Board's Legal Division who has been duly designated for this purpose by the General Counsel.

(3) *Director of Banking Supervision and Regulation.* Any action or determination required or permitted by this regulation to be done by the Director of the Division of Banking Supervision and Regulation may, in the Director's absence, be done by the Deputy Director or other official of the Division who has been duly designated for this purpose by the Director.

Subpart B—Published Information and Records Available to Public: Procedures for Requests

§ 261.5 Published information.

(a) *Federal Register.* The Board publishes in the **Federal Register** for the guidance of the public:

(1) Descriptions of the Board's central and field organization;

(2) Statements of the general course and method by which the Board's functions are channeled and determined, including the nature and requirements of procedures;

(3) Rules of procedure, descriptions of forms available and the place where they may be obtained, and instructions on the scope and contents of all papers, reports, and examinations;

(4) Substantive rules and interpretations of general applicability, and statements of general policy;

(5) Every amendment, revision, or repeal of the foregoing;

(6) General notices of proposed rulemaking;

(7) Notices of applications received under the Bank Holding Company Act of 1956 (12 U.S.C. 1841 et seq.) and the Change in Bank Control Act (12 U.S.C. 1817);

(8) Notices of formal public hearings ordered by the Board;

(9) Notices of all Board meetings, pursuant to 5 U.S.C. 552b;

(10) Notices identifying the Board's systems of records, pursuant to 5 U.S.C. 552a; and

(11) Notices of agency data collection forms being reviewed under the Paperwork Reduction Act (5 U.S.C. 3501 et seq.).

(b) *Board's reports to Congress*—(1) *Annual report under Federal Reserve Act.* The Board's annual report to Congress pursuant to the Federal Reserve Act (12 U.S.C. 247), which is made public upon its submission to Congress, contains a full account of the Board's operations during the year, an economic review of the year, and legislative recommendations to Congress. The report includes:

(i) A full account of the policy actions taken by the Board and the Federal Open Market Committee, showing the votes taken and the underlying reasons (12 U.S.C. 247a);

(ii) Material pertaining to administering Board functions under the Bank Holding Company Act of 1956 (12 U.S.C. 1843(c) and 1844(d));

(iii) Material pertaining to bank mergers approved by the Board under section 18(c) of the Federal Deposit Insurance Act (12 U.S.C. 1828(c)(9)); and

(iv) Reports required by section 114 of the Truth in Lending Act (15 U.S.C. 1613); section 602 of the Change in Bank Control Act (12 U.S.C. 1817(j)(14)); section 121 of the Securities and Exchange Act (15 U.S.C. 78w(b)); the Securities Act Amendments of 1975 (15 U.S.C. 78w); section 707 of the Equal Credit Opportunity Act (15 U.S.C. 1691f); section 18 of the Federal Trade Commission Improvement Act (12 U.S.C. 57a(f)(5)); section 918 of the Electronic Funds Transfer Act (15 U.S.C. 1693p); section 805 of the Community Reinvestment Act (12 U.S.C. 2904); and section 3(h) of the International Banking Act of 1978, Pub. L. 95-369.

(2) *Reports under other Acts.* The Board also reports to Congress annually, or at more frequent intervals, under certain Acts of Congress, including but not limited to the Freedom of Information Act (5 U.S.C. 552(e)); the Government in the Sunshine Act (5 U.S.C. 552b(i)); and the Full Employment and Balanced Growth Act of 1978 (12

U.S.C. 225a), concerning the administration of its functions under each of these acts.

(c) *Federal Reserve Bulletin*—(1) *Contents.* In the *Federal Reserve Bulletin*, which is issued monthly, the Board publishes:

(i) Economic and statistical information;

(ii) Articles on subjects of economic interest or relating to Board activities;

(iii) Regulations;

(iv) Statements of general policy;

(v) Interpretations of laws and regulations of general interest to the public;

(vi) Notices of Board action on certain types of applications; and

(vii) Board orders and accompanying statements on certain types of adjudications.

(2) *Advanced release of information.* Some material published in the *Bulletin* is released in advance of publication, including certain regulations, interpretations, orders and opinions, and the Board's index of industrial production and other statistical series.

(d) *Other published information*—(1) *Statements of financial condition.* As required by section 11(a) of the Federal Reserve Act (12 U.S.C. 248(a)), the Board issues weekly a statement showing the condition of each Federal Reserve Bank and a consolidated statement of the condition of all Federal Reserve Banks.

(2) *Index of applications.* The Board also issues weekly an index of the applications received and the actions taken on such applications, as well as other matters issued, adopted, or promulgated by the Board.

(3) *Statement of changes in bank structure.* In addition, the Board issues weekly a statement showing changes in the structure of the banking industry resulting from mergers and the establishment of branches.

(4) *Press releases.* The Board frequently issues statements to the press and public regarding monetary and credit actions, regulatory actions, actions taken on certain types of applications, and other matters. Current press releases may be obtained from the Board's Publications Services Section.

(5) *Computer tapes.* The Board periodically prepares data of various kinds on computer tapes, which are available to the public upon request pursuant to a current schedule of charges.

(6) *Regulatory Service.* The Board publishes *The Federal Reserve Regulatory Service*, which is a multivolume looseleaf service containing statutes, regulations, interpretations, rulings, staff opinions, and procedural rules under which the Board operates. Parts of the Service are also published as separate looseleaf handbooks relating to Consumer and Community Affairs, Monetary Policy and Reserve Requirements, and Securities Credit Transactions. The Service and each handbook contain subject and citation indexes, are updated monthly, and may be subscribed to on a yearly basis.

(7) *Lists of Board publications.* The Board's Publications Services Section maintains a list of Board publications that are available to the public. In addition, a partial list of important publications is published in the *Federal Reserve Bulletin.*

(e) *Indexes to Board actions.* (1) The Board's Freedom of Information Office maintains an index to Board actions which provides identifying information about any matters issued, adopted, and promulgated by the Board since July 4, 1967. The index is updated weekly and is available to the public on microform. Copies of the index may be obtained upon request to the Secretary of the Board subject to the current schedule of charges, as described in § 261.10 of this regulation.

(2) In addition, the Board publishes a weekly index, as described in paragraph (d)(2) of this section, which provides identifying information on a current basis about matters issued, adopted, and promulgated by the Board. The weekly index is available from the Publications Services Section on a subscription or a single issue basis pursuant to a current schedule of charges. Back issues of this index are available from the Secretary of the Board subject to the schedule of charges, described in § 261.10 of this regulation.

(f) *Obtaining Board publications.* All publications issued by the Board may be obtained from the Publications Services Section of the Federal Reserve Board, 20th Street and Constitution Ave., NW., Washington, DC 20551 (pedestrian entrance is on C Street, NW.), including: (1) Current and available back issues of the Board's Annual Report to Congress (copies of the board's Annual Report to Congress are also normally available for examination at each Federal Reserve Bank); and (2) single current and available back issues of the *Federal Reserve Bulletin*, which may be obtained at the prescribed rates (any individual or group may subscribe annually to the *Bulletin*, at the prescribed rate).

§ 261.6 Records available to public upon request.

(a) *Types of records made available.* Subject to the provisions of this regulation, the following records shall be made available for inspection and copying upon request, unless they were published promptly and made available for sale or without charge:

(1) Orders made in the adjudication of cases, and final opinions, including concurring and dissenting opinions, and orders and opinions issued pursuant to authority delegated by the Board;

(2) Interpretations and statements of policy adopted by the Board that are not published in the **Federal Register**;

(3) Records of the final votes of Board members;

(4) Administrative staff manuals and instructions to staff that affect the public; and

(5) Other records subject to disclosure pursuant to 5 U.S.C. 552.

(b) *Exceptions and limitations*—(1) *Confidentiality.* The Board may delete identifying details from any record to prevent a clearly unwarranted invasion of personal privacy. The Board shall state in writing the reason for the deletion.

(2) *Deferred availability.* Availability of information in any record may be postponed, as provided in § 261.7 of this regulation.

(3) *Exempt records; discretionary release.* Some records are exempt from disclosure under 5 U.S.C. 552(b), as described in § 261.6 of this regulation. However, except where disclosure is expressly prohibited by statute, regulation, or order, the Board may release records that are exempt from mandatory disclosure whenever the Board or designated Board members, the Secretary of the Board, the General Counsel of the Board, the Director of the Division of Banking Supervision and Regulation, or the appropriate Federal Reserve Bank, acting pursuant to this regulation or Part 265 of this title, determines that such disclosure would be in the public interest. In no event shall the release of information that has been requested for commercial solicitation purposes be considered to be in the public interest unless such release is specifically authorized by the persons named in the records to be released.

(4) *Nonexempt information.* Although the Board may deny access to portions of a record, it shall release reasonably segregable nonexempt portions.

(5) *Requests for applications, notices, and reports.* The Board preliminarily identifies public portions of most applications filed under the Bank Holding Company Act, notices filed under the Change in Bank Control Act, and other reports filed in connection with its supervision of financial

institutions. The public portions contain information that may be released by the Board or appropriate Federal Reserve Bank without further review. Each request for these applications, notices, and reports shall be considered to be a request for the public portions only, unless the requester specifically seeks access to the entire document.

(6) *Disposal of records.* Nothing in this regulation precludes the Board from disposing of records eligible for disposal in the normal course of business and in accordance with applicable law.

(c) *How to obtain access to records.* (1) Records of the Board subject to this section are available for inspection and copying, in response to requests for identifiable records pursuant to § 261.9 of this regulation, from 9:00 a.m. to 5:00 p.m. weekdays, at the Office of the Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue NW., Washington, DC 20551 (the pedestrian entrance is on C Street, NW.). Indexes of Board actions and copies of selected Board records are available in the Freedom of Information Office for immediate inspection without a request or other prior arrangements.

(2) The Board may determine that certain classes of publicly available filings shall be made available for inspection and copying only at the Federal Reserve Bank where those records are filed.

(3) The publicly available portions of Reports of Condition and Income of individual banks, as well as certain other data files produced by the Board, are distributed by the National Technical Information Service. Requests for these public reports should be addressed to:

Sales Office,
National Technical Information Service,
U.S. Department of Commerce,
285 Port Royal Road,
Springfield, Virginia 22161,
(703) 487–4650.

§ 261.7 Deferred availability of certain information.

(a) *Information subject to deferred availability.* Certain types of information may not be published in the **Federal Register** or made available for inspection and copying until after a period of time the Board determines to be reasonably necessary to avoid the effects described in paragraph (b) of this section.

(b) *Reasons for deferred availability.* Information may be subject to deferred availability or deferred publication because earlier disclosure would likely:

(1) Interfere with accomplishing the objectives of the Board in the discharge of its statutory functions;

(2) Interfere with the orderly conduct of the foreign affairs of the United States;

(3) Permit speculators or others to gain unfair profits or other unfair advantages by speculative trading in securities or otherwise;

(4) Result in unnecessary or unwarranted disturbances in the securities markets;

(5) Interfere with the orderly execution of the objectives or policies of other government agencies; or

(6) Impair the ability to negotiate any contract or otherwise harm the commercial or financial interests of the United States, the Board, any Federal Reserve Bank, or any department or agency of the United States.

§ 261.8 Exemptions from disclosure.

(a) *Types of information or records that are exempt from disclosure.* The following records and information of the Board are exempt from disclosure under this regulation:

(1) *National defense.* Any information or record that is specifically authorized under criteria established by an Executive order to be kept secret in the interest of national defense or foreign policy and is in fact properly classified pursuant to such Executive order.

(2) *Examination, inspection, operating, or condition reports, and confidential supervisory information.*

(i) Any matter that is contained in or related to confidential supervisory information prepared by, on behalf of, or for the use of the Board, any Federal Reserve Bank, or any Federal or state financial institution supervisory agency that deems such documents or information confidential.

(ii) The Board may, however, determine that certain kinds of operating or condition reports may, for reasons of policy, be routinely disclosed to the public upon request. In such case, no special authorization shall be required for disclosure of the reports by members of the Board's staff or by staff of the Reserve Banks; and there shall be no limitation on the use of the reports by members of the public receiving them.

(3) *Trade secrets; commercial or financial information.*

(i) Any matter that is a trade secret or that constitutes commercial or financial information obtained from a person and that is privileged or confidential.

(ii) The Board may, however, make any information furnished in confidence in connection with an application for Board approval of a transaction available to the public in accordance with § 261.6 of this regulation, and without prior notice and to the extent it deems necessary, may comment on such information in any opinion or statement issued to the public in connection with a Board action to which such information pertains.

(4) *Records or information compiled for law enforcement purposes.* Any records or information compiled for law enforcement purposes, to the extent permitted under 5 U.S.C. 552(b)(7), including information relating to proceedings for:

(i) Issuing cease-and-desist orders, suspension or removal orders, or other orders or actions under the Financial Institutions Supervisory Act of 1966, as amended, the Bank Holding Company Act of 1956, as amended, or the Federal Reserve Act of 1913, as amended;

(ii) Terminating membership of an institution in the Federal Reserve System under section 9 of the Federal Reserve Act (12 U.S.C. 327);

(iii) Suspending a depository institution from use of the credit facilities of the Federal Reserve System under section 4 of the Federal Reserve Act (12 U.S.C. 301); or

(iv) Granting or revoking any approval, permission, or authority, except to the extent provided in this regulation and Part 262 of this chapter concerning bank holding company and bank merger applications.

(5) *Internal personnel rules and practices.* Any information related solely to the internal personnel rules and practices of the Board, within the meaning of 5 U.S.C. 552(b)(2).

(6) *Personnel and medical files.* Any information contained in personnel and medical files and similar files the disclosure of which constitute a clearly unwarranted invasion of personal privacy.

(7) *Inter- or intra-agency memorandums or letters.* Any matter contained in inter- or intra-agency memorandums or letters that would not be routinely available by law to a party (other than an agency) in litigation with an agency, including but not limited to:

(i) Memorandums;

(ii) Reports;

(iii) Other documents prepared by the staffs of the Board or Federal Reserve Banks; and

(iv) Records of deliberations of the Board and of discussions at meetings of the Board, any Board committee, or Board staff, that are not subject to 5 U.S.C. 552b.

(8) *Court order prohibitions.* Any document or information that is covered by an order of a court of competent jurisdiction that prohibits its disclosure.

(9) *Statutory exemption.* Any information specifically exempted from

disclosure by statute (other than 5 U.S.C. 552b), if the statute:

(i) Requires that the matters be withheld from the public in such a manner as to leave no discretion on the issue; or

(ii) Establishes particular criteria for withholding or refers to particular types of matters to be withheld.

(b) *Segregation of nonexempt information*—(1) *Partial release.* The Board shall provide any reasonably segregable portion of a record that is requested after deleting those portions that are exempt under this section. In determining whether exempt information is reasonably segregable, the Board shall consider all relevant factors, including but not limited to:

(i) The amount and placement of nonexempt information in relation to the structure and size of the document; and

(ii) The intelligibility and usefulness of the nonexempt information that is segregated balanced against the administrative burden and cost of segregation.

(2) *Reasonably segregable portions.* Subject to these considerations, reasonably segregable nonexempt portions of a document are those nonexempt portions:

(i) Whose meaning is not distorted by deletion;

(ii) That are sufficiently detailed to be intelligible and useful to the requester; and

(iii) From which a skillful and knowledgeable person could not reconstruct any exempt information.

(3) *Computer tapes.* Information stored on computer tape that can be segregated only by creating a new retrieval program is not considered reasonably segregable.

(c) *Prohibition against disclosure.* Except as provided in this regulation, no officer, employee, or agent of the Board or any Federal Reserve Bank shall disclose or permit the disclosure of any unpublished information of the Board to any person (other than Board or Reserve Bank officers, employees, or agents properly entitled to such information for the performance of official duties), whether by giving out or furnishing the information or a copy of it or by allowing any person to inspect or copy it, or otherwise.

§ 261.9 Procedures for making requests for identifiable records; processing of requests; review of denial of request; time extensions.

(a) *Procedures for making request for records*—(1) *Contents of request.* A request for identifiable records shall reasonably describe the records to which access is sought in a way that enables the Board's staff to identify and produce the records with reasonable effort and without unduly burdening or disrupting any of the Board's operations. The request shall be submitted in writing to the Secretary of the Board, and the envelope clearly marked "Freedom of Information Act Request." The request shall contain the following information:

(i) The name and address of the person filing the request, and the telephone number at which the requester can be reached during normal business hours;

(ii) The name of any pending litigation to which the request relates, the court, and its location;

(iii) Whether the requested information is intended for commercial use, and whether the requester is an educational or noncommercial scientific institution, or news media representative; and

(iv) A statement agreeing to pay the applicable fees; or a statement identifying any fee limitation desired; or a request for a waiver or reduction of fees that satisfies § 261.10(h) of this regulation.

(2) *Defective requests.* (i) The Board need not accept or process a request that is not a request for identifiable records or that:

(A) Can be complied with only by designing an information retrieval system; or

(B) Does not otherwise comply with the requirements of paragraph (a)(1) of this section.

(ii) The Board may return a defective request, specifying the deficiency. The requester may submit a corrected request which shall be treated as a new request.

(3) *Oral requests.* The Board may honor an oral request for records, but if the requester is dissatisfied with the Board's response and wishes to seek review, the requester must submit a written request, which shall be treated as an initial request.

(4) *Advance payment of fees.* Whenever the Board requires advance payment of any fee pursuant to § 261.10(g) of this regulation, the requester shall promptly remit the required advance payment to the Board as a condition to further processing of the request.

(b) *Procedures for responding to requests*—(1) *Time limits.* In response to any request that satisfies paragraph (a) of this section, the Board shall, if necessary, cause an appropriate search to be conducted of records of the Board in existence on the date of receipt of the request, and shall determine within ten working days of receipt of the request whether to comply with the request, unless the running of such time is suspended for payment of fees pursuant to § 261.10(g)(3) of this regulation, or such period is extended, pursuant to paragraph (e) of this section or § 261.7 of this regulation. The date of receipt for any request, including one that is addressed incorrectly or that is referred to the Board by another agency or by a Federal Reserve Bank, is the date the Office of the Secretary actually receives it.

(2) *Response to request.* The Board shall, within the time period specified in paragraph (b)(1) of this section, notify the requester of:

(i) The Board's determination of the request;

(ii) The reasons for the determination;

(iii) The right of the requester to appeal to the Board any denial or partial denial, as specified in paragraph (d) of this section; and

(iv) In the case of a denial of a request, the name and title or position of the person responsible for the denial.

(3) *Refusal to acknowledge records.* If a request covers records or types of records whose existence is confidential, such as records of reforcement actions against identifiable financial institutions, the Board may advise the requester that it can neither confirm nor deny the existence of the requested records and notify the requester of the legal basis for that determination.

(4) *Priority of responses.* The Secretary will assign responsible staff to particular requests and will normally process requests in the order they are received. However, in the Secretary's discretion, or upon a court order in a matter to which the Board is a party, a particular request may be processed out of turn.

(5) *Referrals.* To the extent a request covers documents that were created by, obtained from, or classified by another agency, the Board may refer the request to that agency for a response and inform the requester promptly of the referral.

(c) *Procedures for copying and review of records; number of copies; method of duplication*—(1) *Request for copies.* When a requester asks that documents be copied, copies shall be made at the fee established, as provided in § 261.10 of this regulation. Copies shall be sent to the requester by regular U.S. mail to the address indicated in the request, unless the requester elects to take delivery of the documents at the Board's Freedom of Information Office in Washington, DC, or makes other arrangements acceptable to the Board.

(2) *Number of copies; method of duplication.* The Board need not provide

more than one copy of any record to any requester, and the Board may select the form of the copy provided, such as paper, microform, or other medium.

(3) *Request to review documents.* Requesters may review documents at the Board's Freedom of Information Office under staff supervision. Requesters may not disassemble or alter any record or file being inspected.

(d) *Appeal of denial of request for records*—(1) *Request for review; time limits.* Any person denied access to Board records requested in accordance with this section may file with the Board a written request for review of the denial by the Board or Board member(s) designated to hear such appeal. The request shall be filed within ten working days of the date on which the denial was issued, or, where a request for documents has been partially approved but access to the documents has not been given, within ten working days from the date such documents are transmitted to the requester. The request shall prominently display the word "Appeal" on the first page. An initial request for records may not be combined in the same letter with an appeal.

(2) *Untimely appeals.* The Board may consider an untimely appeal if:

(i) It is accompanied by a written request for leave to file an untimely appeal; and

(ii) The Board or designated Board member(s) determines, in its discretion and for good and substantial cause shown, that the appeal should be considered.

(3) *Decision on appeal; time limits.* The Board or designated Board member(s) shall make a determination with respect to any appeal within 20 working days of actual receipt of the appeal by the Secretary and shall immediately notify the appealing party of the determination and the right to seek judicial review if the determination upholds, in whole or in part, the denial of the request for records. Such determination is not subject to review under § 265.3 of this chapter which provides for review of actions taken under delegated authority.

(4) *Mootness of appeal.* (i) The Board, a Board member, or a staff person designated by the Chairman may declare an appeal wholly or partially moot and instruct the Secretary of the Board to reconsider the previous denial or to release the requested documents, where a determination is made that intervening circumstances or additional facts not known at the time of denial have or may have eliminated any need or justification for withholding the requested documents.

(ii) The Secretary may reconsider a denial being appealed if such intervening circumstances or additional facts come to the attention of the Secretary while an appeal is pending.

(e) *Time extensions in unusual circumstances; failure to comply with time limits*—(1) *Time extensions.* In unusual circumstances, as defined in 5 U.S.C. 552(a)(6), the time limits specified in paragraph (b)(1) and paragraph (d)(3) of this section may be extended for a period of time not to exceed 10 working days by written notice to the requester setting forth the reasons for the extension and the date on which a determination is expected to be dispatched. The extension of time may be divided between the initial and appellate reviews but the total extensions relating to any request and resulting appeal may not exceed 10 working days.

(2) *Failure to comply with time limits.* If the Board fails to comply with the time limits and extensions specified in this section, the Board or other responsible Board employee shall, where practicable, give notice to the requester, stating the reasons for the delay and the date by which the Board expects to dispatch its determination. Without prejudice to the legal remedies provided the requester in 5 U.S.C. 552, the Board shall continue processing the request as quickly as possible and shall dispatch its determination when reached in the same manner as if it had been reached within the applicable time limits.

§ 261.10 Fee schedules; waiver of fees.

(a) *Fee schedules.* Records of the Board available for public inspection and copying are subject to a written Schedule of Fees for search, review, and duplication. (See Appendix A for Schedule of Fees.) The fees set forth in the Schedule of Fees reflect the full allowable direct costs of search, duplication, and review, and may be adjusted from time to time by the Secretary to reflect changes in direct costs.

(b) *Fees charged.* The fees charged only cover the full allowable direct costs of search, duplication, or review.

(1) "Direct costs" mean those expenditures which the Board actually incurs in searching for and duplicating (and in the case of commercial requesters, reviewing) documents to respond to a request made under § 261.9 of this regulation. Direct costs include, for example, the salary of the employee performing work (the basic rate of pay for the employee plus a factor to cover benefits) and the cost of operating duplicating machinery. Not included in direct costs are overhead expenses such as costs of space, and heating or lighting the facility in which the records are stored.

(2) "Duplication" refers to the process of making a copy of a document necessary to respond to a request for disclosure of records, or for inspection of original records that contain exempt material or that otherwise cannot be inspected directly. Such copies may take the form of paper copy, microform, audio-visual materials, or machine readable documentation (*e.g.*, magnetic tape or disk), among others.

(3) "Review" refers to the process of examining documents located in response to a request that is for a commercial use to determine whether any portion of any document located is permitted to be withheld. It also includes processing any documents for disclosure, *e.g.*, doing all that is necessary to excise them and otherwise prepare them for release. Review does not include time spent resolving general legal or policy issues regarding the application of exemptions.

(c) *Commercial use.* (1) The fees in the Schedule of Fees for document search, duplication, and review apply when records are requested for commercial use.

(2) "Commercial use request" refers to a request from or on behalf of one who seeks information for a use or purpose that furthers the commercial, trade, or profit interests of the requester or the person on whose behalf the request is made.

(3) In determining whether a requester properly belongs in this category, the Secretary shall look first to the use to which a requester will put the documents requested. Where a requester does not explain its purpose, or where its explanation is insufficient, the Secretary may seek additional clarification from the requester before categorizing the request as one for commercial use.

(d) *Educational, research, or media use.* (1) Only the fees in the Schedule of Fees for document duplication apply when records are not sought for commercial use and the requester is a representative of the news media, or an educational or noncommercial scientific institution, whose purpose is scholarly or scientific research. However, there is no charge for the first one hundred pages of duplication.

(2) "Educational institution" refers to a preschool, a public or private elementary or secondary school, or an institution of undergraduate higher education, graduate higher education, professional education, or an institution

of vocational education which operates a program of scholarly research.

(3) "Noncommercial scientific institution" refers to an institution that is not operated on a "commercial" basis (as that term is used in paragraph (c) of this section) and which is operated solely for the purpose of conducting scientific research the results of which are not intended to promote any particular product or industry.

(4) "Representative of the news media" refers to any person that is actively gathering news for an entity that is organized and operated to publish or broadcast news to the public. The term "news" means information that is about current events or that would be of current interest to the public. Examples of news media entities include, but are not limited to, television or radio stations broadcasting to the public at large, and publishers of periodicals (but only in those instances when they can qualify as disseminators of "news") who make their products available for purchase or subscription by the general public. "Freelance" journalists may be regarded as working for a news organization if they can demonstrate a solid basis for expecting publication through that organization, even though not actually employed by it.

(e) *Other uses.* For all other requests, the fees in the Schedule of Fees for document search and duplication apply. However, there is no charge for the first one hundred pages of duplication or the first two hours of search time.

(f) *Aggregated requests.* If the Secretary reasonably believes that a requester or group of requesters is attempting to break down a request into a series of requests, each seeking portions of a document or documents solely for the purpose of avoiding the assessment of fees, the Secretary may aggregate such requests and charge accordingly. It is considered reasonable for the Secretary to presume that multiple requests of this type made within a 30-day period have been made to avoid fees.

(g) *Payment procedures.*—(1) *Fee payment.* The Secretary may assume that a person requesting records pursuant to § 261.9 of this regulation will pay the applicable fees, unless a request includes a limitation on fees to be paid or seeks a waiver or reduction of fees pursuant to paragraph (h) of this section.

(2) *Advance notification.* If the Secretary estimates that charges are likely to exceed $25, the requester shall be notified of the estimated amount of fees, unless the requester has indicated in advance willingness to pay fees as high as those anticipated. Upon receipt of such notice the requester may confer with the Secretary as to the possibility of reformulating the request in order to lower the costs.

(3) *Advance payment.* (i) The Secretary may require advance payment of any fee estimated to exceed $250. The Secretary may also require full payment in advance where a requester has previously failed to pay a fee in a timely fashion.

(ii) For purposes of computing the time period for responding to requests under § 261.9(b) of this regulation, the running of the time period will begin only after the Secretary receives the required payment.

(4) *Late charges.* The Secretary may assess interest charges when a fee is not paid within 30 days of the date on which the billing was sent. Interest will be at the rate prescribed in section 3717 of Title 31 U.S.C.A. and will accrue from the date of the billing. This rate of interest is published by the Secretary of the Treasury before November 1 each year and is equal to the average investment rate for Treasury tax and loan accounts for the 12-month period ending on September 30 of each year. The rate is effective on the first day of the next calendar quarter after publication.

(5) *Fees for nonproductive search.* Fees for record searches and review may be charged even if no responsive documents are located or if the request is denied, particularly if the requester insists upon a search after being informed that it is likely to be nonproductive or that any records found are likely to be exempt from disclosure. The Secretary shall apply the standards set out in paragraph (h) of this section in determining whether to waive or reduce fees.

(h) *Waiver or reduction of fees*—(1) *Standards for determining waiver or reduction.* The Secretary or his or her designee shall grant a waiver or reduction of fees chargeable under paragraph (b) of this section where it is determined both that disclosure of the information is in the public interest because it is likely to contribute significantly to public understanding of the operations or activities of the government, and that the disclosure of information is not primarily in the commercial interest of the requester. The Secretary or his or her designee shall also waive fees that are less than the average cost of collecting fees. In determining whether disclosure is in the public interest, the following factors shall be considered:

(i) Whether the subject of the requested records concerns the operations or activities of the government;

(ii) Whether the disclosure is likely to contribute to an understanding of government operations or activities;

(iii) Whether disclosure of the requested information will contribute to public understanding;

(iv) Whether the disclosure is likely to contribute significantly to public understanding of government operations or activities;

(v) Whether the requester has a commercial interest that would be furthered by the requested disclosure; and, if so,

(vi) Whether the magnitude of the identified commercial interest of the requester is sufficiently large, in comparison with the public interest in disclosure, that disclosure is primarily in the commercial interest of the requester.

(2) *Contents of request for waiver.* The Secretary shall normally deny a request for a waiver of fees that does not include:

(i) A clear statement of the requester's interest in the requested documents;

(ii) The use proposed for the documents and whether the requester will derive income or other benefit from such use;

(iii) A statement of how the public will benefit from such use and from the Board's release of the requested documents; and

(iv) If specialized use of the documents or information is contemplated, a statement of the requester's qualifications that are relevant to the specialized use.

(3) *Burden of proof.* In all cases the burden shall be on the requester to present evidence or information in support of a request for a waiver or reduction of fees.

(4) *Employee requests.* In connection with any request by an employee, former employee, or applicant for employment, for records for use in prosecuting a grievance or complaint of discrimination against the Board, fees shall be waived where the total charges (including charges for information provided under the Privacy Act of 1974 (5 U.S.C. 552a)) are $50 or less; but the Secretary may waive fees in excess of that amount.

Subpart C—Confidential Information Made Available to Supervised Institutions, Financial Institution Supervisory Agencies, Law Enforcement Agencies, and Others in Certain Circumstances

§ 261.11 Confidential supervisory information made available to supervised financial institutions and financial institution supervisory agencies.

(a) *Disclosure of confidential supervisory information to supervised financial institutions.* Confidential supervisory information concerning a supervised bank, bank holding company (including subsidiaries), U.S. branch or agency of a foreign bank, or other institution examined by the Federal Reserve System ("supervised financial institution") may be made available by the Board or the appropriate Federal Reserve Bank to the supervised financial institution.

(b) *Disclosure of confidential supervisory information by supervised financial institution*—(1) *Parent bank holding company, directors, officers, and employees.* Any supervised financial institution lawfully in possession of confidential supervisory information of the Board pursuant to this section may disclose such information, or portions thereof, to its directors, officers, and employees, and to its parent bank holding company and its directors, officers, and employees.

(2) *Certified public accountants and legal counsel.* Any supervised financial institution lawfully in possession of confidential supervisory information of the Board pursuant to this section may disclose such information, or portions thereof, to any certified public accountant or legal counsel employed by the supervised financial institution, subject to the following conditions:

(i) Certified public accountants or legal counsel shall review the confidential supervisory information only on the premises of the supervised financial institution, and shall not make or retain any copies of such information;

(ii) The certified public accountants or legal counsel shall not disclose the confidential supervisory information for any purpose without the prior written approval of the Board's General Counsel except as necessary to provide advice to the supervised financial institution, its parent bank holding company, or the officers, directors, and employees of such supervised financial institution and parent bank holding company.

(c) *Disclosure upon request to Federal financial institution supervisory agencies.* Upon requests, the Director of the Division of Banking Supervision and Regulation or the appropriate Federal Reserve Bank, may make available to the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Federal Home Loan Bank Board and their regional offices and representatives, confidential supervisory information and other appropriate information (such as confidential operating and condition reports) relating to a bank, bank holding company (including subsidiaries), U.S. branch or agency of a foreign bank, or other supervised financial institution.

(d) *Disclosure upon request to state financial institution supervisory agencies.* Upon requests, the Director of the Division of Banking Supervision and Regulation or the appropriate Federal Reserve Bank may make available confidential supervisory information and other appropriate information (such as confidential operating and condition reports) relating to a bank, bank holding company (including subsidiaries), U.S. branch or agency of a foreign bank, or other supervised financial institution to:

(1) A state financial institution supervisory agency having direct supervisory authority over such supervised financial institution; or

(2) A state financial institution supervisory agency not having direct supervisory authority over such supervised financial institution if the requesting agency has entered into an information sharing agreement with the appropriate Federal Reserve Bank and the information to be provided concerns a supervised financial institution that has acquired or has applied to acquire a financial institution subject to that agency's direct supervisory authority.

(e) *Discretionary disclosures.* The Board may determine, from time to time, to authorize other disclosures of confidential information as necessary.

(f) *Conditions and limitations.* The Board may impose any conditions or limitations on disclosure under this section that it determines are necessary to effect the purposes of this regulation.

(g) *Other disclosure prohibited.* All confidential supervisory information or other information made available under this section shall remain the property of the Board. No supervised financial institution, financial institution supervisory agency, person, or any other party to whom the information is made available, or any other officer, director, employee or agent thereof, may disclose such information without the prior written permission of the Board's General Counsel except in published statistical material that does not disclose, either directly or when used in conjunction with publicly available information, the affairs of any individual, corporation, or other entity. No person obtaining access to confidential supervisory information pursuant to this section may make a personal copy of any such information; and no person may remove confidential supervisory information from the premises of the institution or agency in possession of such information except as permitted by specific language in this regulation or by the Board.

(h) *Disclosure of Foreign Bank Confidential Report of Operations*—(1) *Availability of Foreign Bank Confidential Report of Operations to Bank Supervisory Agencies.* Notwithstanding any other provision of this regulation, any Confidential Report of Operations (Form F.R. 2068) of a foreign banking organization may, upon written request to and approval by the Director of the Division of Banking Supervision and Regulation (or his delegee), and with the concurrence of the General Counsel (or his delegee), be made available for inspection to another bank supervisory authority having general supervision of any United States branch, agency, subsidiary bank or commercial lending company of the foreign banking organization, only for use where necessary in the performance of official duties. These reports shall be made available for inspection by authorized persons only on Federal Reserve premises under the same procedures as apply to personnel of the Federal Reserve System. All reports made available under this paragraph shall remain the property of the Board; and no person, agency or authority who obtains access to any such report, or any officer, director, or employee thereof, shall publish, publicize, or otherwise disclose any information contained in the report to any person.

(2) *Restrictions on disclosure by Federal Reserve System employees.* It is the Board's policy that the confidentiality of a foreign banking organization's Confidential Report of Operations (Form F.R. 2068) should be maintained at all times. Except as provided by paragraph (h)(1) of this section, information submitted to the Board as part of any Confidential Report of Operations is not available for public inspection by any person other than an officer, employee, or agent of the Board or of a Federal Reserve Bank properly entitled to such information in the performance of such person's official duties. Any employee that violates this section by releasing such a report to any unauthorized person may be subject to disciplinary action under 12 CFR 264.735–5 (Rules of Employee Responsibilities and Conduct).

§ 261.12 Confidential information made available to law enforcement agencies and other nonfinancial institution supervisory agencies.

(a) *Disclosure upon request.* Upon written request, the Board may make available to appropriate law enforcement agencies and to other nonfinancial institution supervisory agencies for use where necessary in the performance of official duties, reports of examination and inspection, confidential supervisory information, and other confidential documents and information of the Board concerning banks, bank holding companies and their subsidiaries, U.S. branches and agencies of foreign banks, and other examined institutions.

(b) *Eligibility.* Federal, state, and local law enforcement agencies and other nonfinancial institution supervisory agencies may file written requests with the Board for access to confidential documents and information under this section of the regulation. Properly accredited foreign law enforcement agencies and other foreign government agencies may also file written requests with the Board.

(c) *Contents of request.* To obtain access to confidential documents or information under this section of the regulation, the head of the law enforcement agency or nonfinancial institution supervisory agency (or their designees) shall address a letter request to the Board's General Counsel, specifying:

(1) The particular information, kinds of information, and where possible, the particular documents to which access is sought;

(2) The reasons why such information cannot be obtained from the examined institution in question rather than from the Board;

(3) A statement of the law enforcement purpose or other purpose for which the information shall be used;

(4) Whether the requested disclosure is permitted or restricted in any way by applicable law or regulation;

(5) A commitment that the information requested shall not be disclosed to any person outside the agency without the written permission of the Board or its General Counsel; and

(6) If the document or information requested includes customer account information subject to the Right to Financial Privacy Act, as amended (12 U.S.C. 3401 et seq.), a statement that such customer account information need not be provided, or a statement as to why the Act does not apply to the request, or a certification that the requesting agency has complied with the requirements of the Act.

(d) *Action on request.* (1) The General Counsel shall review each request and may approve the request upon determining that:

(i) The request complies with this section;

(ii) The information is needed in connection with a formal investigation or other official duties of the requesting agency;

(iii) Satisfactory assurances of confidentiality have been given; and

(iv) No law prohibits the requested disclosure.

(2) The General Counsel may impose any conditions or limitations on disclosure that the General Counsel determines to be necessary to effect the purposes of this regulation or to insure compliance with applicable laws or regulations.

(e) *Federal and state grand jury, criminal trial, and government administrative subpoenas.* The Board's General Counsel shall review and may approve the disclosure of confidential information pursuant to Federal and state grand jury, criminal trial, and government administrative subpoenas. The General Counsel may impose such conditions or limitations on disclosure under this section that the General Counsel determines are necessary to effect the purposes of this regulation, to insure compliance with applicable laws or regulations, or to protect the confidentiality of the Board's information.

(f) *Requests for testimony or interviews.* Government agencies seeking to obtain testimony or interviews from current and former Federal Reserve System staff concerning any confidential information of the Board shall use the procedures set out in paragraph (c) of this section.

(g) *Other disclosure prohibited.* All reports and information made available under this section remain the property of the Board, and except as otherwise provided in this regulation, no person, agency, or authority to whom the information is made available, or any officer, director, or employee thereof, may disclose any such information except in published statistical material that does not disclose, either directly or when used in conjunction with publicly available information, the affairs of any individual or corporation.

§ 261.13 Other disclosure of confidential supervisory information.

(a) *Board policy.* It is the Board's policy regarding confidential supervisory information that such information is confidential and privileged. Accordingly, the Board will not normally disclose this information to the public. The Board, when considering a request for disclosure of confidential supervisory information under this section, will not authorize disclosure unless the person requesting disclosure is able to show a substantial need for such information that outweighs the need to maintain confidentiality.

(b) *Requests for disclosure.*—(1) *Requests from litigants for information or testimony.* Any person (except agencies identified in §§ 261.11 and 261.12 of this regulation) seeking access to confidential supervisory information or seeking to obtain the testimony of present or former Board or Reserve Bank employees on matters involving confidential supervisory information of the Board, whether by deposition or otherwise, for use in litigation before a court, board, commission, or agency, shall file a written request with the General Counsel of the Board. The request shall describe:

(i) The particular information, kinds of information, and where possible, the particular documents to which access is sought;

(ii) The judicial or administrative action for which the confidential supervisory information is sought;

(iii) The relationship of the confidential supervisory information to the issues or matters raised by the judicial or administrative action;

(iv) The requesting person's need for the information;

(v) The reason why the requesting person cannot obtain the information sought from any other source; and

(vi) A commitment to obtain a protective order acceptable to the Board from the judicial or administrative tribunal hearing the action preserving the confidentiality of any information that is provided.

(2) *All other requests.* Any other person (except agencies identified in §§ 261.11 and 261.12 of this regulation) seeking access to confidential supervisory information for any other purpose shall file a written request with the General Counsel of the Board. A request under this paragraph (b)(2) shall describe the purpose for which such disclosure is sought.

(c) *Action on request.*—(1) *Determination of approval.* The General Counsel of the Board may approve a request made under this section provided that he or she determines that:

(i) The person making the request has shown a substantial need for confidential supervisory information that outweighs the need to maintain confidentiality; and

(ii) Disclosure is consistent with the supervisory and regulatory

responsibilities and policies of the Board.

(2) *Conditions or limitations.* The General Counsel of the Board may, in approving a request, impose such conditions or limitations on use of any information disclosed as is deemed necessary to protect the confidentiality of the Board's information.

(d) *Exhaustion of administrative remedies for discovery purposes in civil, criminal, or administrative action.* Action on a request under this section by the General Counsel of the Board shall exhaust administrative remedies for discovery purposes in any civil, criminal, or administrative proceeding. A request made pursuant to § 261.9 of this regulation does not exhaust administrative remedies for discovery purposes. Therefore, it is not necessary to file a request pursuant to § 261.9 to exhaust administrative remedies under this section.

(e) *Other disclosure prohibited.* All confidential supervisory information made available under this section shall remain the property of the Board. Any person in possession of such information shall not use or disclose such information for any purpose other than that authorized by the General Counsel of the Board without his or her prior written approval.

§ 261.14 Subpoenas, orders compelling production, and other process.

(a) *Advice by person served.* Any person (including any officers, employee, or agent of the Board or any Federal Reserve Bank) who has documents or information of the Board that may not be disclosed and who is served with a subpoena, order, or other judicial or administrative process requiring his or her personal attendance as a witness or requiring the production of documents or information in any proceeding, shall:

(1) Promptly inform the Board's General Counsel of the service and all relevant facts, including the documents and information requested, and any facts of assistance to the Board in determining whether the material requested should be made available; and

(2) At the appropriate time inform the court or tribunal that issued the process and the attorney for the party at whose instance the process was issued of the substance of these rules.

(b) *Appearance by person served.* Unless the Board has authorized disclosure of the information requested, any person who has Board information that may not be disclosed, and who is required to respond to a subpoena or other legal process, shall attend at the time and place required and decline to disclose or to give any testimony with respect to the information, basing such refusal upon the provisions of this regulation. If the court or other body orders the disclosure of the information or the giving of testimony, the person having the information shall continue to decline to disclose the information and shall promptly report the facts to the Board for such action as the Board may deem appropriate.

Subpart D—Requests for Confidential Treatment

§ 261.15 Scope of subpart.

(a) *Data collection forms.* This subpart does not apply to data collected by the Board on forms that are approved pursuant to the Paperwork Reduction Act (44 U.S.C. 3501 *et seq*) and are deemed confidential by the Board. Any such form deemed confidential by the Board shall contain language so indicating on the face of the form or in its instructions. Such information may, however, be disclosed in aggregate form in such a manner that individual company data is not disclosed or derivable.

(d) *Duty to submit information.* This subpart does not modify in any manner the obligation of any person or company to submit, pursuant to any law or regulation, any document, information, form, or other filing to the Board or any Federal Reserve Bank.

(c) *Public comments.* (1) Any comments submitted by a member of the public on applications and regulatory proposals being considered by the Board are public unless the Board or the Secretary determines that confidential treatment is warranted.

(2) A request for confidential treatment of such comments shall be submitted in a separate letter or memorandum accompanying the comments and on which the words, "Request for Confidential Treatment" are prominently displayed. Notwithstanding any other provision of this regulation, the Board need not inform any person submitting such comments of a decision not to afford confidential treatment to the comments.

§ 261.16 Submission and form of request for confidential treatment; action on request.

(a) *Submission of request.* Any submitter of documents or information to the Board who desires that they be afforded confidential treatment pursuant to 5 U.S.C 552(b)(4) shall file a request for confidential treatment with the Board (or in the case of documents filed with a Federal Reserve Bank, with that Reserve Bank), at the time they are submitted or a reasonable time after submission.

(b) *Form of request.* Each request for confidential treatment shall state in reasonable detail the facts and arguments supporting the request and its legal justification. Conclusory statements that particular information would be useful to competitors or would impair sales, or similar statements, generally will not be considered sufficient to justify confidential treatment.

(c) *Designation and separation of confidential material.* All information considered confidential by a submitter shall be clearly designated "Confidential" in the submission and clearly separated from information for which confidential treatment is not requested.

(d) *Action on request.* (1) Requests for confidential treatment of any documents shall be considered in connection with any request for access to the documents. At their discretion, appropriate Board or staff members (including Reserve Bank staff) may act on the request for confidentiality prior to any request for access to the documents.

(2) Any request for confidentiality pursuant to 5 U.S.C. 552(b)(4) shall be handled in accordance with § 261.17 of this subpart.

(3) Nothing in this section limits the Secretary's authority to make determinations regarding requests for access to records under § 261.9.

(e) *Special procedures.* The Board may establish special procedures for particular documents, filings, or types of information by express provisions in this regulation or by instructions on particular forms that are approved by the Board. These special procedures shall take precedence over the procedures set out in this subpart.

§ 261.17 Confidential commercial or financial information.

(a) *Request for confidential information.* (1) The Secretary shall notify a submitter of any request for access to all or a portion of information provided to the Board by the submitter if:

(i) The submitter requested confidential treatment of that information pursuant to 5 U.S.C. 552(b)(4) ("trade secrets and commercial or financial information obtained from a person and privileged or confidential"); and

(ii) The request by the submitter for confidential treatment was made within 10 years preceding the date of the request for access.

(2) Absent a request by a submitter for confidential treatment, the Secretary may notify a submitter of a request for access to all or a portion of information provided by the submitter if it appears to the Secretary that disclosure of the information may reasonably be expected to cause substantial competitive harm to the submitter.

(b) *Notice to submitter.* The notice given to the submitter pursuant to paragraph (a) of this section shall:

(1) Where possible, be given within five working days of the receipt of the request for access;

(2) Describe the request;

(3) Give the submitter a reasonable opportunity, not to exceed ten working days, to submit written objections to disclosure of the information; and

(4) If given orally, be promptly confirmed in writing by the Secretary.

(c) *Notice to requester.* At the same time the Secretary notifies the submitter, the Secretary shall also notify the requester that the request is subject to the provisions of this section and that the submitter is being notified of the request.

(d) *Determination by Secretary.* The Secretary's determination whether or not to disclose any document for which confidential treatment has been requested pursuant to this section shall be communicated to the submitter and the requester immediately. If the Secretary determines to disclose the document or information and the submitter has objected to such disclosure pursuant to paragraph (b) of this section, the Secretary shall provide the submitter with the reasons for disclosure, and shall delay release of the document or information for ten working days following the date of the determination.

(e) *Exceptions to notice to submitter.* Notice to the submitter need not be given if:

(1) The Secretary determines, prior to giving such notice, that the request for access should be denied;

(2) The requested information lawfully has been published or otherwise made available to the public;

(3) Disclosure of the information is required by law (other than 5 U.S.C. 552); or

(4) The submitter's claim of confidentiality under 5 U.S.C. 552(b)(4) appears obviously frivolous or has already been denied by the Secretary, except that in this last instance the Secretary shall give the submitter written notice of the determination to disclose the information at least five working days prior to release.

(f) *Notice of lawsuit.* (1) The Secretary shall promptly notify any submitter of information or documents covered by this section of the filing of any suit against the Board pursuant to 5 U.S.C. 552 to compel disclosure of such documents or information.

(2) The Secretary shall promptly notify the requester of any suit filed against the Board to enjoin the disclosure of any documents requested by the requester.

(g) *Exception for Board rulings.* Nothing in this section shall apply in connection with any determination by the Board to comment upon information submitted to the Board in any opinion or statement issued to the public as described in § 261.8 of this regulation.

By order of the Board of Governors of the Federal Reserve System, June 1, 1988.

William W. Wiles,

Secretary of the Board.

[FR Doc. 88-12719 Filed 6-6-88; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. 87-NM-175-AD; Amdt. 39-5949]

Airworthiness Directives; Avions Marcel Dassault-Breguet Aviation (AMB-BA) Model Fan Jet Falcon Series Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment adopts a new airworthiness directive (AD), applicable to certain AMB-BA Model Fan Jet Falcon series airplanes, which requires modification of the main landing gear (MLG) release mechanism. This amendment is prompted by reports of jamming of the rear lock when the emergency manual control is operated. This condition, if not corrected, could result in failure of the MLG to extend.

DATE: Effective July 11, 1988.

ADDRESSES: The applicable service information may be obtained from Falcon Jet Corporation, 77737 Terrace Avenue, Hasbrouck Heights, New Jersey 07604. This information may be examined at the FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or the Seattle Aircraft Certification Office, 9010 East Marginal Way South, Seattle, Washington.

FOR FURTHER INFORMATION CONTACT: Armella Donnelly, Standardization Branch, ANM-113; telephone (206) 431-1967. Mailing address: FAA, Northwest Mountain Region, 17900 Pacific Highway South, C-68966, Seattle, Washington 98168.

SUPPLEMENTARY INFORMATION: A proposal to amend Part 39 of the Federal Aviation Regulations, applicable to certain AMB-BA Model Fan Jet Falcon series airplanes, which require modification of the main landing gear (MLG) release mechanism, was published in the **Federal Register** on March 8, 1988 (53 FR 7371).

Interested parties have been afforded an opportunity to participate in the making of this amendment. No comments were received in response to the proposal.

After careful review of the available data, the FAA has determined that air safety and the public interest require the adoption of the rule as proposed.

It is estimated that 117 airplanes of U.S. registry will be affected by this AD, that it will take approximately 3 manhours per airplane to accomplish the required actions, and that the average labor cost will be $40 per manhour. Based on these figures, the total cost impact of this AD to U.S. operators is estimated to be $14,040.

The regulations set forth in this amendment are promulgated pursuant to the authority in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1301, *et seq.*), which statute is construed to preempt state law regulating the same subject. Thus, in accordance with Executive Order 12612, it is determined that such regulations do not have federalism implications warranting the preparation of a Federalism Assessment.

For the reasons discussed above, the FAA has determined that this regulation is not considered to be major under Executive Order 12291 or significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979) and it is further certified under the criteria of the Regulatory Flexibility Act that this rule will not have a significant ecomomic impact, positive or negative, on a substantial number of small entities because of the minimal cost of compliance per airplane ($120). A final evaluation has been prepared for this regulation and has been placed in the docket.

List of Subjects in 14 CFR Part 39

Aviation safety, Aircraft.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration

amends § 39.13 of Part 39 of the Federal Aviation Regulations as follows:

PART 39—[AMENDED]

1. The authority citation for Part 39 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); and 14 CFR 11.89.

§ 39.13 [Amended]

2. By adding the following new airworthiness directive:

Avions Marcel Dassault-Breguet Aviation (AMD-BA): Applies to Model Fan Jet Falcon series airplanes as listed in AMD-BA Service Bulletin FJF-32-45(502), Revision 1, dated May 27, 1987, certificated in any category. Compliance is required within 60 days after the effective date of this AD, unless previously accomplished.

To prevent the inability to extend the main landing gear (MLG) due to the lateral door rear lock jamming, accomplish the following:

A. Install a stop on each MLG lateral door rear lock in accordance with AMD-BA Fan Jet Falcon Service Bulletin FJF-32-45(502), Revision 1, dated May 27, 1987.

B. An alternate means of compliance or adjustment of the compliance time, which provides an acceptable level of safety, may be used when approved by the Manager, Standardization Branch, ANM-113, FAA, Northwest Mountain Region.

Note: The request should be forwarded through an FAA Principal Maintenance Inspector (PMI), who may add any comments and then send it to the Manager, Standardization Branch, ANM-113.

C. Special flight permits may be issued in accordance with FAR 21.197 and 21.199 to operate airplanes to a base for the accomplishment of the modification required by this AD.

All persons affected by this directive who have not already received the appropriate service documents from the manufacturer may obtain copies upon request to Falcon Jet Corporation, 77737 Terrace Avenue, Hasbrouck Heights, New Jersey 07604. These documents may be examined at the FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or at the Seattle Aircraft Certification Office, 9010 East Marginal Way South, Seattle, Washington.

This amendment becomes effective July 11, 1988.

Issued in Seattle, Washington, on May 26, 1988.

Frederick M. Isaac,

Acting Director, Northwest Mountain Region.

[FR Doc. 88-12735 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

14 CFR Part 39

[Docket No. 88-NM-68-AD; Amdt. 39-5946]

Airworthiness Directives; Cessna Model S550 Series Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment supersedes an existing airworthiness directive (AD), applicable to certain Cessna Model S550 series airplanes, which currently requires repetitive inspections of the cotter pins securing the main landing gear (MLG) torque link connections, and repair, if necessary. This action expands the applicability to include all Cessna Model S550 series airplanes, and revises the corrective action procedures. This amendment is prompted by reports that the cotter pins securing the MLG torque link connections were found broken on other airplanes, and reports that corrective repairs accomplished in accordance with the existing AD are inadequate. This condition, if not corrected, could result in failure of the cotter pins, which could lead to loss of control of the airplane during takeoff or landing.

EFFECTIVE DATE: June 20, 1988.

ADDRESSES: The applicable service information may be obtained from Cessna Aircraft Company, Citation Marketing Division, P.O. Box 7706, Wichita, Kansas 67277. This information may be examined at FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or FAA, Central Region, Wichita Aircraft Certification Office, 1801 Airport Road, Room 100, Mid-Continent Airport, Wichita, Kansas.

FOR FURTHER INFORMATION CONTACT: Mr. Douglas W. Haig, Aerospace Engineer, Wichita Aircraft Certification Office, FAA, Central Region, 1801 Airport Road, Room 100, Mid-Continent Airport, Wichita Kansas 67209; telephone (316) 946-4409.

SUPPLEMENTARY INFORMATION: On February 6, 1986, the FAA issued AD 86-01-02, Amendment 39-5237 (51 FR 5513; February 14, 1986), applicable to Cessna Model S550 series airplanes, Serial Numbers S550-0001 through S550-0079, which requires inspection to ensure that the cotter pins securing the left and right MLG torque link connections are not missing or do not indicate evidence of being cut or sheared by the attaching nut. If the pins are not in place, or are broken, they must be replaced or repaired. That action was prompted by reports of broken cotter pins. This condition, if not corrected, could result in loosening of the attaching nut and bolt, and could lead to loss of control of the airplane during takeoff or landing.

Recently, the FAA has received reports of broken cotter pins found on other Cessna Model S550 series airplanes with serial numbers outside of those affected by the existing AD. Accordingly, the FAA has determined that the unsafe condition addressed in AD 86-01-02 may exist on any airplane of this model.

Additionally, there have been two reports of broken cotter pins found on airplanes on which corrective repair action had been taken in accordance with AD 86-01-02. This indicates that the corrective action was apparently inadequate.

Since this situation is likely to exist or develop on other airplanes of the same type design, this AD requires a revision to the Airplane Flight Manual (AFM) requiring inspection of the cotter pins prior to the first flight of the day, and replacement of the cotter pin and retorquing of the attaching nut, if necessary.

The manufacturer has indicated that it is designing a modification which, if installed, would eliminate the need for the inspections required by this AD. Once this modification is available, the FAA may consider further rulemaking to require its installation.

Since a situation exists that requires immediate adoption of this regulation, it is found that notice and public procedure hereon are impracticable, and good cause exists for making this amendment effective in less than 30 days.

The regulations set forth in this amendment are promulgated pursuant to the authority in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1301, *et seq.*), which statute is construed to preempt state law regulating the same subject. Thus in accordance with Executive Order 12612, it is determined that such regulations do not have federalism implications warranting the preparation of a Federalism Assessment.

The FAA has determined that this regulation is an emergency regulation that is not considered to be major under Executive Order 12291. It is impracticable for the agency to follow the procedures of Order 12291 with respect to this rule since the rule must be issued immediately to correct an unsafe condition in aircraft. It has been further determined that this document involves an emergency regulation under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). If this action is subsequently determined to

involve a significant/major regulation, a final regulatory evaluation or analysis, as appropriate, will be prepared and placed in the regulatory docket (otherwise, an evaluation is not required).

List of Subjects in 14 CFR Part 39

Aviation safety, Aircraft.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends § 39.13 of Part 39 of the Federal Aviation Regulations (14 CFR 39.13) as follows:

PART 39—[AMENDED]

1. The authority citation for Part 39 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised Pub. L. 97–449, January 12, 1983); and 14 CFR 11.89.

§ 39.13 [Amended]

2. By superseding AD 86–01–02, Amendment 39–5237 (51 FR 5513; February 14, 1986), with the following new airworthiness directive:

Cessna: Applies to all Model S550 series airplanes, certificated in any category. Compliance required as indicated, unless previously accomplished.

To prevent loss of control of the airplane during landing or takeoff due to failure of the cotter pins securing the main landing gear torque link connections, accomplish the following:

A. Within 48 hours after the effective date of this AD, incorporate the following into the Limitations Section of the FAA-approved Airplane Flight Manual (AFM). This may be accomplished by including a copy of this AD in the AFM:

"Prior to the first flight of each day, verify that the cotter pins securing the left and right main landing gear torque link connections are installed. If either cotter pin is broken, missing, or exhibits any evidence of being cut or sheared by the nut, prior to further flight, accomplish paragraph B. of this AD."

B. If either cotter pin is broken, missing, or exhibits any evidence of being cut or sheared by the nut, the nut must be retorqued to 630 inch-pounds, then tightened to align the cotter pin(s) hole up to a maximum torque of 810 inch-pounds, and a new cotter pin(s), P/N MS24665–287, installed. This must be accomplished in accordance with Cessna S550 Maintenance Manual Section 32–11–01, pages 403, 404, and 405.

C. An alternate means of compliance or adjustment of the compliance time, which provides an acceptable level of safety, may be used when approved by the Manager, Wichita Aircraft Certification Office, FAA, Central Region.

All persons affected by this directive who have not already received the appropriate service information from the manufacturer may obtain copies upon request to Cessna Aircraft Company, Citation Marketing Division, P.O. Box 7706, Wichita, Kansas 67277. This information may be examined at FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or FAA, Central Region, Wichita Aircraft Certification Office, 1801 Airport Road, Room 100, Mid-Continent Airport, Wichita, Kansas.

This supersedes Ad 86–01–02, Amendment 39–5237.

This amendment becomes effective June 20, 1988.

Issued in Seattle, Washington, on May 25, 1988.

Frederick M. Isaac,

Acting Director, Northwest Mountain Region.

[FR Doc. 88–12727 Filed 6–6–88; 8:45 am]

BILLING CODE 4910–13–M

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14 CFR Part 39

[Docket No. 88–NM–47–AD; Amdt. 39–5947]

Airworthiness Directives; Boeing Model 767 Series Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment supersedes telegraphic Airworthiness Directive T88–06–51, issued on March 11, 1988, applicable to all Boeing Model 767 series airplanes, which currently requires a functional flow check of the cargo compartment Halon fire extinguishant distribution system. This amendment requires additional inspection or testing of the cargo compartment Halon fire extinguishant distribution system. This amendment is prompted by reports that the cargo fire extinguishant system plumbing was connected in reverse on some airplanes and, in one case, the extinguishant discharge nozzle in the aft compartment was covered by a ceiling panel. These conditions, if not corrected, could result in severe damage to an airplane in the event of a cargo compartment fire.

DATE: Effective June 20, 1988.

ADDRESS: The applicable service information may be obtained from the Boeing Commercial Airplane Company, P.O. Box 3707, Seattle, Washington 98124–2207. This information may be examined at FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or Seattle Aircraft Certification Office, FAA, Northwest Mountain Region, 9010 East Marginal Way South, Seattle, Washington.

FOR FURTHER INFORMATION CONTACT: Mr. Henry A. Jenkins, Systems and Equipment Branch, ANM–130S; telephone (206) 431–1946. Mailing address: FAA, Northwest Mountain Region, 17900 Pacific Highway South, C–68966, Seattle, Washington 98168.

SUPPLEMENTARY INFORMATION: On March 11, 1988, the FAA issued telegraphic AD 88–06–51, applicable to all Boeing Model 767 airplanes, which requires flow testing of the cargo compartment fire extinguishant system, and repair, if necessary. That action was prompted by two recent reports in which cargo fire extinguishant system plumbing was connected in reverse, the aft discharge port to the forward compartment distribution line and vice versa.

Since the issuance of AD T88–06–51, one recent report also disclosed that an extinguishant discharge nozzle in the aft cargo compartment on one plane was covered by a ceiling panel. This condition could prevent discharge of the fire extinguishant into the cargo compartment through that nozzle.

These conditions, if not corrected, could result in severe damage to the airplane in the event of a cargo compartment fire.

The FAA has reviewed and approved Boeing Alert Service Bulletin 767–26A0036, dated March 11, 1988, and Boeing Service Letter 767–SL–26–11 dated March 10, 1988, which describe inspections for both the cargo fire extinguishant distribution system reversal and covered extinguishant discharge nozzles.

Since this condition is likely to exist on other airplanes of the same type design, this AD supersedes telegraphic AD T88–06–51 and requires inspection to assure freedom from coverage of the discharge nozzles, and either a part number inspection in accordance with the previously mentioned service bulletin or, alternatively, a functional flow test of the distribution system to ensure proper operation.

Since a situation exits that requires immediate adoption of this regulation, it is found that notice and public procedure hereon are impracticable, and good cause exists for making this amendment effective in less than 30 days.

Information collection requirements contained in this regulation have been approved by the Office of Management and Budget under the provisions of the Paperwork Reduction Act of 1980 (Pub. L. 96–511) and have been assigned OMB Control Number 2120–0056.

The regulations set forth in this amendment are promulgated pursuant to the authority in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1301, *et*

seq.), which statute is construed to preempt state law regulating the same subject. Thus, in accordance with Executive Order 12612, it is determined that such regulations do not have federalism implications warranting the preparation of a Federalism Assessment.

The FAA has determined that this regulation is an emergency regulation that is not considered to be major under Executive Order 12291. It is impracticable for the agency to follow the procedures of Order 12291 with respect to this rule since the rule must be issued immediately to correct an unsafe condition in aircraft. It has been further determined that this document involves an emergency regulation under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). If this action is subsequently determined to involve a significant/major regulation, a final regulatory evaluation or analysis, as appropriate, will be prepared and placed in the regulatory docket (otherwise, an evaluation is not required).

List of Subjects in 14 CFR Part 39

Aviation safety, Aircraft.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the administrator, the Federal Aviation Administration amends § 39.13 of Part 39 of the Federal Aviation Regulations (14 CFR 39.13) as follows:

PART 39—[AMENDED]

§ 39.13 [Amended]

1. The authority citation for Part 39 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised) Pub. L. 97–449, January 12, 1983); and 14 CFR 11.89.

2. By superseding telegraphic AD 88–06–51, issued March 11, 1988, with the following new airworthiness directive:

Boeing: Applies to Boeing Model 767 series airplanes, certificated in any category. Compliance required as indicated, unless previously accomplished.

To prevent severe damage to the airplane in the event of a cargo compartment fire, due to fire extinguishant distribution system reversals or covered extinguishant discharge nozzles, accomplish the following:

A. Within the next 24 hours (1 day) after the effective date of this AD, accomplish either of the following:

1. Conduct the cargo compartment fire extinguishant distribution system part number inspection, in accordance with Boeing Alert Service Bulletin 767–26A0036, dated March 11, 1988; or

2. Conduct the functional flow check of the cargo compartment Halon fire extinguishant distribution system using guidelines in the applicable section of Maintenance Manual 26–23–00. Verify that the flow is distributed to the proper cargo compartment.

B. Within the next 30 days after the effective date of this AD, inspect the cargo fire extinguishant nozzles in accordance with either Boeing Alert Service Bulletin 767–26A0036, dated March 11, 1988, or Boeing Service Letter 767–SL–26–11, dated March 10, 1988.

C. Any detected cargo fire extinguishant distribution system reversals and/or covered extinguishant nozzles must be ordered, in accordance with the Boeing Model 767 Maintenance Manual, prior to further flight with baggage or cargo in either the forward or aft cargo compartments.

D. Within 7 days, report a complete description of the findings from the accomplishment of the requirements paragraph A., above, from which it is determined that the flow is not distributed to the proper cargo compartment; and from the requirements of paragraph B., above, from which it is determined that a nozzle is covered; to the Manager, Seattle Aircraft Certification Office, FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington 98168.

E. An alternate means of compliance or adjustment of the compliance time, which provides an acceptable level of safety, may be used when approved by the Manager Seattle Aircraft Certification Office, FAA, Northwest Mountain Region.

Note: The request should be forwarded through an FAA Principal Maintenance Inspector (PMI), who may add any comments and then send it to the Seattle Aircraft Certification Office.

F. Special flight permits may be issued in accordance with FAR 21.197 and 21.199 to operate airplanes to a base for the accomplishment of the tests required by this AD.

All persons affected by this directive who have not already received the appropriate service information from the manufacturer may obtain copies upon request to the Boeing Commercial Airplane Company, P.O. Box 3707, Seattle, Washington 98124. This information may be examined at FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or Seattle Aircraft Certification Office, FAA, Northwest Mountain Region, 9010 East Marginal Way South, Seattle, Washington.

This supersedes telegraphic AD T88–06–51 issued March 11, 1988

This amendment becomes effective June 20, 1988.

Issued in Seattle, Washington, on May 25, 1988.

Frederick M. Issac,

Acting Director, Northwest Mountain Region.

[FR Doc. 88–12728 Filed 6–6–88; 8:45 am]

BILLING CODE 4910–13–M

14 CFR Part 39

[Docket No. 87–NM–130–AD; Amdt. 39–5950]

Airworthiness Directives; Short Brothers, PLC, Model SD3–30 Series Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment adopts a new airworthiness directive (AD), applicable to certain Shorts Model SD3–30 series airplanes, which requires replacement of certain pitot tubes. This amendment is prompted by reports of inoperative pitot tubes due to icing. This condition, if not corrected, could result in erroneous airspeed and altitude indications.

DATE: Effective July 11, 1988.

ADDRESSES: The applicable service information may be obtained from the Short Brothers, PLC, Service Representative, 2011 Crystal Drive, Suite 713, Arlington, Virginia 22202–3702. This information may be examined at the FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or the Seattle Aircraft Certification Office, 9010 East Marginal Way South, Seattle, Washington.

FOR FURTHER INFORMATION CONTACT: Ms. Armella Donnelly, Standardization Branch, ANM–113; telephone (206) 431–1967. Mailing address: FAA, Northwest Mountain Region, 17900 Pacific Highway South, C–68966, Seattle, Washington 98168.

SUPPLEMENTARY INFORMATION: A proposal to amend Part 39 of the Federal Aviation Regulations to include an airworthiness directive (AD), applicable to Shorts Brothers Model SD3–30 series airplanes, which requires replacement of certain pitot tubes, was published in the **Federal Register** on March 22, 1988 (52 FR 9322).

Interested person have been afforded an opportunity to participate in the making of this amendment. No comments were received in response to the proposal.

After careful review of the available data, the FAA has determined that air safety and the public interest require adoption of the rule as proposed.

It is estimated that 66 airplanes of U.S. registry will be affected by this AD, that it will take approximately 3 manhours per airplane to accomplish the required actions, and that the average labor cost will be $40 per manhour. Based on these figures, the total cost impact of this AD

to U.S. operators is estimated to be $7,920.

The regulations set forth in this amendment are promulgated pursuant to the authority in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1301, *et seq.*), which statute is construed to preempt state law regulating the same subject. Thus, in accordance with Executive Order 12612, it is determined that such regulations do not have federalism implications warranting the preparation of a Federalism Assessment.

For the reasons discussed above, the FAA has determined that this document (1) involves a proposed regulation which is not major under Executive Order 12291 and (2) is not a significant rule pursuant to the Department of Transportation Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and it is further certified under the criteria of the Regulatory Flexibility Act that this proposed rule, if promulgated, will not have a significant economic impact, positive or negative, on a substantial number of small entities because of the minimal cost of compliance per airplane ($120). A final evaluation prepared for this action is contained in the regulatory docket.

List of Subjects in 14 CFR Part 39

Aviation safety, Aircraft.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends § 39.13 of Part 39 of the Federal Aviation Regulations as follows:

PART 39—[AMENDED]

1. The authority citation for Part 39 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); and 14 CFR 11.89.

§ 39.13 [Amended]

2. By adding the following new airworthiness directive:

Short Brothers, PLC: Applies to Model SD3-30 series airplanes; serial numbers SH3002 through SH3096, inclusive; certificated in any category. Compliance required as indicated, unless previously accomplished.

To prevent pitot tubes from becoming inoperative due to icing, which could result in erroneous airspeed and altitude indication, accomplish the following:

A. Within the next 180 days after the effective date of this AD, replace pitot tubes having the code letter "Z" adjacent to the serial number with one containing a code letter other than "Z", in accordance with accomplishment instructions in Service Bulletin SD3-34-26, Revision 1, dated September 1, 1985.

B. An alternate means of compliance or adjustment of the compliance time, which provides an acceptable level of safety and which has the concurrence of an FAA Principal Maintenance Inspector, may be used when approved by the Manager, Standardization Branch, ANM-113, FAA, Northwest Mountain Region.

Note: The request should be forwarded through an FAA Principal Maintenance Inspector (PMI), who may add any comments and then send it to the Manager, Seattle Aircraft Certification Office.

C. Special flight permits may be issued in accordance with FAR 21.197 and 21.199 to operate airplanes to a base for the accomplishment of the requirements required by this AD.

All persons affected by this directive who have not already received the appropriate service information from the manufacturer may obtain copies upon request to Short Brothers, PLC, Service Representative, 2011 Crystal Drive, Suite 713, Arlington, Virginia 22202-3702. This information may be examined at the FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or the Seattle Aircraft Certification Office, 9010 East Marginal Way South, Seattle, Washington.

This amendment becomes effective July 11, 1988.

Issued in Seattle, Washington, on May 26, 1988.

Frederick M. Isaac,

Acting Director Northwest Mountain Region.

[FR Doc. 88-12736 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

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14 CFR Part 39

[Docket No. 87-NM-74-AD; Amdt. 39-5948]

Airworthiness Directives; Boeing Model 747 Series Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment adopts a new airworthiness directive (AD), applicable to certain Boeing Model 747 airplanes equipped with an integrated autopilot/flight director and a Landing Rollout Control Unit (LRCU) computer, which requires certain revisions to the Airplane Flight Manual (AFM) concerning landing operations and the installation of a placard on the instrument panel, or, as an alternate, rework of the computer. This amendment is prompted by an incident of excessive bank angle during touchdown. This condition, if not corrected, could result in contact of the engine nacelle with the runway upon landing.

DATE: Effective July 11, 1988.

ADDRESSES: The applicable service information may be obtained from the Boeing Commercial Airplane Company, P.O. Box 3707, Seattle, Washington 98124. This information may be examined at FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or the Seattle Aircraft Certification Office, 9010 East Marginal Way South, Seattle, Washington.

FOR FURTHER INFORMATION CONTACT: Mr. Frank vanLeynseele, Systems and Equipment Branch, ANM-130S; telephone (206) 431-1948. Mailing address: FAA, Northwest Mountain Region, 17900 Pacific Highway South, C-68966, Seattle, Washington 98168.

SUPPLEMENTARY INFORMATION: A proposal to amend Part 39 of the Federal Aviation Regulations to include an airworthiness directive which requires certain revisions to the Airplane Flight Manual (AFM) concerning landing operations and the installation of a placard on the instrument panel on certain Boeing Model 747 airplanes was published in the **Federal Register** on July 15, 1987 (52 FR 26484).

Interested persons have been afforded an opportunity to participate in the making of this amendment. Due consideration has been given to the comments received.

The first commenter, the Air Transport Association (ATA) of America, expressed no objections to the proposed rule.

The other commenter, the Boeing Commercial Airplane Company, submitted a letter from a foreign operator of a Model 747 airplane indicating that the operational costs resulting from the proposed rule could be far in excess of that indicated in the Notice. The FAA agrees that additional, *indirect* costs might be incurred if, for example, it were necessary that an airplane divert to a different airport as a result of the limitations imposed by this AD. However, the economic analysis of this rulemaking identifies only those costs associated directly with the requirements of the AD, in this case, a change to pages in the AFM and cockpit placards, or an optional modification.

Further, Boeing submitted data obtained from simulated landings which indicate that a pilot would recognize the cross-wind condition and take over from the autoland system to prevent the airplane from striking an engine nacelle on the runway. Therefore, the commenter suggested that the

requirements of the proposed AD are unnecessarily restrictive. The FAA does not concur. These airplanes must be able to land under low visibility minimums without developing high bank angles in an effort to correct for cross-wind drift.

Since the issuance of the Notice, Boeing has developed a modification to correct the excessive roll condition that could occur during a cross-wind landing. The FAA has reviewed and approved Boeing Service Bulletin 747-22-2166 dated March 17, 1988, which describes a modification to the Landing Rollout Control Unit (LRCU) computer, P/N 60B00013-759. The FAA has determined that modification of the LRCU in accordance with the aforementioned service bulletin is an acceptable alternate means of compliance with the intent of this rule, and has revised the final rule to include this modification as an optional requirement.

After careful review of the available data, including the comments noted above, the FAA has determined that air safety and the public interest require the adoption of the rule, with the change previously described.

It is estimated that 4 airplanes of U.S. registry will be affected by this AD. The costs to operators who elect to revise pages of the FAA-approved AFM and install placard (which can be manufactured locally) is estimated to be approximately one manhour per airplane at an average labor cost of $40 per manhour. Based on these figures, the total cost impact of the AD on U.S. operators is estimated to be $160. The cost to operators who elect to rework the LRCU computer to a part number 60B00013-760 is estimated to be approximately 8 manhours per airplane at an average labor cost of $40 per manhour. Based on these figures, the total cost impact of the AD on U.S. operators is estimated to be $1,280.

The regulations set forth in this amendment are promulgated pursuant to the authority in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1301, *et seq.*), which statute is construed to preempt state law regulating the same subject. Thus, in accordance with Executive Order 12612, it is determined that such regulations do not have federalism implications warranting the preparation of a Federalism Assessment.

For the reasons discussed above, the FAA has determined that this regulation is not considered to be major under Executive Order 12291 or significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and it is further certified under the criteria of the Regulatory Flexibility Act that this rule will not have a significant economic impact, positive or negative, on a substantial number of small entities, because the minimal cost of compliance per airplane ($40 or $320). A final evaluation has been prepared for this regulation and has been placed in the regulatory docket.

List of Subjects in 14 CFR Part 39

Aviation safety, Aircraft.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends § 39.13 of Part 39 of the Federal Aviation Regulations (14 CFR 39.13) as follows:

PART 13—[AMENDED]

1. The authority citation for Part 39 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); and 14 CFR 11.89.

§ 39.13 [Amended]

2. By adding the following new airworthiness directive:

Boeing: Applies to Model 747 series airplanes, equipped with the autopilot/flight director which has the Landing Rollout Control Unit (LRCU), part number 60B00013-759, with the rollout function not installed or previously removed, certificated in any category. Compliance is required as indicated, unless previously accomplished.

To prevent engine contact with the runway as a result of excessive airplane roll after touchdown, accomplish the following:

A. Within the next 15 days after the effective date of this AD, accomplish the following:

1. Incorporate the following into the Limitations Section of the Airplane Flight Manual (AFM). This may be accomplished by inserting a copy of this AD in the AFM: "Disconnect autopilot prior to 50 feet AGL during approach to land;" and

2. Install a placard in plain view of both the Captain and First Officer, which reads as follows: "Disconnect autopilot prior to 50 feet AGL."

B. Rework of the LRCU, P/N 60B00013-759, in accordance with the instructions contained in Boeing Service Bulletin 747-22-2166, dated March 17, 1988, constitutes terminating action for the requirements of paragraph A., above.

C. An alternate means of compliance or adjustment of compliance time, which provides an acceptable level of safety, may be used when approved by the Manager, Seattle Aircraft Certification Office, FAA, Northwest Mountain Region.

Note: The request should be forwarded through an FAA Principal Avionics Inspector (PAI), who may add any comments and then send it to the Seattle Aircraft Certification Office.

D. Special flight permits may be issued in accordance with FAR 21.197 and 21.199 to operate airplanes to a base for the accomplishment of the requirements of this AD.

All persons affected by this directive who have not already received the appropriate service documents from the manufacturer may obtain copies upon request to Boeing Commercial Airplane Company, P.O. Box 3707 Seattle, Washington 98124. These documents may be examined at FAA, Northwest Mountain Region, 17900 Pacific Highway South, Seattle, Washington, or at the Seattle Aircraft Certification Office, 9010 East Marginal Way South, Seattle, Washington.

This amendment becomes effective July 11, 1988.

Issued in Seattle, Washington, on May 26, 1988.

Frederick M. Isaac,

Acting Director, Northwest Mountain Region.

[FR Doc. 88-12734 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

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14 CFR Part 39

[Docket No. 87-CE-36-AD; Amdt. 39-5953]

Airworthiness Directives; Partenavia Costruzione Aeronautiche, S.p.A., Models P 68, P 68B, P 68C, P68C-TC, P 68 "Observer", and P 68-TC "Observer" Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment adopts a new Airworthiness Directive (AD), applicable to Partenavia Costruzione Aeronautiche, S.p.A., Models P 68, P 68B, P 68C, P 68C-TC, P 68 "Observer", and P 68-TC "Observer" airplanes, which requires initial and recurring visual or non-destructive inspection of the engine mounting brackets, repair or replacement if corrosion or cracking is found, and modification of the airplane to provide inspection access. Several reports of cracks and corrosion have been received by the airplane manufacturer. Undetected corrosion or cracks can result in structural failure of the engine mounts, whirl mode flutter, and subsequent loss of the airplane. The actions required by this AD will prevent structural failure of the engine mounts.

DATES: *Effective Date:* July 13, 1988.

Compliance: As prescribed within the body of the AD.

ADDRESSES: Partenavia Costruzione Aeronautiche, S.p.A. Service Bulletin (S/B) No. 70, Revision 1, dated May 13,

1987, applicable to this AD may be obtained from Partenavia Costruzione Aeronautiche, S.p.A., Via Cava, Casoria-Naples, Italy; Telephone: 81 759-0948. This information may also be examined at the Rules Docket, FAA, Office of the Regional Counsel, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

FOR FURTHER INFORMATION CONTACT: Mr. Munro Dearing, Aircraft Certification Staff, AEU-100, Europe, Africa and Middle East Office, FAA, c/o American Embassy, B-1000, Brussels, Belgium; Telephone 513.38.30, ext. 2710/2711; or Mr. John P. Dow, Sr., FAA, ACE-109, 601 East 12th Street, Kansas City, Missouri 64106; Telephone (816) 426-6932.

SUPPLEMENTARY INFORMATION: A proposal to amend Part 39 of the Federal Aviation Regulations to include an AD requiring initial and recurring visual or non-destructive inspection of the engine mounting brackets, repair or replacement if corrosion or cracking is found, and modification of the airplane to provide inspection access on Partenavia Costruzione Aeronautiche, S.p.A., Models P 68, P 68B, P 68C, P68C-TC, P 68 "Observer", and P 68-TC "Observer" airplanes was published in the **Federal Register** on December 10, 1987 (52 FR 46776). The airplane manufacturer issued S/B 70, dated November 21, 1986, applicable to Model P 68, P 68B, P 68C, P 68C-TC, P 68 "Observer", and P 68-TC "Observer" airplanes based on one report of corroded or cracked engine mount brackets. The FAA determined at that time that the unsafe condition addressed by Partenavia S/B 70 was not likely to exist or develop in other products of the same type design.

An additional thirteen reports of corrosion and cracks were subsequently received, including areas not previously reported. Consequently, Partenavia Costruzione Aeronautiche, S.p.A. issued Partenavia S/B No. 70, Rev. 1, dated May 13, 1987, which describes initial and recurrent visual or non-destructive inspection and modification to install inspection holes and repair or replacement of engine mount brackets if corrosion or a crack is found.

As a result of these additional reports, the FAA has determined that if the cracks and corrosion addressed in these reports remain undetected, catastrophic failure of the engine mount may occur resulting in possible whirl mode flutter and loss of the airplane.

The Registro Aeronautico Italiano (RAI), which has responsibility and authority to maintain the continuing airworthiness of these airplanes in Italy, classified Partenavia S/B No. 70, Rev. 1, dated May 13, 1987, and RAI AD No. 87-141/P.68-36, Rev. 2, dated August 31, 1987, and the actions recommended therein by the manufacturer as mandatory to assure the continued airworthiness of the affected airplanes. On airplanes operated under Italian registration, this action has the same effect as an AD on airplanes certified for operation in the United States. The FAA relies upon the certification of the RAI combined with FAA review of pertinent documentation in finding compliance of the design of these airplanes with the applicable United States airworthiness requirements and the airworthiness and conformity of products of this design certificated for operation in the United States.

The FAA examined the available information related to the issuance of Partenavia S/B No. 70, Rev. 1, dated May 13, 1987, and the mandatory classification of this S/B by the RAI, as well as the information available concerning the additional reports of corrosion and cracks in the engine mount brackets, and concluded that the condition addressed by Partenavia S/B No. 70, Rev. 1, dated May 13, 1987, was an unsafe condition that may exist on other airplanes of this type certificated for operation in the United States. Accordingly, the FAA proposed an amendment to Part 39 of the FAR to include an AD on this subject.

Interested persons have been afforded an opportunity to comment on the proposal. No comments or objections were received on the proposal or the FAA determination of the related cost to the public.

Subsequent to the issuance of the NPRM, the FAA discovered that instructions for recurrent inspections and serial number effectivity had been omitted. Accordingly, since no additional cost to the public is incurred, and no change of the intent or substance of the NPRM is involved, the AD is adopted with the subject matter of those omissions incorporated therein.

The FAA has determined that this regulation involves 70 U.S. registered airplanes at an appropriate initial cost of $2,216 per airplane and $80 thereafter per inspection for each airplane resulting in a total initial fleet cost of $155,120 and recurring fleet inspection cost of $5,600 thereafter. The cost of compliance with the proposed AD is so small that the expense of compliance will not be a significant financial impact on any small entities operating this airplane.

The regulations set forth in this amendment are promulgated pursuant to authority in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1301 *et seq.*), which statute is construed to preempt State law regulating the same subject. Thus, in accordance with Executive Order 12612, it is determined that such regulation does not have federalism implications warranting the preparation of a Federalism Assessment.

Therefore, I certify that this action (1) is not a "major rule" under Executive Order 12291; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and (3) will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

A copy of the final evaluation prepared for this action is contained in the regulatory docket. A copy of it may be obtained by contacting the Rules Docket at the location provided under the caption "**ADDRESSES**".

List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Safety.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends § 39.13 of Part 39 of the FAR as follows:

PART 39—[AMENDED]

1. The authority citation for Part 39 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised, Pub. L. 97-449, January 12, 1983); and 14 CFR 11.89.

§ 39.13 [Amended]

2. By adding the following new AD:

Partenavia Costruzione Aeronautiche S.p.A.: Applies to Models P 68, P 68B, P68C, P68C-TC, P 68 "Observer", and P 68-TC "Observer" (all serial numbers (S/N)) airplanes certificated in any category.

Compliance: Required initially within 6 calendar months after the effective date of this AD unless already accomplished within the last 24 calendar months preceding the effective date of this AD, and thereafter at intervals not to exceed 24 calendar months or 500 hours time-in-service, (TIS) whichever occurs first, unless already accomplished.

To prevent engine mount failure, whirl mode flutter, and structural failure of the wing, accomplish the following:

(a) For S/N 1 thru 368, at the time of the initial inspection specified in this AD, modify the engine skin panels for inspection access in accordance with the instructions in Section 1 of Partenavia Service Bulletin (S/B) No. 70, Rev. 1, dated May 13, 1987.

(b) For S/N 1 thru 368, visually inspect the upper and lower engine mounts and attachments for surface corrosion and cracks

in accordance with the instructions in Section 1 of the above S/B. If cracks or surface corrosion are found, prior to further flight repair the affected structure in accordance with the instructions in paragraph (d) of this AD.

(c) For S/N 369 and subsequent, visually inspect the upper and lower engine mounts and attachments for surface corrosion and cracks in accordance with the instructions in Section 3 of the above S/B. If cracks or surface corrosion are found, prior to further flight repair the affected structure in accordance with the instructions in paragraph (d) of this AD.

(d) If cracks or surface corrosion are found as a result of the inspections specified in paragraph (b) or (c) of this AD, prior to further flight, repair the affected structure as follows:

(1) If the surface corrosion or crack extends no deeper than 75/1000 (7.5%) of the original local thickness, so that no less than 92.5% of the original local thickness remains, repair using the procedures described in Section 1 of Partenavia S/B No. 70, Rev. 1, dated May 13, 1987.

(2) If any crack or surface corrosion extends deeper than 75/1000 (7.5%) of the original local thickness, so that less than 92.5% of the original local thickness remains including blistering, pitting, or flaking, prior to further flight, remove and replace the affected part with a serviceable part as described in Section 2 of Partenavia S/B No. 70, Rev. 1, dated May 13, 1987.

(e) Within one week following each inspection specified in paragraph (b) or (c) of this AD, submit a written report of the result of that inspection to include whether or not damage was found, part number(s) involved, extent, location, and description of any damage found, and a brief description of remedial measures. Submit the reports to the FAA, ACE-109, 601 East 12th Street, Kansas City, Missouri 64106. If an inspection was made previous to this AD, forward the requested data within one week of receipt of this AD. (Report approved by the Office of Management and Budget under OMB No. 2120-0056.)

(f) Aircraft may be flown in accordance with FAR 21.197 to a location where this AD may be accomplished.

(g) An equivalent means of compliance with this AD may be used if approved by the Manager, Aircraft Certification Staff, AEU-100, Europe, Africa and Middle East Office, FAA, c/o American Embassy, B-1000, Brussels, Belgium; Telephone (322) 513.3830 ext. 3710/2711.

All persons affected by this directive may obtain copies of the document(s) referred to herein upon request to Partenavia Costruzione Aeronautiche, S.p.A., Via Cava, Casoria-Naples, Italy; Telephone 81 759-0946 (Product Support); or may examine these documents at the FAA, Office of the Regional Counsel, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

This amendment becomes effective on July 13, 1988.

Issued in Kansas City, Missouri, on May 27, 1988.

Jerold M. Chavkin,

Acting Director, Central Region.

[FR Doc. 88-12733 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

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14 CFR Part 71

[Airspace Docket No. 88-ANM-4]

Amendment of Transition Area, Holyoke, CO

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This action amends the Holyoke, Colorado, Transition Area. The amendment is necessary to provide controlled airspace for a new instrument approach procedure. The area will be depicted on aeronautical charts for pilot reference, and is intended to segregate aircraft operating in Instrument Flight Rules conditions and other aircraft which are operating in Visual Flight Rules conditions.

EFFECTIVE DATE: 0901 UTC, July 8, 1988.

FOR FURTHER INFORMATION CONTACT: Ted Melland, ANM-536, Federal Aviation Administration, Docket No. 88-ANM-4, 17900 Pacific Highway South, C-68966, Seattle, Washington 98168, Telephone: (206) 431-2536.

SUPPLEMENTARY INFORMATION:

History

On March 1, 1988, the FAA proposed to amend Part 71 of the Federal Aviation Regulations (14 CFR Part 71) to amend the Holyoke, Colorado Transition Area (53 FR 6160.).

Interested parties were invited to participate in this rulemaking proceeding by submitting written comments on the proposal to the FAA. No comments objecting to the proposal were received. Section 71.181 of Part 71 of the Federal Aviation Regulations was republished in Handbook 7400.6D dated January 4, 1988.

The Rule

This amendment to Part 71 of the Federal Aviation Regulations adds controlled airspace to the Holyoke, Colorado, Transition Area. The additional area is needed to encompass a new approach procedure to the Holyoke Airport, Colorado. The area will be depicted on aeronautical charts for pilot reference enabling pilots to remain clear of controlled airspace or otherwise comply with Instrument Flight Rules.

The FAA has determined that this proposed regulation only involves an established body of technical regulations for which frequent and routine amendments are necessary to keep them operationally current. It, therefore—(1) is not a "major rule" under Executive Order 12291; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and (3) does not warrant preparation of a regulatory evaluation as the anticipated impact is so minimal. Since this is a routine matter that will only affect air traffic procedures and air navigation, it is certified that this rule, when promulgated, will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

List of Subjects in 14 CFR Part 71

Aviation safety, Transition areas.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me, Part 71 of the Federal Aviation Regulations (14 CFR Part 71) is amended as follows:

PART 71—[AMENDED]

1. The authority citation for Part 71 continues to read as follows:

Authority: 49 U.S.C. 1348(a), 1354(a), 1510; Ex.O. 10854; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); 14 CFR 11.69.

§ 71.181 [Amended]

2. Section 71.181 is amended as follows:

Holyoke, Colorado (Amended)

On the sixth line after "Heginbotham NDB", change the period to a semicolon and add the following: "* * * and that airspace extending upward from 1,200 feet above the surface bounded by V80 on the north, V8 on the south, and by the Colorado-Nebraska State boundary on the east."

Issued in Seattle, Washington, on May 20, 1988.

F.E. Davis,

Assistant Manager, Air Traffic Division Northwest Mountain Region.

[FR Doc. 88-12730 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

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14 CFR Part 71

[Airspace Docket No. 88-ANM-11]

Alteration of Transition Area, Missoula, MT

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Correction to final rule.

SUMMARY: This action corrects Federal Register Document 88–7885 (as published in the Federal Register on April 11, 1988, 53 FR 11841) which corrected the final rule revising the transition area description for Missoula, Montana (FR Document 88–835 as published in the Federal Register on January 19, 1988, 53 FR 1336). The aforementioned correction document incorrectly referenced the Missoula VORTAC 209° radial rather than the Missoula 290° radial in the 700-foot transition area description.

FOR FURTHER INFORMATION CONTACT: Bob Brown, ANM–535, Federal Aviation Administration, Docket No. 88–ANM–11, 17900 Pacific Highway South, C–68966, Seattle, Washington 98168, Telephone: (206) 431–2535.

Issued in Seattle, Washington, on May 20, 1988.

F.E. Davis,

Assistant Manager, Air Traffic Division, Northwest Mountain Region.

[FR Doc. 88–12731 Filed 6–6–88; 8:45 am]

BILLING CODE 4910–13–M

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14 CFR Part 71

[Airspace Docket No. 88–AGL–14]

Transition Area Alteration; Mobridge, SD

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The nature of this action is to reflect the name change of a navigational facility currently contained in the Mobridge, SD, transition area description. The published description inadvertently refers to the NDB (Nondirectional Radio Beacon) as "Mobridge NDB" when in actuality the facility name is "Riverbend NDB." This action only involves the facility name change and no other changes.

EFFECTIVE DATE: 0901 UTC, August 25, 1988.

FOR FURTHER INFORMATION CONTACT: Harold G. Hale, Air Traffic Division, Airspace Branch, AGL–520, Federal Aviation Administration, 2300 East Devon Avenue, Des Plaines, Illinois 60018, telephone (312) 694–7360.

SUPPLEMENTARY INFORMATION:

The Rule

This amendment to Part 71 of the Federal Aviation Regulations will alter the Mobridge, SD, transition area by changing the NDB facility name from "Mobridge NDB" to "Riverbend NDB" where it appears in the transition area description.

The alterations will affect only the published description and will cause no change to aeronautical operations as currently conducted or to the general configuration of the airspace.

I find that notice and public procedure under 5 U.S.C. 553(b) are unnecessary because this action is a minor amendment in which the public would not be particularly interested. Section 71.181 of Part 71 of the Federal Aviation Regulations was republished in Handbook 7400.6D dated January 4, 1988.

The FAA has determined that this proposed regulation only involves an established body of technical regulations for which frequent and routine amendments are necessary to keep them operationally current. It, therefore—(1) is not a "major rule" under Executive Order 12291; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and (3) does not warrant preparation of a regulatory evaluation as the anticipated impact is so minimal. Since this is a routine matter that will only affect air traffic procedures and air navigation, it is certified that this rule, when promulgated, will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

List of Subjects in 14 CFR Part 71

Aviation safety, Transition areas.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me, Part 71 of the Federal Aviation Regulations (14 CFR Part 71) is amended as follows:

PART 71—[AMENDED]

1. The authority citation for Part 71 continues to read as follows:

Authority: 49 U.S.C. 1348(a), 1354(a), 1510; E.O. 10854; 49 U.S.C. 106(g) (Revised Pub. L. 97–449, January 12, 1983); 14 CFR 11.69.

§ 71.181 [Amended]

2. Section 71.181 is amended as follows:

Mobridge, SD [Amended]

Wherever the words "Mobridge NDB" appears substitute the words "Riverbend NDB."

Issued in Des Plaines, Illinois, on May 26, 1988.

Teddy W. Burcham,

Manager, Air Traffic Division.

[FR Doc. 88–12729 Filed 6–6–88; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF COMMERCE

Bureau of Export Administration

15 CFR Part 390

[Docket No. 80227–8081]

Discontinuance of Daily License List

AGENCY: Bureau of Export Administration, Commerce.

ACTION: Final rule.

SUMMARY: In accordance with § 390.4 of the Export Administration Regulations, the Department of Commerce has published a daily list of Export Licenses Approved and Reexports Authorized. A notice was published in the Federal Register on April 1, 1988 (53 FR 10553) stating that, effective May 2, 1988, the Department of Commerce would discontinue publication of this list. Supplementary information in the notice provided the financial justification for this action and informed subscribers that current subscription balances would be refunded by the Department within approximately six months.

This rule revises § 390.4 of the Export Administration Regulations by removing the provisions on the availability of the daily licensing list.

EFFECTIVE DATE: This rule is effective May 2, 1988.

FOR FURTHER INFORMATION CONTACT: Willard Fisher, Regulations Branch, Bureau of Export Administration, Telephone: (202) 377–3856.

SUPPLEMENTARY INFORMATION:

Rulemaking Requirements

1. Because this rule concerns a foreign and military affairs function of the United States, it is not a rule or regulation within the meaning of section 1(a) of Executive Order 12291, and it is not subject to the requirements of that Order. Accordingly, no preliminary or final Regulatory Impact Analysis has to be or will be prepared.

2. This rule does not contain a collection of information subject to the Paperwork Reduction Act of 19870 (44 U.S.C. 3501 *et seq.).*

3. Because a notice of proposed rulemaking and an opportunity for public comment are not required to be given for this rule by section 553 of the Administrative Procedure Act (5 U.S.C. 553), or by any other law, under sections 603(a) and 604(a) of the Regulatory Flexibility Act (5 U.S.C. 603(a) and 604(a)) no initial or final Regulatory Flexibility Analysis has to be or will be prepared.

4. Section 13(a) of the Export Administration Act of 1979, as amended (EAA) (50 U.S.C. app. 2412(a)), exempts this rule from all requirements of section 553 of the Administrative Procedure Act (APA) (5 U.S.C. 553), including those requiring publication of a notice of proposed rulemaking, an opportunity for public comment, and delay in effective date. This rule is also exempt from these APA requirements because it involves a foreign and military affairs function of the United States. Section 13(b) of the EAA does not require that this rule be published in proposed form because this rule does not impose a new control. Further, no other law requires that a notice of proposed rulemaking and an opportunity for public comment by given for this rule.

5. This rule does not contain policies with Federalism implications sufficient to warrant preparation of a Federalism assessment under Executive Order 12612.

Therefore, this regulation is issued in final form. Although there is no formal comment period, public comments on this regulation are welcome on a continuing basis. Comments should be submitted to Willard Fisher, Office of Technology and Policy Analysis, Bureau of Export Administration, Department of Commerce, P.O. Box 273, Washington, DC 20044.

List of Subjects in 15 CFR Part 390

Administrative practice and procedure, Advisory committees, Exports.

Accordingly, Part 390 of the Export Administration Regulations (15 CFR Parts 368–399) is amended as follows:

PART 390—[AMENDED]

1. The authority citation for 15 CFR Part 390 continues to read as follows:

Authority: Pub. L. 96–72, 93 Stat. 503 (50 U.S.C. app. 2401 *et seq.*), as amended by Pub. L. 97–145 of December 29, 1981 and by Pub. L. 99–64 of July 12, 1985; E.O. 12525 of July 12, 1985 (50 FR 28757, July 16, 1985); Pub. L. 95–223 of December 28, 1977 (50 U.S.C. 1701 *et seq.*); E.O. 12543 of January 7, 1986 (51 FR 875, January 9, 1986).

2. Section 390.4 is revised to read as follows:

§ 390.4 Disclosure of license issuance and other information.

As provided by section 12(c) of the Export Administration Act of 1979, as amended, information obtained for the purpose of considering license applications and other information obtained by the U.S. Department of Commerce concerning license applications will not be made available to the public without the approval of the Secretary of Commerce. Shippers' Export Declarations also are exempt from public disclosure, except with the approval of the Secretary of Commerce, in accordance with section 12(c) of the Export Administration Act of 1979 and section 301(g) of Title 13, United States Code.

Dated: June 2, 1988.

Vincent F. DeCain,

Deputy Assistant Secretary for Export Administration.

[FR Doc. 88–12794 Filed 6–6–88; 8:45 am]

BILLING CODE 3510–DT–M

FEDERAL TRADE COMMISSION

16 CFR Part 13

[Dkt. C–3230]

Sun Industries, Inc.; Prohibited Trade Practices, and Affirmative Corrective Actions

AGENCY: Federal Trade Commission.

ACTION: Consent order.

SUMMARY: In settlement of alleged violations of federal law prohibiting unfair acts and practices and unfair methods of competition, this consent order prohibits, among other things, a Jonesboro, AR., manufacturer and seller of tanning devices and related products from misrepresenting that the use of a tanning device does not pose a risk of any harmful side effects to users. The consent order also requires the respondent to include a warning statement in any advertisements or promotional materials used for its tanning devices.

DATE: Complaint and Order issued May 13, 1988.[1]

FOR FURTHER INFORMATION CONTACT: Brinley H. Williams, Cleveland Regional Office, Federal Trade Commission, Suite 500-Mall Bldg., 118 St. Clair Ave., Cleveland, OH. 44114. (216) 522–4210. Toby M. Levin, FTC/S–4002, Washington, DC 20580. (202) 326–3156.

SUPPLEMENTARY INFORMATION: On Wednesday, December 23, 1987, there was published in the **Federal Register**, 52 FR 48543, a proposed consent agreement with analysis In the Matter of Sun Industries, Inc., a corporation, for the purpose of soliciting public comment. Interested parties were given sixty (60) days in which to submit comments, suggestions or objections regarding the proposed form of order.

Comments were filed and considered by the Commission. The Commission has ordered the issuance of the complaint in the form contemplated by the agreement, made its jurisdictional findings and entered its order to cease and desist, as set forth in the proposed consent agreement, in disposition of this proceeding.

The prohibited trade practices and/or corrective actions, as codified under 16 CFR Part 13, are as follows: Subpart—Advertising Falsely Or Misleadingly: § 13.10 Advertising falsely or misleadingly; § 13.195 Safety; § 13.195–60 Product; § 13.205 Scientific or other relevant facts; § 13.210 Scientific tests. Subpart—Corrective Actions And/Or Requirements: § 13.533 Corrective actions and/or requirements; § 13.533–10 Corrective advertising; § 13.533–20 Disclosures; § 13.533–40 Furnishing information to media; § 13.533–45 Maintain records; § 13.533–45(a) Advertising substantiation; § 13.533–50 Maintain means of communication. Subpart—Misrepresenting Oneself And Goods—Goods: § 13.1590–20 Federal Trade Commission Act; § 13.1710 Qualities or properties; § 13.1740 Scientific or other relevant facts.

List of Subjects in 16 CFR Part 13

Suntanning devices, Trade practices.

(Sec. 6, 38 Stat. 721; 15 U.S.C. 46. Interprets or applies sec. 5, 38 Stat. 719, as amended; 15 U.S.C. 45, 52)

Emily H. Rock,

Secretary.

[FR Doc. 88–12749 Filed 6–6–88; 8:45 am]

BILLING CODE 6750–01–M

16 CFR Part 500

Rules and Regulations Under the Fair Packaging and Labeling Act

AGENCY: Federal Trade Commission.

ACTION: Final rule.

SUMMARY: The Federal Trade Commission, in accordance with the requirements of the Regulatory Flexibility Act,[1] has conducted a review of the Commission's Rules and Regulations Under the Fair Packaging and Labeling Act [2] to determine if the Rules have had a significant economic impact on small entities and, if so, whether the Rules should be amended to minimize any such impact. In the course of its review, the Commission has found that there is an insufficient basis to

[1] Copies of the Complaint and the Decision and Order are available from the Commission's Public Reference Branch, H–130, 6th Street & Pennsylvania Avenue NW., Washington, DC 20580.

[1] Pub. L. 96–354, 94 Stat. 1164, 5 U.S.C. 601 *et seq.* (1982) ("the RFA").

[2] 16 CFR Part 500 ("the Rules").

conclude that the Rules have had a significant economic impact upon a substantial number of small entities. The Commission, therefore, is terminating this review proceeding and is leaving the Rules in effect without change.

DATE: This action is effective as of June 7 1988.

FOR FURTHER INFORMATION CONTACT: James G. Mills, (202) 326–3035, Attorney, Division of Enforcement, Bureau of Consumer Protection, Federal Trade Commission, Washington, DC 20580.

SUPPLEMENTARY INFORMATION: The Regulatory Flexibility Act requires that the FTC conduct a periodic review of rules that have or will have a significant economic impact upon a substantial number of small entities.

The Fair Packaging and Labeling Act, 15 U.S.C. 1453–1455 (the "FPLA"), was enacted in order to eliminate consumer confusion in the marketplace; to standardize the means used by sellers to disclose package content information to buyers; and to eliminate consumer deception and confusion concerning product size representations. Section 2 of the Act states Congress' policy on informing consumer: "Packages and their labels should enable consumers to obtain accurate information as to the quantity of the contents and should facilitate value comparisons." 15 U.S.C. 1451.

The Federal Trade Commission has enforcement responsibility over package disclosures placed upon "consumer commodities" as defined in the FPLA. The Food and Drug Administration and the U.S. Department of Agriculture have analogous responsibilities and regulations covering foods, drugs, devices and cosmetics, and meat and poultry products, respectively.

In 1968, The Commission issued rules implementing the Fair Packaging and Labeling Act. These rules are codified at 16 CFR Part 500. The FPLA regulations, which closely parallel the Act's requirements, establish requirements for the manner and form of the labeling of consumer commodities (as defined in the FPLA) with: (1) The identity of the commodity; (2) the name and place of business of the manufacturer, packer or distributor; (3) the net quantity of contents; and (4) the net quantity of servings, uses or applications represented to be present. 16 CFR 500.3–500.26. The rules also require sellers that make "cents off," "introductory offer," or "economy size" claims to keep records for one year showing compliance with the Act's substantiation requirements for such claims. 16 CFR 500.100–500.103.

On December 24, 1987, the Commission, in accordance with the requirements of the RFA and the Commission's plan for the Periodic Review of the Rules,[3] published a notice in the **Federal Register** [4] soliciting comments on whether the Commission's Rules and Regulations Under the Fair Packaging and Labeling Act have had a significant economic impact on small entities and, if so, whether the Rules should be amended to minimize any such impact. The notice requested that all comments and data be submitted to the Commission no later than January 25, 1988.

The purpose of this review was limited to determining whether the Rules should be continued without change, or should be amended or rescinded, consistent with the stated objectives of the applicable statute, to minimize any significant economic impact of the Rules upon a substantial number of small entities.

No comments were received in response to the Notice requesting comments. In view of this fact, the Commission concludes that there is an insufficient basis for finding that the Rules have had a significant economic impact on a substantial number of small entities. Therefore, the Commission hereby terminates the review proceeding and leaves the Rules in effect without modification.

List of Subjects in 16 CFR Part 500

Packaging, Labeling, Trade practices.

Authority: The Regulatory Flexibility Act, 5 U.S.C. 601 *et seq.* (1980).

By direction of the Commission.

Emily H. Rock,

Secretary.

[FR Doc. 88–12748 Filed 6–6–88; 8:45 am]

BILLING CODE 6750–01–M

[3] 46 FR 35118 at 35119 (July 7, 1981).

[4] 52 FR 48716 (Dec. 24, 1987).

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

18 CFR Part 284

[Docket No. RM88–14–001]

Interpretation of Section 5 of the Outer Continental Shelf Lands Act (OCSLA)

Issued: June 1, 1988.

AGENCY: Federal Energy Regulatory Commission, DOE.

ACTION: Order granting rehearing solely for the purpose of further consideration.

SUMMARY: On April 1, 1988, the Federal Energy Regulatory Commission (Commission) issued an interpretative rule in Order No. 491 interpreting section 5 of the Outer Continental Shelf Lands Act (OCSLA). The Commission grants rehearing of its interpretative rule solely for the purpose of further consideration.

EFFECTIVE DATE: June 1, 1988.

FOR FURTHER INFORMATION CONTACT: Roger E. Smith, Office of the General Counsel, Federal Energy Regulatory Commission, 825 North Capitol Street, NE., Washington, DC 20426, (202) 357–8530.

SUPPLEMENTARY INFORMATION:

Before Commissioners: Martha O. Hesse, Chairman; Anthony G. Sousa, Charles G. Stalon and Charles A. Trabandt.

Order Granting Rehearing Solely for the Purpose of Further Consideration

On April 1, 1988, the Federal Energy Regulatory Commission (Commission) issued an interpretative rule (Order No. 491) and a notice of proposed rulemaking (NOPR) with respect to section 5 of the Outer Continental Shelf Lands Act (OCSLA).[1]

Pursuant to 18 CFR 385.713 (1987), the Commission has received 13 requests for rehearing on the interpretative rule.[2] The issues raised in the requests for rehearing are inextricably intertwined with the issues in the NOPR. The Commission will address the issues discussed in the requests for rehearing when it reviews the comments received in response to the NOPR. Therefore, the Commission is granting rehearing of the other solely for the purpose of further consideration. This order is effective on the date of issuance. This action does not constitute a grant or denial of the requests on their merits in whole or in part.

Pursuant to Rule 713(d) of the Commission's Rules of Practice and

[1] Interpretative Rule on Section 5 of the Outer Continental Shelf Lands Act (Docket No. RM88–14–000), 53 FR 14922 (April 26, 1988); and Regulations Under section 5 of the Outer Continental Shelf Lands Act (OCSLA) Governing Transportation of Natural Gas by Interstate Natural Gas Pipelines on the Outer Continental Shelf (Docket No. RM88–15–000), 53 FR 14923 (April 26, 1988).

[2] Northern Illinois Gas Co.; Producer Associations; Black Marlin Pipeline Co.; Enron Interstate Pipelines; ANR Pipeline Co.; United Gas Pipe Line Co. and Sea Robin Pipeline Co.; Texas Eastern Transmission Corp.; High Island Offshore System and Interstate Natural Gas Association of America; Tennessee Gas Pipeline Co.; Tarpon Transmission Co.; Transcontinental Gas Pipe Line Corp.; Stingray Pipeline Co. and Trunkline Gas Co.; Natural Gas Pipeline Company of America.

Procedure (18 CFR 385.713(d) (1987), no answers to the requests for rehearing will be entertained by the Commission.

By the Commission.

Lois D. Cashell,

Acting Secretary.

[FR Doc. 88-12779 Filed 6-6-88; 8:45 am]

BILLING CODE 6717-01-M

DEPARTMENT OF THE TREASURY

Customs Service

19 CFR Part 134

[T.D. 88-31]

Country of Origin Marking Requirement on Fruit Juice Containers

AGENCY: Customs Service, Department of the Treasury.

ACTION: Notice of effective date of interpretive rule.

SUMMARY: This document informs the public that Customs has made its determination regarding an implementation date for the requirement that labels on frozen concentrated and reconstituted fruit juice products which contain imported concentrate be marked to show the foreign country of origin of the products. Customs had previously announced that this requirement, heretofore limited to orange juice, would be extended to cover other fruit juices, and sought public comment on an effective date for the requirement.

Effective on June 7, 1989, fruit juice processors may use the "major supplier marking" that was approved for containers of orange juice on other fruit containers. Thus, if a processor obtains 75 percent or more of its imported concentrate from a single source country, it is sufficient to disclose only that source. Otherwise, disclosure of all foreign sources is required.

Interested parties are advised to consult another Customs document published in today's **Federal Register** for a proposed interpretive rule that would discontinue major supplier marking for all fruit juices made with imported concentrate. That proposal, if adopted, would supersede the rule described in this document.

DATE: This decision will be effective as to merchandise entered, or withdrawn from warehouse, for consumption, on or after June 7, 1989.

FOR FURTHER INFORMATION CONTACT: John Doyle, Office of Regulations & Rulings (202-566-5765).

SUPPLEMENTARY INFORMATION:

Background

In a ruling dated September 4, 1985 (C.S.D. 85-47, 19 Cust. Buil. No. 39 at 21), the Customs Service held that containers of orange juice in frozen concentrated or reconstituted forms which contain foreign concentrate must be labeled to comply with the country of origin marking requirements of section 304, Tariff Act of 1930, as amended (19 U.S.C. 1304). The ruling was based on the determination that the foreign concentrate which is imported into the U.S. and used in the production of frozen concentrated or reconstituted orange juice is not substantially transformed after undergoing further processing in the U.S., including blending with other batches of orange concentrate; addition of water, oils, and essences; pasteurization or freezing; and repacking. In *National Juice Products Association* v. *United States*, CIT Slip Op. 86-13 (Jan. 30, 1986), the Court of International Trade held that C.S.D. 85-47 was substantively valid.

On March 19, 1986, Customs held in Ruling No. 729410 (C.S.D. 86-19, Cust. Bull. No. 33 at 17), that orange juice containers would meet the marking requirements if only the major foreign sources of the imported product were listed ("major supplier marking"). Current major supplier marking practice permits a processor that obtains 75 percent or more of its imported concentrate from one country to disclose only that source. If there is not one source country supplying 75 percent or more of the imported concentrate, all foreign countries from which the concentrate is derived must be disclosed.

On June 25, 1986, Customs published T.D. 86-120 in the **Federal Register** (51 FR 23045), informing the public that frozen concentrated and reconstituted orange juice products containing imported concentrate were required to bear labels marked for country of origin by February 1, 1987. The notice of the decision announced that Customs had considered the comments submitted in response to an earlier notice published in the **Federal Register** (51 FR 7285), on March 3, 1986, and that requiring the country of origin marking for these products was consistent with the court decision in *National Juice Products*.

Applicability of C.S.D. 85-47 to Other Juices

On July 30, 1986, Customs announced in a **Federal Register** notice (51 FR 27195), that the principles set forth in C.S.D. 85-47 and supported by the court in *National Juice Products* were applicable to containers of other fruit juices containing imported concentrate as well as to those of orange juice. In other words, all imported fruit juice concentrate which is imported into the U.S. and used in the production of reconstituted fruit juice is not substantially transformed after undergoing further processing in the U.S. involving blending with other batches of concentrate; addition of water, oils, and essences; pasteurization or freezing; and repacking. Accordingly, pursuant to the notice, all frozen concentrated or reconstituted fruit juices made from frozen concentrate and so processed must be required to be marked to indicate the country of origin of the frozen concentrate. The notice sought public comment on the issue of establishing a date upon which the marking requirements would go into effect.

Discussion of Comments

Thirty-six comments were received in response to the notice. Approximately half of the comments were submitted on behalf of the fruit juice processors that use imported concentrate in their products. The other half were submitted on behalf of domestic apple growers and other farming groups. Although the July 30, 1986 notice stated that the principles set forth in C.S.D. 85-47 are to be applicable to all fruit juices containing foreign concentrate, and asked for comments solely regarding a practicable implementation date, many of the commenters addressed problems specifically associated with the marking of apple juice and raised additional issues, including the method of compliance.

The analysis of comments presented in this document pertains only to the extension of the orange juice ruling to other fruit juices. In another document published in today's **Federal Register**, Customs discusses comments regarding the manner of marking.

The commenters representing the domestic industry advocate an implementation date of 6 months from the date of the final ruling. They contend that processors should have already taken steps to begin complying with the marking requirement.

The commenters representing juice processors using imported concentrate generally advocate a period of 18 months from the date of the July 30, 1986 notice, or one year from the date of the publication of this notice. They point out that Customs allowed orange juice processors approximately one year from the date of the ruling to comply with the marking requirements, so that those processors would have sufficient lead

time to obtain new labels and to deplete inventories. The commenters believe that a similar time frame should be accorded other juice processors. Many of the commenters stress that the multiple sourcing practices with respect to apple juice and other juices complicate the labeling task facing these juice processors. Many commenters also point to the label supplier bottleneck and capacity limitations as another factor requiring a sufficient amount of time to comply with the new requirements. It is claimed that there is a limited number of label suppliers and packaging manufacturers and that many of these also supply the orange juice processors.

Determination

After reviewing all the comments concerning an effective date, we are satisfied that the same circumstances that warranted a delay of approximately one year in the implementation of the orange juice ruling are relevant here. (For a detailed discussion of these factors, see T.D. 86–120, published in the **Federal Register** dated June 25, 1986 (51 FR 23045)). Although Customs announced that the orange juice ruling would be extended to other juices in the notice of July 30, 1986, the method of compliance that would be required was not determined at that time. Unitl now, processors could not take the necessary steps to comply with the new labeling requirements. Accordingly, the implementation date for marking of other juices will be June 7, 1989. All importations of juice concentrate entered for consumption or withdrawn from warehouse for consumption on or after the effective date will be subject to the marking requirements.

This extended period of time will enable processors to develop the necessary procedures to comply with the specific marking requirements set forth in this document.

Major Supplier Marking

In another document published in today's **Federal Register**, Customs proposes to disallow major supplier marking for fruit juices containing imported concentrate. Customs questions whether major supplier marking for these fruit juices provides the level of information to consumers in the U.S. that was contemplated by the country of origin marking laws, as codified in section 304, Tariff Act of 1930, as amended (19 U.S.C. 1304).

Despite the on-going reconsideration of the correct method of marking fruit juices, Customs believes that fruit juice processors may reasonably have expected that major supplier marking would apply to them as it currently applies to orange juice processors. For reasons of fairness, when the new marking requirements become effective on June 7, 1989, fruit juice processors may utilize major supplier marking.

Major supplier marking stipulates that if a processor obtains 75 percent or more of its imported concentrate from one source country, only that source country need be disclosed. Otherwise, disclosure of all foreign sources is required.

If there is a change in the Customs Service's interpretation of the country of origin marking rules as they are applied to containers of fruit juice made with imported juice concentrate as a result of the review announced in another Customs document published in today's **Federal Register**, major supplier marking may be disallowed in the future.

Method of Compliance

Customs recommends that fruit juice containers be marked by printing the name of the country of origin of the concentrate by the same method that is used to print other information subject to change, such as the product codes or the use-by dates. For example, a blank space could be left on the juice labels immediately prior to their attachment to the containers. A second alternative would be to print the information directly on the containers, such as on the edge of the bottle cap or the end of the can. Yet another alternative is to print the country of origin on adhesive stickers. It would be required that such stickers remain on the containers until the containers reach the ultimate purchaser.

Scope of Ruling

Several commenters asked whether the marking requirements are applicable to blended juices containing foreign concentrate (*e.g.*, cranberry-apple; orange-grapefruit) and fruit drink products which are made from foreign concentrate but contain additional ingredients. The marking requirement set forth in the July 30, 1986 notice applies only to concentrated and reconstituted fruit juices processed in the manner described in C.S.D. 85–47. Blended juices and fruit drink products are outside the scope of the ruling. This does not preclude Customs from ruling specifically on the marking requirements of these products in the future.

Drafting Information

The principal author of this document was John Doyle, Office of Regulations & Rulings, U.S. Customs Service. However, personnel from other offices participated in its development.

Edward F. Kwas,

Acting Commissioner of Customs.

Francis A. Keating, II,

Assistant Secretary of the Treasury.

[FR Doc. 88–12782 Filed 6–6–88; 8:45 am]

BILLING CODE 4820-02-M

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

21 CFR Part 172

[Docket No. 84F-0137]

Food Additives Permitted for Direct Addition to Food for Human Consumption; Aspartame

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the food additive regulations to provide for the safe use of aspartame as a sweetener in ready-to-serve gelatin desserts. This action responds to a petition filed by Bernard Food Industries, Inc.

DATES: Effective June 7, 1988; objections by July 7, 1988.

ADDRESS: Written objections may be sent to the Dockets Management Branch (HFA–305), Food and Drug Administration, Rm. 4–62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Carl L. Giannetta, Center for Food Safety and Applied Nutrition (HFF–334), Food and Drug Administration, 200 C Street SW., Washington, DC 20204, 202–426–5487.

SUPPLEMENTARY INFORMATION: In a notice published in the **Federal Register** of May 18, 1984 (49 FR 21118), FDA announced that a food additive petition (FAP 4A3775) had been filed by Bernard Food Industries, Inc., 1125 Hartrey Avenue, Evanston, IL 60204, proposing that § 172.804 *Aspartame* (21 CFR 172.804) be amended to provide for the safe use of aspartame (1-methyl-*N*-L-α-aspartyl-L-phenylalanine) as a sweetener in ready-to-serve gelatin desserts to the extent standards of identity do not preclude such use.

One comment was received in response to the filing of the petition. The comment requested that the regulation be worded broadly to cover all ready-to-serve desserts, not just gelatin desserts. The comment was not supported by any data or information. Similarly, in a letter

dated September 30, 1986, the petitioner requested that his petition be amended to include ready-to-eat gelatins, puddings, and fillings. Accordingly, in a notice published in the **Federal Register** of December 19, 1986 (51 FR 45555), FDA announced that it was amending the filing notice for a food additive petition filed by Bernard Food Industries, Inc., to include ready-to-serve gelatins, puddings, and fillings regardless of the "setting system." The agency reviewed its aspartame files to determine if they contained sufficient technical information to support the amended petition (which now includes aseptically packaged puddings and fillings). The agency determined that the petition contained insufficient data on aspartame degradation in aseptically packaged puddings and fillings. The agency communicated its finding of this deficiency in the petition to the petitioner and requested additional data to address the issue. The petitioner responded to the agency's request for additional data by dropping its request for the expanded uses and by asking the agency to revert to the petitioner's original request which was for the use of aspartame as a sweetener in ready-to-serve gelatin desserts. In response to the petitioner's request, FDA reevaluated the original data in the petition and other relevant materials related to the use of aspartame in ready-to-serve gelatin desserts, and has concluded that the proposed food additive use is safe. The agency has no basis upon which to make a similar conclusion for the requested expanded uses. Therefore, the agency concludes that the regulation in 21 CFR 172.804(c)(13) should be amended as set forth below.

In accordance with § 171.1(h) (21 CFR 171.1(h)), the petition and the documents that FDA considered and relied upon in reaching its decision to approve the petition are available for inspection at the Center for Food Safety and Applied Nutrition by appointment with the information contact person listed above. As provided in 21 CFR 171.1(h), the agency will delete from the documents any materials that are not available for public disclosure before making the documents available for inspection.

The agency has carefully considered the potential environmental effects of this action and has concluded that the action will not have a significant impact on the human environment and that an environmental impact statement is not required. The agency's finding of no significant impact and the evidence supporting that finding, contained in an environmental assessment, may be seen in the Dockets Management Branch (address above) between 9 a.m. and 4 p.m., Monday through Friday. This action was considered under FDA's final rule implementing the National Environmental Policy Act (21 CFR Part 25).

Any person who will be adversely affected by this regulation may at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) written objections thereto. Each objection shall be separately numbered, and each numbered objection shall specify with particularity the provisions of the regulation to which objection is made and the grounds for the objection. Each numbered objection on which a hearing is requested shall specifically so state. Failure to request a hearing for any particular objection shall constitute a waiver of the right to a hearing on that objection. Each numbered objection for which a hearing is requested shall include a detailed description and analysis of the specific factual information intended to be presented in support of the objection in the event that a hearing is held. Failure to include such a description and analysis for any particular objection shall constitute a waiver of the right to a hearing on the objection. Three copies of all documents shall be submitted and shall be identified with the docket number found in brackets in the heading of this document. Any objections received in response to the regulation may be seen in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

List of Subjects in 21 CFR Part 172

Food additives.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, Part 172 is amended as follows:

PART 172—FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION

1. The authority citation for 21 CFR Part 172 continues to read as follows:

Authority: Secs. 201(s), 409, 72 Stat. 1784–1788 as amended (21 U.S.C. 321(s), 348); 21 CFR 5.10 and 5.61.

2. Section 172.804 is amended by adding a new paragraph (c)(13) to read as follows:

§ 172.804 Aspartame.

* * * * *

(c) * * *

(13) Refrigerated ready-to-serve gelatin desserts.

* * * * *

Dated: May 31, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88-12742 Filed 6-6-88; 8:45 am]

BILLING CODE 4160-01-M

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21 CFR Part 172

[Docket No. 85F-0092]

Food Additives Permitted for Direct Addition to Food for Human Consumption; Aspartame

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the food additive regulations to provide for the safe use of aspartame as a sweetener for ready-to-serve nonrefrigerated, pasteurized, aseptically packaged dilute fruit juice beverages. This action responds to a petition filed by Squirt & Co.

DATES: Effective June 7, 1988; objections by July 7, 1988.

ADDRESS: Written objections may be sent to the Dockets Management Branch (HFA-305), Food and Drug Administration, Rm. 4-62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Carl L. Giannetta, Center for Food Safety and Applied Nutrition (HFF-334), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, 202-426-5487.

SUPPLEMENTARY INFORMATION: In a notice published in the **Federal Register** of April 2, 1985 (50 FR 13084), FDA announced that a food additive petition (FAP 5A3829) had been filed by Squirt & Co., 777 Brooks Ave., Holland, MI 49423, proposing that § 172.804 *Aspartame* (21 CFR 172.804) be amended to provide for the safe use of aspartame (1-methyl *N*-L-α-aspartyl-L-phenylalanine) as a sweetener in ready-to-serve nonrefrigerated, pasteurized, aseptically packaged dilute fruit juice beverages.

The agency received comments on the petition from the General Foods Corp. and the Coca-Cola Co. The comments addressed the use of pasteurization after the addition of aspartame to the finished product. The comments provided data to support the firms' contentions that minimal loss of aspartame occurs during pasteurization, provided that the PH is 4.5 or less, and that, under these conditions, the aspartame levels before and after pasteurization, are the same within the experimental error for the analytical method. The agency agrees

with the comments because the data submitted in them presented convincing evidence that conditions commonly used in the beverage industry do not result in significant losses of aspartame. Therefore, the final rule will provide for the addition of aspartame either before or after pasteurization, except that when the pH of the beverage is greater than 4.5, aspartame may be added only subsequent to pasteurization.

FDA has evaluated these comments, the data in the petition, and other relevant materials, and has concluded that the proposed food additive use is safe, and that the regulation should be amended as set forth below.

In accordance with § 171.1(h) (21 CFR 171.1(h)), the petition and the documents that FDA considered and relied upon in reaching its decision to approve the petition are available for inspection at the Center for Food Safety and Applied Nutrition by appointment with the information contact person listed above. As provided in 21 CFR 171.7(h), the agency will delete from the documents any materials that are not available for public disclosure before making the documents available for inspection.

The agency has carefully considered the potential environmental effects of this action and has concluded that the action will not have a significant impact on the human environment and that an environmental impact statement is not required. The agency's finding of no significant impact and the evidence supporting that finding, contained in an environmental assessment, may be seen in the Dockets Management Branch (address above) between 9 a.m. and 4 p.m., Monday through Friday. This action was considered under FDA's final rule implementing the National Environmental Policy Act (21 CFR Part 25).

Any person who will be adversely affected by this regulation may at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) written objections thereto. Each objection shall be separately numbered, and each numbered objection shall specify with particularity the provisions of the regulation to which objection is made and the grounds for the objection. Each numbered objection on which a hearing is requested shall specifically so state. Failure to request a hearing for any particular objection shall constitute a waiver of the right to a hearing on that objection. Each numbered objection for which a hearing is requested shall include a detailed description and analysis of the specific factual information intended to be presented in support of the objection in the event that a hearing is held. Failure to include such a description and analysis for any particular objection shall constitute a waiver of the right to a hearing on the objection. Three copies of all documents shall be submitted and shall be identified with the docket number found in brackets in the heading of this document. Any objections received in response to the regulation may be seen in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

List of Subjects in 21 CFR Part 172

Food additives.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, Part 172 is amended as follows:

PART 172—FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION

1. The authority citation for 21 CFR Part 172 continues to read as follows:

Authority: Secs. 201(s), 409, 72 Stat. 1784–1788 as amended (21 U.S.C. 321(s), 348); 21 CFR 5.10 and 5.61.

2. In § 172.804, paragraph (c)(12) is added to read as follows:

§ 172.804 Aspartame.

* * * * *

(c) * * *

(12) Ready-to-serve nonrefrigerated, pasteurized, aseptically packaged diluted fruit juice beverages. For beverages whose pH is above 4.5, aspartame may be added only subsequent to pasteurization.

* * * * *

Dated: May 31, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–12741 Filed 6–6–88; 8:45 am]

BILLING CODE 4160–01–M

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21 CFR Part 172

[Docket No. 86F–0280]

Food Additives Permitted for Direct Addition to Food for Human Consumption; Aspartame

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the food additive regulations to provide for the safe use of aspartame as a sweetener in fruit (including grape) wine beverages with ethanol content below 7 percent volume per volume. This action responds to a petition filed by Canandaigua Wine Co., Inc.

DATES: Effective June 7, 1988 objections by July 7, 1988.

ADDRESS: Written objections may be sent to the Dockets Management Branch (HFA–305), Food and Drug Administration, Rm. 4–62, 5600 Fishers Lane, Rockville, Md. 20857.

FOR FURTHER INFORMATION CONTACT: Carl L. Giannetta, Center for Food Safety and Applied Nutrition (HFF–334), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, 202–426–5487.

SUPPLEMENTARY INFORMATION: In a notice published in the **Federal Register** of July 22, 1986 (51 FR 26308), FDA announced that a food additive petition (FAP 6A3942) had been filed by Canandaigua Wine Co., Inc., 116 Bufalo St., Canandaigua, NY 14424, proposing that § 172.804 *Aspartame* (21 CFR 172.804) be amended to provide for the safe use of aspartame in alcoholic beverages containing wine with ethanol content below 7 percent volume per volume.

Two comments were received in response to the filing of the Canandaigua petition. Salzman Beverage Importers, Ltd. requested that the scope of the final regulation be broad enough to include any carbonated or noncarbonated fruit vine (i.e., not only vine made from grapes, but also wine which is made from any kind of fruit). The agency has considered this comment in evaluating the Canandaigua petition and agrees that the data in the petition support the use of aspartame in these products. Therefore, the final rule reflects Salzman's request.

The second comment was submitted by the Stroh Brewery Co. The comment, which was unaccompanied by any supporting data or information, requested that a regulation be issued permitting the use of aspartame in alcoholic beverages with ethanol contents of less than 7 percent by volume. The agency has considered but finds that because the request specifically addressed malt-based coolers, it is outside the scope of the Canandaigua petition. Thus, this use is not included in the regulation. Moreover, as a minimum, stability data and information regarding aspartame in malt coolers would be needed before any action could be taken on a petition supporting the request.

Based on its review of the petition and other relevant data, the agency has concluded that the proposed use of aspartame as a sweetener in alcoholic beverages containing any fruit

(including grape) wine with ethanol content below 7 percent per volume is safe, and that the regulations should be amended as set forth below.

In accordance with § 171.1(h) (21 CFR 171.1(h)), the petition and the documents that FDA considered and relied upon in reaching its decision to approve the petition are available for inspection at the Center for Food Safety and Applied Nutrition by appointment with the information contact person listed above. As provided in 21 CFR 171.1(h), the agency will delete from the documents any materials that are not available for public disclosure before making the documents available for inspection.

The agency has carefully considered the potential environment effects of this action and has concluded that the action will not have a significant impact on the human environment and that an environmental impact statement is not required. The agency's finding of no significant impact and the evidence supporting that finding may be seen in the Dockets Management Branch (address above) between 9 a.m. and 4 p.m., Monday through Friday. This action was considered under FDA's final rule implementing the National Environmental Policy Act (21 CFR Part 25).

Any person who will be adversely affected by this regulation may at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) written objections thereto. Each objection shall be separately numbered, and each numbered objection shall specify with particularity the provisions of the regulation to which objection is made and the grounds for the objection. Each numbered objection on which a hearing is requested shall specifically so state. Failure to request a hearing for any particular objection shall constitute a waiver of the right to a hearing on that objection. Each numbered objection for which a hearing is requested shall include a detailed description and analysis of the specific factual information intended to be presented in support of the objection in the event that a hearing is held. Failure to include such a description and analysis for any particular objection shall constitute waiver of the right to a hearing on the objection. Three copies of all documents shall be submitted and shall be identified with the docket number found in brackets in the heading of this document. Any objections received in response to the regulation may be seen in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

List of Subjects in 21 CFR Part 172

Food additives.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, Part 172 is amended as follows:

PART 172—FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION

1. The authority citiation for 21 CFR Part 172 continues to read as follows:

Authority: Secs. 201(s), 409, 72 Stat. 1784–1788 as amended (21 U.S.C. 321(s), 348); 21 CFR 5.10 and 5.61.

2. Section 172.804 is amended by adding new paragraph (c)(14) to read as follows:

§ 172.804 Aspartame.

* * * * *

(c)* * *

(14) Fruit (including grape) wine beverages with ethanol contents below 7 percent volume per volume.

* * * * *

Dated: May 31, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–12746 Filed 6–6–88; 8:45 am]

BILLING CODE 4160–01–M

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21 CFR Part 172

[Docket No. 86F–0420]

Food Additives Permitted for Direct Addition to Food for Human Consumption; Aspartame

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the food additive regulations to provide for the safe use of aspartame as a sweetener in yogurt-type products. This action responds to a petition filed by the Milk Industry Foundation, the NutraSweet Co., and Beatrice Dairy Products, Inc.

DATES: Effective June 7, 1988; objections by July 7, 1988.

ADDRESS: Written objections may be sent to the Dockets Management Branch (HFA–305), Food and Drug Administration, Rm. 4–62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Carl L. Giannetta, Center for Food Safety and Applied Nutrition (HFF–334), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, 202–426–5487.

SUPPLEMENTARY INFORMATION: In a notice published in the **Federal Register** of November 21, 1986 (51 FR 42139), FDA announced that a food additive petition (FAP 6A3964) had been filed by the Milk Industry Foundation, 888 16th St. NW., Washington, DC 20006, Beatrice Dairy Products, Inc., 1526 South State St., Chicago IL 60605, and the NutraSweet Co., 4711 Golf Rd., Skokie, IL 60076, proposing that § 172.804 *Aspartame* (21 CFR 172.804) be amended to provide for the safe use of aspartame as a sweetener in yogurt-type products.

One comment was received in response to the filing of this petition for the use of aspartame in yogurt-type products. The Pro-Mark Companies (Weight Watchers Dairy Products) expressed its objection to the proposed use. The firm's main concern was that such approval would dilute the standards of identity for yogurt, lowfat yogurt, and nonfat yogurt. The agency notes that the petition is for products that are not covered by the standards of identity for yogurt, lowfat yogurt, and nonfat yogurt. Therefore, the agency concludes that approval of the petition would have no effect on these standards.

FDA has evaluated data in the petition and other relevant material on yogurt-type products. The agency concludes that the proposed use is safe, and that the regulation in 21 CFR 172.804 should be amended by adding a new paragraph (c)(15).

In accordance with § 171.1(h) (21 CFR 171.1(h)), the petition and the documents that FDA considered and relied upon in reaching its decision to approve the petition are available for inspection at the Center for Food Safety and Applied Nutrition by appointment with the information contact person listed above. As provided in 21 CFR 171.1(h), the agency will delete from the documents any materials that are not available for public disclosure before making the documents available for inspection.

The agency has carefully considered the potential environmental effects of this action and has concluded that the action will not have a significant impact on the human environment and that an environmental impact statement is not required. The agency's finding of no significant impact and the evidence supporting that finding, contained in an environmental assessment, may be seen in the Dockets Management Branch (address above) between 9 a.m. and 4 p.m., Monday through Friday. This action was considered under FDA's final rule implementing the National Environmental Policy Act (21 CFR Part 25).

Any person who will be adversely affected by this regulation may at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) written objections thereto. Each objection shall be separately numbered, and each numbered objection shall specify with particularity the provisions of the regulation to which objection is made and the grounds for the objection. Each numbered objection on which a hearing is requested shall specifically so state. Failure to request a hearing for any particular objection shall constitute a waiver of the right to a hearing on that objection. Each numbered objection for which a hearing is requested shall include a detailed description and analysis of the specific factual information intended to be presented in support of the objection in the event that a hearing is held. Failure to include such a description and analysis for any particular objection shall constitute a waiver of the right to a hearing on the objection. Three copies of all documents shall be submitted and shall be identified with the docket number found in brackets in the heading of this document. Any objections received in response to the regulation may be seen in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

List of Subjects in 21 CFR Part 172

Food additives.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, Part 172 is amended as follows:

PART 172—FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION

1. The authority citation for 21 CFR Part 172 continues to read as follows:

Authority: Secs. 201(s), 409, 72 Stat. 1784–1788 as amended (21 U.S.C. 321(s), 348); 21 CFR 5.10 and 5.61.

2. Section 172.804 is amended by adding a new paragraph (c)(15) to read as follows:

§ 172.804 Aspartame.

* * * * *

(c) * * *

(15) Yogurt-type products where aspartame is added after pasteurization and culturing.

* * * * *

Dated: May 31, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–12744 Filed 6–6–88; 8:45 am]

BILLING CODE 4160-01-M

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21 CFR Part 172

[Docket No. 86F-0279]

Food Additives Permitted for Direct Addition to Food for Human Consumption; Aspartame

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the food additive regulations to provide for the safe use of aspartame as a sweetener in refrigerated flavored milk beverages. This action responds to a petition filed by the Milk Industry Foundation, the NutraSweet Co., and Beatrice Dairy Products, Inc.

DATES: Effective June 7, 1988; objections by July 7, 1988.

ADDRESS: Written objections may be sent to the Dockets Management Branch (HFA–305), Food and Drug Administration, Rm. 4–62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Carl L. Giannetta, Center for Food Safety and Applied Nutrition (HFF–334), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, 202–426–5487.

SUPPLEMENTARY INFORMATION: In a notice published in the Federal Register of July 31, 1986 (51 FR 27461), FDA announced that a food additive petition (FAP 6A3945) had been filed by the Milk Industry Foundation, 888 16th St. NW., Washington, DC 20006, the NutraSweet Co., 4711 Golf Rd., Skokie, IL 60076, and Beatrice Dairy Products, Inc., 1526 South State St., Chicago, IL 60605, proposing that § 172.804 *Aspartame* (21 CFR 172.804) be amended to provide for the safe use of aspartame as a sweetener in refrigerated flavored milk beverages to the extent standards of identity do not preclude such use.

The agency has evaluated data in the petition and other relevant material. Based on this evaluation the agency concludes that the proposed use is safe, and that the regulations in 21 CFR 172.804 should be amended by adding a new paragraph (c)(16).

In accordance with § 171.1(h) (21 CFR 171.1(h)), the petition and the documents that FDA considered and relied upon in reaching its decision to approve the petition are available for inspection at the Center for Food Safety and Applied Nutrition by appointment with the information contact person listed above. As provided in 21 CFR 171.1(h), the agency will delete from the documents any materials that are not available for public disclosure before making the documents available for inspection.

The agency has carefully considerd the potential environmental effects of this action and has concluded that the action will not have a significant impact on the human environment and that an environmental impact statement is not required. The agency's finding of no significant impact and the evidence supporting that finding, contained in an environmental assessment, may be seen in the Dockets Management Branch (address above) between 9 a.m. and 4 p.m., Monday through Friday. This action was considered under FDA's final rule implementing the National Environmental Policy Act (21 CFR Part 25).

Any person who will be adversely affected by this regulation may at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) written objections thereto. Each objection shall be separately numbered, and each numbered objection shall specify with particularity the provisions of the regulation to which objection is made and the grounds for the objection. Each numbered objection on which a hearing is requested shall specifically so state. Failure to request a hearing for any particular objection shall constitute a waiver of the right to a hearing on that objection. Each numbered objection for which a hearing is requested shall include a detailed description and analysis of the specific factual information intended to be presented in support of the objection in the event that a hearing is held. Failure to include such a description and analysis for any particular objection shall constitute a waiver of the right to a hearing on the objection. Three copies of all documents shall be submitted and shall be identified with the docket number found in brackets in the heading of this document. Any objections received in response to the regulation may be seen in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

List of Subjects in 21 CFR Part 172

Food additives.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner

of Food and Drugs, Part 172 is amended as follows:

PART 172—FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION

1. The authority citation for 21 CFR Part 172 continues to read as follows:

Authority: Secs. 201(s), 409, 72 Stat. 1784–1788 as amended (21 U.S.C. 321(s), 348); 21 CFR 5.10 and 5.61.

2. Section 172.804 is amended by adding a new paragraph (c)(16) to read as follows:

§ 172.804 Aspartame.

* * * * *

(c) * * *

(16) Refrigerated flavored milk beverages.

* * * * *

Dated: May 31, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–12743 Filed 6–6–88; 8:45 am]

BILLING CODE 4160–01–M

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21 CFR Part 172

[Docket No. 85F–0345]

Food Additives Permitted for Direct Addition To Food for Human Consumption; Aspartame

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the food additive regulations to provide for the safe use of aspartame as a sweetener in frozen desserts where standards of identity do not preclude this use. This action responds to a petition filed by Pfizer Central Research, Pfizer, Inc.

DATES: Effective June 7, 1988; objections by July 7, 1988.

ADDRESS: Written objections may be sent to the Dockets Management Branch (HFA–305), Food and Drug Administration, Rm. 4–62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Carl L. Giannetta, Center for Food Safety and Applied Nutrition (HFF–334), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, 202–426–5487.

SUPPLEMENTARY INFORMATION: In a notice published in the **Federal Register** of August 23, 1985 (50 FR 34198), FDA announced that a food additive petition (FAP 5A3861) had been filed by Pfizer Central Research, Pfizer, Inc., 235 East 42nd St., New York, NY 10017, proposing that § 172.804 *Aspartame* (21 CFR 172.804) be amended to provide for the safe use of aspartame to sweeten frozen desserts where standards of identity do not preclude this use.

The agency has evaluated data in the petition and other relevant material and concludes that the proposed use is safe. Therefore, the regulation in 21 CFR 172.804 is amended by adding a new paragraph (c)(17).

In accordance with § 171.1(h) (21 CFR 171.1(h)), the petition and the documents that FDA considered and relied upon in reaching its decision to approve the petition are available for inspection at the Center for Food Safety and Applied Nutrition by appointment with the information contact person listed above. As provided in 21 CFR 171.1(h), the agency will delete from the documents any materials that are not available for public disclosure before making the documents available for inspection.

The agency has carefully considered the potential environmental effects of this action and has concluded that the action will not have a significant impact on the human environment and that an environmental impact statement is not required. The agency's finding of no significant impact and the evidence supporting that finding, contained in an environmental assessment, may be seen in the Dockets Management Branch (address above) between 9 a.m. and 4 p.m., Monday through Friday. This action was considered under FDA's final rule implementing the National Environmental Policy Act (21 CFR Part 25).

Any person who will be adversely affected by this regulation may at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) written objections thereto. Each objection shall be separately numbered, and each numbered objection shall specify with particularity the provisions of the regulation to which objection is made and the grounds for the objection. Each numbered objection on which a hearing is requested shall specifically so state. Failure to request a hearing for any particular objection shall constitute a waiver of the right to a hearing on that objection. Each numbered objection for which a hearing is requested shall include a detailed description and analysis of the specific factual information intended to be presented in support of the objection in the event that a hearing is held. Failure to include such a description and analysis for any particular objection shall constitute a waiver of the right to a hearing on the objection. Three copies of all documents shall be submitted and shall be identified with the docket number found in brackets in the heading of this document. Any objections received in response to the regulation may be seen in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

List of Subjects in 21 CFR Part 172

Food additives.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, Part 172 is amended as follows:

PART 172—FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION

1. The authority citation for 21 CFR Part 172 continues to read as follows:

Authority: Secs. 201(s), 409, 72 Stat. 1784–1788 as amended (21 U.S.C. 321(s), 348); 21 CFR 5.10 and 5.61.

2. Section 172.804 is amended by adding a new paragraph (c)(17) to read as follows:

§ 172.804 Aspartame.

* * * * *

(c) * * *

(17) Frozen desserts.

* * * * *

Dated: May 31, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–12745 Filed 6–6–88; 8:45 am]

BILLING CODE 4160–01–M

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21 CFR Parts 510, 522, 548 and 558

Animal Drugs, Feeds, and Related Products; Change of Sponsor

AGENCY: Food and Drug Administration.

ACTION: Final rule.

SUMMARY: The Food and Drug Administration (FDA) is amending the animal drug regulations to reflect a change of sponsor of several NADA's from International Minerals & Chemical Corp. (IMC), to Pitman-Moore, Inc. Pitman-Moore, Inc., requested the change to indicate that it is the parent company currently sponsoring the NADA's.

EFFECTIVE DATE: June 7, 1988.

FOR FURTHER INFORMATION CONTACT: John R. Markus, Center for Veterinary Medicine (HFV–142), Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, 301–443–3442.

SUPPLEMENTARY INFORMATION: Pitman-Moore, Inc., of Washington Crossing, NJ 08560, has informed FDA that it is now sponsor of several NADA's formerly held by International Minerals & Chemical Corp., Veterinary Division, P.O. Box 207, Terre Haute, IN 47808.

The NADA's affected are:

NADA	Product
38-233	RALGRO® (Zeranol) Implants for Cattle and Lambs.
46-920	Baciferm® 10, 25, 30, 40, 50, and 60 (Bacitracin Zinc Type A Article).
65-313	Baciferm® Soluble-50 (Bacitracin Zinc for Drinking Water).
105-758	Bacitracin Zinc/Amprolium plus Ethopabate/Roxarsone.
114-794	Bacitracin Zinc/Amprolium plus Ethopabate.
123-154	Bacitracin Zinc/Monensin/Roxarsone.
136-484	Bacitracin Zinc/Carbarsone.
139-190	Bacitracin Zinc/Salinomycin/Roxarsone.
139-235	Bacitracin Zinc/Salinomycin.

The agency is amending 21 CFR Parts 510, 522, 548 and 558 to reflect the new sponsor.

List of Subjects

21 CFR Part 510

Administrative practice and procedure, Animal drugs, Labeling, Reporting and recordkeeping requirements.

21 CFR Part 522

Animal drugs.

21 CFR Part 548

Animal drugs, Antibiotics.

21 CFR Part 558

Animal drugs, Animal feeds.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs and redelegated to the Center for Veterinary Medicine, 21 CFR Parts 510, 522, 548, and 558 are amended as follows:

PART 510—NEW ANIMAL DRUGS

1. The authority citation for 21 CFR Part 510 continues to read as follows:

Authority: Secs. 512, 701(a) (21 U.S.C. 360b, 371(a)); 21 CFR 5.10 and 5.83.

§ 510.600 [Amended]

2. Section 510.600 *Names, addresses, and drug labeler codes of sponsors of approved applications* is amended in paragraph (c)(1) by removing the entry for "International Minerals & Chemical Corp." and in paragraph (c)(2) by removing the entry for the number "012769."

PART 522—IMPLANTATION OR INJECTABLE DOSAGE FORM NEW ANIMALS DRUGS NOT SUBJECT TO CERTIFICATION

3. The authority citation for 21 CFR Part 522 continues to read as follows:

Authority: Sec. 512(i), 82 Stat. 347 (21 U.S.C. 360b(i)); 21 CFR 5.10 and 5.83.

§ 552.2680 [Amended]

4. Section 522.2680 *Zerano* is amended in paragraph (c) by removing "No. 012769" and by adding in its place "No. 011716."

PART 548—CERTIFIABLE PEPTIDE ANTIBIOTIC DRUGS FOR ANIMAL USE

5. The authority citation for 21 CFR Part 548 continues to read as follows:

Authority: Sec. 512, 82 Stat. 343–351 (21 U.S.C. 360b); 21 CFR 5.10, 5.83.

§ 548.114 [Amended]

6. Section 548.114 *Bacitracin zinc soluble powder* is amended in paragraph (c)(2) by removing "No. 012769" and by adding in its place "No. 011716."

PART 558—NEW ANIMAL DRUGS FOR USE IN ANIMAL FEEDS

7. The authority citation for 21 CFR Part 558 continues to read as follows:

Authority: Sec. 512, 82 Stat. 343–351 (21 U.S.C. 360b); 21 CFR 5.10 and 5.83.

§ 558.15 [Amended]

8. Section 558.15 *Antibiotic, nitrofuran, and sulfonamide drugs in the feed of animals* is amended in paragraphs (g)(1) and (g)(2) in the tables under the "Drug sponsor" column by removing "International Minerals & Chemicals Corp." and by adding in its place "Pitman-Moore, Inc."

§ 558.58 [Amended]

9. Section 558.58 *Amprolium and ethopabate* is amended in paragraph (d)(1) in the table in entry (iii) under the "Limitations" and "sponsor" columns by removing the number "012769" each time it appears, and by adding in its place the number "011716."

§ 558.78 [Amended]

10. Section 558.78 *Bacitracin zinc* is amended in paragraph (a)(2), paragraph (d)(1) in the table under the "Sponsor" column, and in paragraph (d)(2)(ii) by removing the number "012769" wherever it appears, and by adding in its place the number "011716."

§ 558.105 [Amended]

11. Section 558.105 *Buquinolate* is amended in paragraph (d)(1)(xi)(*b*) by removing "No. 012769" and by adding in its place "No. 011716."

§ 558.120 [Amended]

12. Section 558.120 *Carbarsone (not U.S.P.)* is amended in paragraph (c)(1)(iii)(*b*) by removing "No. 012769" and by adding in its place "No. 011716."

§ 558.175 [Amended]

13. Section 558.175 *Clopidol* is amended in paragraphs (c)(1)(iii)(*b*) and (c)(1)(iv)(*b*) by removing "No. 012769" and by adding in its place "No. 011716."

§ 558.195 [Amended]

14. Section 558.195 *Decoquinate* is amended in paragraph (d) in the table under the "Limitations" column by removing "No. 012769" each time it appears and by adding in its place "No. 011716".

§ 558.311 [Amended]

15. Section 558.311 *Lasalocid* is amended in paragraph (e)(1) in the table in entry (ii) under the "Limitations" column by removing "No. 012769" and by adding in its place "No. 011716".

§ 558.355 [Amended]

16. Section 558.355 *Monensin* is amended in paragraphs (b)(9), (f)(1)(iv)(*b*), (f)(1)(v)(*b*), (f)(1)(xv)(*b*), and (f)(1)(xvi)(*b*) by removing the number "012769" and by adding in its place the number "011716."

§ 558.515 [Amended]

17. Section 558.515 *Robenidine hydrochloride* is amended in paragraph (d)(1)(vi)(*b*) by removing "No. 012769" and by adding in its place "No. 011716."

§ 558.550 [Amended]

18. Section 558.550 *Salinomycin* is amended in paragraphs (b)(1)(vii)(*c*) and (b)(1)(ix)(*c*) by removing "No. 012769" and by adding in its place "No. 011716."

Dated: May 27, 1988.

Richard A. Carnevale,

Deputy Director, Office of New Animal Drug Evaluation, Center for Veterinary Medicine.

[FR Doc. 88-12740 Filed 6-6-88; 8:45 am]

BILLING CODE 4160-01-M

DEPARTMENT OF DEFENSE

Office of the Secretary

32 CFR Part 114

[DoD Instruction 7730.54]

Reserve Components Common Personnel Data System (RCCPDS)

AGENCY: Office of the Secretary, DoD.

ACTION: Final rule.

SUMMARY: This part provides DoD policy and guidance for reporting

Reserve Component categories, personnel transactions accounting, personnel data items, definitions, and accuracy standards to the Reserve Components Common Personnel Data System (RCCPDS). The RCCPDS is the computerized data base that has been established to meet the policy requirements and to provide statistical tabulations of Reserve Components strengths and related data for use throughout the Department of Defense, other Government Agencies, and the Congress. This revision corrects administrative changes required by standardization of data elements for the automated system.

EFFECTIVE DATE: May 13, 1988.

ADDRESS: Office of the Assistant Secretary of Defense (Reserve Affairs), the Pentagon, Washington, DC 20301.

FOR FURTHER INFORMATION CONTACT: K. Robinson, telephone (202) 696-5848.

SUPPLEMENTARY INFORMATION:

List of Subjects in 32 CFR Part 114

Archives and records, Armed forces reserves.

Accordingly, 32 CFR Part 114 is revised as follows:

PART 114—RESERVE COMPONENTS COMMON PERSONNEL DATA SYSTEM (RCCPDS)

Sec.

Authority: 10 U.S.C. 261, 267, 275, 511, 651, 652, 671, 1331, 3914, 6330, and 8914.

§ 114.1 Reissuance and purpose.

This part revises 32 CFR Part 114 to correct administrative changes required by standardization of Data Elements for the Reserve Components Common Personnel Data System (RCCPDS).

§ 114.2 Applicability and scope.

(a) This Part applies to the Office of the Secretary of Defense (OSD), the Military Departments (including their National Guard and Reserve components), the Organization of the Joint Chiefs of Staff, the Defense Agencies, and the U.S. Coast Guard (by agreement with the Department of Transportation).

(b) The provisions of this Part govern all officers, warrant officers, and enlisted personnel assigned to the Ready Reserve, the Standby Reserve, and the Retired Reserve. Reservists on active duty for training who continue their assignment with a Reserve component are included. Reserve Officer Training Corps (ROTC) members, who are not members of the Simultaneous Membership Program (SMP), are excluded. Also excluded are individuals who have elected discharge after 20 creditable years instead of transfer to the Retired Reserve. The Defense Manpower Data Center (DMDC) shall maintain a historical file on these individuals.

(c) Enlisted members of an active component who also have a Reserve commission shall not be reported in RCCPDS.

(d) Members on extended active duty who are part of the active component or assigned to the Selective Service System shall not be reported. (This does not include members identified in §114.5(a)(1)).

§ 114.3 Policy.

(a) RCCPDS is the computerized common data base that has been established to meet the policy requirements and to provide statistical tabulations of Reserve components' strengths and related data for use throughout the Department of Defense, other Government Agencies, the Congress, and for appropriate public release by the Assistant Secretary of Defense (Public Affairs) (ASD(PA)) (DoD Directive 1205.17 [1])

(b) The requirements and procedures prescribed by 32 CFR Part 286a must be followed to safeguard the personnel data maintained in this reporting system. Individuals having access to identifiable personnel information may be held personally responsible and punishable under the law for making unauthorized disclosures.

§ 114.4 Responsibilities.

(a) *The Assistant Secretary of Defense (Reserve Affairs)* (ASD(RA)) shall:

(1) Establish policy and provide guidance for Reserve Component Categories, personnel transaction accounting, personnel data items, definitions, and accuracy standards.

(2) Provide policy guidance to the DMDC on the content and use of the RCCPDS including data fields, definitions, frequency, format, and the content of periodic and special RCCPDS reports in accordance with responsibilities detailed in DoD Directive 1205.17 and 32 CFR Part 379.

(3) Revise and maintain this Part as necessary to update data requirements and provide accurate and effective guidance on personnel data management to the Military Departments and their Reserve components.

(b) The *Assistant Secretary of Defense (Force Management and Personnel* (ASD(FM&P)) shall:

(1) Ensure that Reserve component military personnel information requirements for actuarial valuations and for effective Total Force military personnel management are identified to the ASD(RA).

(2) Exercise such policy guidance and management supervision for the DMDC consistent with ASD(FM&P) responsibilities in DoD Directive 5124.2 [2] as required to ensure adequate resources are available and used by the DMDC to fulfill its responsibilities.

(c) The *Director, Defense Manpower Data Center* shall:

(1) Operate and maintain the RCCPDS, to include computer support, software development, quality control, inquiry capability, and administrative support.

(2) Develop, produce, and distribute all periodic and special RCCPDS reports.

(3) Provide programing and analytical support to ASD(RA) for special studies requiring use of the RCCPDS.

(4) Modify the RCCPDS to reflect the changing nature of the Reserve components.

(5) Inform the ASD(RA) of data produced from the RCCPDS for other users and of the state and quality of the information submitted by the Reserve components.

(d) The *Secretaries of the Military Departments and the Commandant of the U.S. Coast Guard* shall:

(1) Provide their respective Reserve components with the support necessary to maintain a personnel data system.

(2) Prepare, at the end of each month, a Master Officer File and Master Enlisted File reflecting the status of each member of the Reserve component as of the last day of each month as stated in enclosure 2 of DoD Instruction 7730.54.[3]

(3) Prepare, at the end of each month, an Officer Transaction File and an Enlisted Transaction File reflecting the gains, losses, reenlistments, extensions, and transfers of Reserve component personnel that occurred during the reporting month as stated in enclosure 4 of DoD Instruction 7730.54.

(4) Edit monthly submissions according to the editing concept defined

[1] Copies may be obtained, if needed, from the U.S. Naval Publication and Forms Center, Attn: Code 1052, 5801 Tabor Avenue, Philadelphia, PA 19120.

[2] See footnote 1 to §114.3(a).

[3] See footnote 1 to § 114.3(a).

in enclosure 3 of DoD Instruction 7730.54.

(5) Perform a quality control validation of the data before submission to the OSD.

§ 114.5 Procedures.

(a) The following categories of full-time support personnel shall be reported in RCCPDS:

(1) *Active Guard/Reserve.* Guardsmen and Reservists on active duty to provide full-time support to the Ready Reserve and who are paid from the Reserve personnel appropriations of the Military Department concerned.

(2) *Military Technicians.* Federal civilian personnel of a Military Department who occupy Military Technician positions and are members of the Reserve component they support.

(b) As the official DoD vehicle for reporting Reserve component manpower strengths, records reported in this system (as prescribed in this Part) may not be duplicated in other DoD-wide strength reporting systems. Additionally, to support the accuracy of strength data in the system, DoD Components shall ensure that:

(1) All strength-affecting changes are processed and reported without delay.

(2) All master and transaction files are edited before submission following the procedures stated in enclosure 3 of DoD Instruction 7730.54.

(c) Requests to provide specifically tailored reports and inquiries to system users shall be directed to the address shown at § 114.5(g). A Reserve component may not be provided data relative to another Reserve component without prior approval of that component.

(d) Any information available to RCCPDS required by the Selective Service System and the Veterans' Administration shall be provided by magnetic tape extracts of data submitted in compliance with this part.

(e) Information from RCCPDS shall be provided annually to Federal Agencies screening employees who are also Reserve component members, as prescribed by 32 CFR Part 44.

(f) RCCPDS data validity shall be ensured as follows:

(1) The following shall be critical data for all Reserve component members, and the goal shall be 100 percent validity to ensure acceptability in the system.

Record field	Data field	Record position
1	Reserve Component	1-2
2a	Reserve Component Category Indicator.	3
2b	Reserve Component Training-Retirement Category Indicator.	4
3	Social Security Number	5-13
92	Transaction Codes	399-400

(2) Each of the following (as applicable within each Reserve Component Category) shall have as a goal at least 98 percent validity.

Record field	Data field	Record position
6	Name, Individual	24-50
7	Date of Birth	51-56
8	Sex	57
11	Marital Status	60
13	Educational Designator	63
17	Date of Rank	155-160
18	Pay Grade, Uniformed Services.	161-163
19	Pay Entry Base Date (PEBD).	164-169
35(a), (b), (c), (d)	Date of Appointment/Date of Expiration of Current Service Agreement.	229-234
40	Armed Forces Qualification Test (AFQT) Percentile Score (Enlisted Only).	243-244
46	Military Unit Designator (Unit Identification Code).	251-258
47	States of the United States, and Countries (Unit).	259-260
48	National Zoning Improvement Plan (Unit Zip Code).	261-269
66(a), (b)	Year and Month, Reserve Component Incentive Program Eligibility Effective Date.	311-314
67	Reserve Component Incentive Program Type.	315
68	Reserve Component Incentive Program Educational Type.	316
70	Active Component Montgomery GI Bill (MGIB) Eligibility Status (Title 38, U.S.C. Chapter 30).	323
76	Reserve Component Montgomery GI Bill (MGIB) Eligibility Status (Title 10, U.S.C. Chapter 106).	339
88	Notification of Eligibility for Retired Pay Indicator (20-Year Letter Indicator).	385
89	Date of Transfer to the Retired Reserve.	386-391
90	Date of Transfer to the Standby Reserve.	392-397

(3) The goal for all remaining data fields shall be:

(i) Ninety-five percent validity for the Ready Reserve and Standby Reserve.

(ii) Ninety-five percent validity for the Retired Reserve receiving pay or eligible for pay at age 60.

(4) The data validity rates (§ 114.5(f) (1) through (3)) shall be used as standards for judging the validity of this data base and shall be provided to any audit or inspection agency reviewing their accuracy.

(g) Magnetic tape files and the quality control edit reports shall be delivered by the 20th of the month following the previous report period. The mailing address is Defense Manpower Data Center, ATTN: Reserve File Manager, 550 Camino el Estero, Suite 200, Monterey, CA 93940-3231.

§ 114.6 Information requirements.

The reporting requirements for this part are assigned the following Report Control Symbols:

Master File..... DD-RA(M)1147
Transaction File..... DD-RA(M)1148

Standard data elements from DoD 5000.12-M [4] are being used in these reporting requirements where applicable.

§ 114.7 Effective date and implementation.

This part is effective May 13, 1988. Implementation shall be completed by 1 July 1988. Forward two copies of implementing documents and phased time plan to the Assistant Secretary of Defense (Reserve Affairs) within 120 days.

Linda M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

June 1, 1988.

[FR Doc. 88-12810 Filed 6-6-88; 8:45 am]

BILLING CODE 3810-01-M

[4] Copies may be obtained, at cost, from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 271

[FRL-3392-2]

North Carolina; Order to Commence Proceedings To Determine Whether To Withdraw Hazardous Waste Program Approval; Correction of Date and Location of Hearing

AGENCY: Environmental Protection Agency.

ACTION: Notice of correction of hearing and date and location.

SUMMARY: This notice corrects the date and location previously published in the **Federal Register** (53 FR 3894) on February 10, 1988, establishing the dates and location for the North Carolina withdrawal proceeding hearing. The hearing will be held on September 19-21, 1988, at the Jane S. McKimmon Center, North Carolina State University, Raleigh, NC.

FOR FURTHER INFORMATION CONTACT: Otis Johnson, Jr., at (404) 347-3016.

Dated: May 23, 1988.

Joe R. Franzmathes,

Acting Regional Administrator.

[FR Doc. 88-12770 Filed 6-6-88; 8:45 am]

BILLING CODE 6560-50-M

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

43 CFR Public Land Order 6679

[AK-932-08-4220-10; F-012718]

Modification of Public Land Order (PLO) No. 1571, as Amended, for Selection of the Oil and Gas Estates by the State of Alaska; Alaska

AGENCY: Bureau of Land Management, Interior.

ACTION: Public land order.

SUMMARY: This order will open and classify the oil and gas estates of 678.20 acres of public land for selection and conveyance of the oil and gas estates to the State of Alaska. The land is and will continue to be withdrawn for the Department of the Air Force for military purposes by PLO No. 1571, and for study and classification by PLO No. 5187.

EFFECTIVE DATE: June 7, 1988.

FOR FURTHER INFORMATION CONTACT: Sandra C. Thomas, BLM State Office, 701 C Street, Box 13, Anchorage, Alaska 99513, 907-271-5477.

By virtue of the authority vested in the Secretary of the Interior by section 204 of the Federal Land Policy and Management Act of 1976, 90 Stat. 2751; 43 U.S.C. 1714, and by section 17(d)(1) of the Alaska Native Claims Settlement Act of December 18, 1971, 85 Stat. 708 and 709; 43 U.S.C. 1616(d)(1), it is ordered as follows:

1. Public Land Order No. 1571, as amended, is hereby modified to permit selection of the oil and gas estates of the following described land by the State of Alaska under either the Alaska Statehood Act of July 7, 1958, 72 Stat. 339, *et seq.*; 48 U.S.C. prec. 21, or section 906(b) of the Alaska National Interest Lands Conservation Act of December 2, 1980, 94 Stat. 2437-2438; 43 U.S.C. 1635:

Oliktok Point (PLO No. 1571)

U.S. Survey No. 4275, Alaska.
The area described contains 678.20 acres.

2. Subject to valid existing rights, the oil and gas estates of the land described above are hereby classified as suitable for and opened to selection by the State of Alaska under either the Alaska Statehood Act of July 7, 1958, 72 Stat. 339, *et seq.*; 48 U.S.C. prec. 21, or section 906(b) of the Alaska National Interest Lands Conservation Act of December 2, 1980, 94 Stat. 2437-2438; 43 U.S.C. 1635.

3. As provided by section 6(g) of the Alaska Statehood Act, the State of Alaska is provided a preference right of selection for the oil and gas estates of the above described land, for a period of ninety-one (91) days from the date of publication of this order, if the land is otherwise available. If not selected by the State of Alaska, the oil and gas estates of the land will remain under the jurisdiction of the Secretary of Interior and shall remain closed until a further opening order is published.

4. The remaining estates of the land described above continue to be subject to the terms and conditions of PLO No. 1571, as amended, and PLO No. 5187, and no surface occupancy of the land shall be permitted.

J. Steven Griles,

Assistant Secretary of the Interior.

May 31, 1988.

[FR Doc. 88-12760 Filed 6-6-88; 8:45 am]

BILLING CODE 4310-JA-M

FEDERAL EMERGENCY MANAGEMENT AGENCY

44 CFR Part 64

[Docket No. FEMA 6792]

Suspension of Community Eligibility; New York

AGENCY: Federal Emergency Management Agency, FEMA.

ACTION: Final rule.

SUMMARY: This rule lists communities, where the sale of flood insurance has been authorized under the National Flood Insurance Program (NFIP), that are suspended on the effective date shown in this rule because of noncompliance with the revised floodplain management criteria of the NFIP. If FEMA receives documentation that the community has adopted the required revisions prior to the effective suspension date given in this rule, the community will not be suspended and the suspension will be withdrawn by publication in the **Federal Register.**

EFFECTIVE DATE: June 15, 1988.

FOR FURTHER INFORMATION CONTACT: Frank H. Thomas, Assistant Administrator, Office of Loss Reduction, Federal Insurance Administration, Federal Center Plaza, 500 C Street, SW., Room 416, Washington, DC 20472, (202) 646-2717.

SUPPLEMENTARY INFORMATION: The NFIP enables property owners to purchase flood insurance at rates made reasonable through a Federal subsidy. In return, communities agree to adopt and administer local floodplain management measures aimed at protecting lives and new construction from future flooding. Section 1315 of the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4022), prohibits flood insurance coverage as authorized under the NFIP (42 U.S.C. 4001-4128) unless an appropriate public body shall have adopted adequate floodplain management measures with effective enforcement measures.

On August 25, 1986, FEMA published a final rule in the **Federal Register** that revised the NFIP floodplain management criteria. The rule became effective on October 1, 1986. As a condition for continued eligibility in the NFIP, the criteria at 44 CFR 60.7 require communities to revise their floodplain management regulations to make them consistent with any revised NFIP regulation within 6 months of the effective date of that revision or be subject to suspension from participation in the NFIP.

The communities listed in this notice have not amended or adopted floodplain management regulations that incorporate the rule revision. Accordingly, the communities are not compliant with NFIP criteria and will be suspended on the effective date shown in this final rule. However, some of these communities may adopt and submit the required documentation of legally enforceable revised floodplain management regulations after this rule is published but prior to the actual suspension date. These communities will not be suspended and will continue their eligibility for the sale of insurance. A notice withdrawing the suspension of the communities will be published in the **Federal Register.** In the interim, if you wish to determine if a particular community was suspended on the suspension date, contact the appropriate FEMA Regional Office or the NFIP servicing contractor.

The Administrator finds that notice and public procedures under 5 U.S.C. 533(b) are impracticable and unnecessary because communities listed in this final rule have been adequately notified. Each community receives a 90- and 30-day notification addressed to the Chief Executive Officer that the community will be suspended unless the required floodplain management measures are met prior to the effective suspension date. For the same reasons, this final rule may take effect within less than 30 days.

Pursuant to the provision of 5 U.S.C. 605(b), the Administrator, Federal Insurance Administration, FEMA, hereby certifies that this rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As stated in section 2 of the Flood Disaster Protection Act of 1973, the establishment of local floodplain management together with the availability of flood insurance decreases the economic impact of future flood losses to both the particular community and the nation as a whole.

This rule in and of itself does not have a significant economic impact. Any economic impact results from the community's decision not to adopt adequate floodplain management measures, thus placing itself in noncompliance with the Federal standards required for community participation.

List of Subjects in 44 CFR Part 64

Flood insurance, Floodplains.

1. The authority citation for Part 64 continues to read as follows:

Authority: 42 U.S.C. 4001 *et. seq.*, Reorganization Plan No. 3 of 1978, E.O. 12127.

2. Section 64.6 is amended by adding in alphabetical sequence new entries to the table.

§ 64.6 List of eligible communities.

State	Community name	County	Community No.	Effective date
New York	Holland Patent, village of	Oneida	360530	June 15, 1988.
Do	Huron, town of	Wayne	360892	Do.
Do	Jay, town of	Essex	360265	Do.
Do	Lebanon, town of	Madison	360403	Do.
Do	Leicester, village of	Livingston	361456	Do.
Do	Lexington, town of	Greene	360294	Do.
Do	Lima, town of	Livingston	360457	Do.
Do	Lincoln, town of	Madison	360405	Do.
Do	Lyons, town of	Wayne	361226	Do.
Do	Marathon, town of	Cortland	361327	Do.
Do	Marathon, village of	Cortland	360183	Do.
Do	Mechanicville, city of	Saratoga	360721	Do.
Do	Middlesex, town of	Yates	360960	Do.
Do	Newark, village of	Wayne	360894	Do.
Do	Newcomb, town of	Essex	361390	Do.
Do	Pelham, village of	Westchester	360925	Do.
Do	Pharsalia, town of	Chenango	361091	Do.
Do	Plandome, village of	Nassau	360484	Do.
Do	Pulaski, village of	Oswego	360659	Do.
Do	Rensselaer, Falls, village of	St. Lawrence	361466	Do.
Do	Richford, town of	Tioga	361216	Do.
Do	Round Lake, village of	Saratoga	360726	Do.
Do	Rushford, town of	Allegany	360033	Do.
Do	Savona, village of	Steuben	361049	Do.
Do	Scriba, town of	Oswego	360663	Do.
Do	Sherbourne, town of	Chenango	360164	Do.
Do	Sherman, town of	Chautauqua	361502	Do.
Do	Shoreham, village of	Suffolk	361506	Do.
Do	Smithfield, town of	Madison	361294	Do.
Do	Smithville, town of	Chenango	361040	Do.
Do	Smyrna, town of	Chenango	361308	Do.
Do	Sodus Point, village of	Wayne	360899	Do.
Do	Solon, town of	Cortland	361329	Do.
Do	Speculator, village of	Hamilton	361527	Do.
Do	Stockport, town of	Columbia	361322	Do.
Do	Syracuse, city of	Onandaga	360595	Do.
Do	Taghkanic, town of	Columbia	361324	Do.
Do	Taylor, town of	Cortland	361330	Do.
Do	Tivoli, village of	Dutchess	361507	Do.
Do	Valatie, village of	Columbia	361508	Do.
Do	Valley Falls, village of	Rensselaer	361469	Do.
Do	Van Etten, village of	Chemung	361045	Do.
Do	Wallkill, town of	Orange	360634	Do.
Do	Wappingers Falls, village of	Dutchess	360223	

Harold T. Duryee,

Administrator, Federal Insurance Administration.

Issued: June 1, 1988.

[FR Doc. 88-12758 Filed 6-6-88; 8:45 am]

BILLING CODE 6718-21-M

FEDERAL MARITIME COMMISSION

46 CFR Part 586

[Docket No. 87-6]

Actions To Adjust or Meet Conditions Unfavorable to Shipping in the United States/Peru Trade

AGENCY: Federal Maritime Commission.

ACTION: Proceeding held in abeyance.

SUMMARY: The Federal Maritime Commission, in response to comments filed by interested parties on reconsideration of the Final Rule issued in this proceeding, has determined to hold the proceeding in abeyance for a period of time, and requests further comments by August 31, 1988.

DATE: Comments due on or before August 31, 1988.

ADDRESS: Comments (Original and 15 copies) to Joseph C. Polking, Secretary, Federal Maritime Commission, 1100 L

Street NW., Washington, DC 20573, (202) 523-5725.

FOR FURTHER INFORMATION CONTACT: Robert D. Bourgoin, Federal Maritime Commission, 1100 L Street NW., Washington, DC 20573, (202) 523-5740.

SUPPLEMENTARY INFORMATION: On March 3, 1988, the Federal Maritime Commission ("Commission" or "FMC") gave notice that it would reconsider the Final Rule earlier promulgated in this proceeding, and invited comments and information on present conditions in the U.S./Peru trade from interested parties. Comments have been received from eleven parties in response to that Notice. Comments have been received from the United States Executive Agencies ("Executive Agencies");[1] Shippers for Competitive Ocean Transportation ("SCOT"); Campania Sud Americana de Vapores ("CSAV"), Great Lakes Transcaribbean Line ("GLTL"); Naviera Amazonica Peruana, S.A. ("NAPSA"); Nedlloyd Lines ("Nedlloyd"), Compania Peruana de Vapores ("CPV"), Naviera Neptuno, S.A. ("Neptuno") and Empresa Naviera Santa, S.A. ("Santa"), jointly ("the Peruvian carriers"); the American Chamber of Commerce of Peru ("Chamber"), Georgetown Steel Corporation ("GSC"); Occidental International Exploration and Production Company ("Occidental"); and Southern Peru Copper Corporation ("SPCC").

Those comments and related recent events have been considered by the Commission, as set forth below. Based on those comments, the Commission herein announces that this proceeding will be held in abeyance and invites further comments and information from interested parties by August 31, 1988.

Background

On December 2, 1987, the Commission issued a Final Rule in this proceeding (52 FR 46356, December 7, 1987) stating that it finds "conditions unfavorable to shipping" within the meaning of section 19(1)(b) of the Merchant Marine Act, 1920, 46 U.S.C. app. 876(1)(b) ("Section 19"), exist in the foreign oceanborne trade between the United States and Peru ("Trade"). The Commission advised in its Final Rule that the GOP, through its laws and regulations, imposed burdens on non-Peruvian-flag carriers which are not experienced by Peruvian-flag carriers. The Commission therefore suspended the tariffs of certain Peruvian-flag carriers in the U.S. trade.

The GOP laws and regulations to which the Commission referred in its Final Rule include Supreme Decree No. 009-86-TC [2] ("Decree 009-86"), which reserves 100 percent of all imported and exported ocean freight generated by Peru's foreign trade for Peruvian-flag carriers. The amount of cargo reserved by Decree 009-86 for Peruvian-flag carriers could be reduced: (1) On the basis of strict reciprocity;[3] (2) pursuant to government or commercial agreements [4] among non-Peruvian and Peruvian-flag carriers, preferably include CPV, the Peruvian state-owned shipping line; or (3) when the Peruvian Director General of Maritime Transportation or Peruvian Consuls grant non-Peruvian-flag or non-associate carriers permission to carry Peruvian export or import cargoes. Authorization for the use of non-Peruvian-flag or non-associate carriers would be granted in the form of a waiver or cargo manifest certification when Peruvian-flag or associate carriers were not available and in position within 12 days [5] following the proposed date of shipment of non-perishable products, or within 4 days in the case of perishable products, or when no Peruvian-flag carrier serves the relevant port.

Subsequent to issuance of the Proposed Rule which initiated this proceeding,[6] regulations ("Regulations")[7] were issued by the GOP pursuant to a Memorandum of Understanding ("MOU") signed by the USG and the GOP on May 1, 1987. These Regulations set forth new requirements and procedures that shipping lines operating third-flag vessels must observe in order to obtain authorizations from the GOP Ministry of Transportation and Communications ("Ministry") to participate in the Trade. The GOP advised through the Department of State that the "authorization" system under the Regulations totally replaced the existing "waiver" system for granting third-flag carriers access to the Trade.

In issuing its Final Rule the Commission explained that while it recognized the good faith efforts made by the USG and GOP to address the situation in the Trade through diplomatic means, the resultant Regulations which implement the MOU did not satisfactorily resolve that situation. The Commission stated that, in fact, the Regulations, in effect, continue in place the very types of restrictions and impediments which prompted this proceeding in the first instance. Although third-flag carriers were no longer required to obtain "waivers" for individual shipments, they were to obtain "authorizations" to participate in the Trade. The Commission found this authorization process as inconsistent with free access to trade, as was the waiver system it replaced. In this regard, the Commission also added that it was unknown whether Chilean-flag carriers would be granted authorizations and allowed to operate in the Trade, particularly in light of the existence of Peruvian Resolution No. 044-86-TC/AC ("Resolution 044-86"), which excludes Chilean-flag carriers from certain Peru/third-country trades.

Finally, the Commission advised that it could not accept as a satisfactory resolution of this matter an accommodation which would permit the GOP to deny authorization to a third-flag operator in the Trade if the country of nationality of that operator bars participation to Peruvian-flag carriers in any of its third-country trades. The Commission explained that to accept the proposition that the GOP can settle disputes with foreign nations by imposing burdens on U.S.-Peru trade hostage to obtaining concessions elsewhere.

Thus, the Final Rule suspended the tariffs of the Peruvian-flag carriers operating in the Trade, with the exception of Naviera Amazonica

[1] The Department of Transportation ("DOT") submitted these comments on behalf of the Executive Agencies. In addition, earlier on March 3, 1988, the DOT, on its own behalf, submitted a letter to the Commission reporting on consultations between the United States Government ("USG") and the Government of Peru ("GOP") held in Lima on February 25-26, 1988.

[2] Decree 009-86 amended Supreme Decree No. 036-82-TC ("Decree 036-82"), effective September 1982. Decree 036-82 reserves Peruvian import and export cargoes for Peruvian-flag vessels and sets out waiver and cargo manifest certification requirements for non-Peruvian-flag carriers. The exact percentage of cargo reserved for Peruvian-flag carriers is not specified in Decree 036-82. An earlier decree states that 50 percent of Peruvian import and export cargo is reserved for Peruvian-flag carriers.

[3] *E.g.*, U.S. carriers' access to Peruvian cargoes would be proportional to Peruvian carriers' access to U.S. cargoes.

[4] Non-Peruvian-flag carriers which become parties to such commercial agreements may be granted associate status upon approval by the GOP. Associate carriers are excepted from cargo manifest certification and waiver requirements under Decree Nos. 009-86 and 036-82.

[5] Supreme Decree No. 033-86-TC modified Decree 009-86 by reducing the number of days a shipment must wait for a Peruvian or associate carrier from 15 days to 12 days.

[6] *See* Notice of Proposed Rulemaking, 52 FR 11832, April 13, 1987.

[7] These Regulations were contained in Ministerial Resolution No. 027-87-TC/AC ("Resolution").

Peruana, S.A. ("NAPSA"),[8] unless such carriers obtain authorized status from the Commission.[9] The suspension of these tariffs was to become effective March 7, 1988.

On February 4, 1988, the Peruvian carriers filed a Petition for Reconsideration ("Petition") requesting that the FMC reconsider its Final Rule, or, in the alternative, stay the effective date of the Final Rule on grounds that the Rule is basically directed at Decree 009–86 of February 28, 1986, which has been rescinded by GOP Supreme Decree No. 004–88–TC ("Decree 004–88") of January 22, 1988.[10] Further, the Peruvian carriers submitted that the Regulations which implement the MOI also have been rescinded.[11]

The Peruvian carriers alleged that with such action by the GOP, Peruvian cargo preference law has reverted to its status prior to enactment of Decree 009–86, and prior to the initiation of this proceeding which resulted from complaints to the Commission about Decree 009–86. They advised that while Decree 009–86 reserved 100 percent of all Peruvian import and export cargoes, Decree 004–88 reestablishes legislation in existence between 1970 and 1986 which reserves 50 percent of Peruvian cargoes to Peruvian-flag or associate carriers.[12] The Peruvian carriers took the position that since, as the Commission states in its Final Rule, this proceeding arose from complaints about the enactment, implementation and enforcement by the GOP of Decree 009–86, the Commission should reconsider its Final Rule and terminate the proceeding due to the rescission of Decree 009–86.

As an alternative to reconsideration and termination of the proceeding, the Peruvian carriers suggested that the Commission stay its Final Rule pending investigation of present conditions in the Trade or judicial review,[13] whichever is later, particularly if the Commission determines that it has insufficient knowledge of present conditions in the Trade to order termination of the proceeding. The Peruvian carriers contended that a stay would allow time for the Commission to gather any facts required for reconsideration and, if necessary, for the Court to clarify "serious legal issues in this proceeding."

After analyzing the Petition and replies thereto, the Commission issued its Notice of Reconsideration of Final Rule ("March Notice".) In its March Notice the Commission discussed the GOP initiatives, noting that some action was necessary to recognize the change status of the issues brought about by the GOP's actions and, as a technical legal matter, because the rescission of Decree 009–86 and Resolution 044–86 appeared to have undermined the basis cited in the Final Rule for the Commission's findings of conditions unfavorable to shipping in the Trade. The Commission withdrew the Final Rule for reconsideration and again invited interested parties to comment. However, the Commission also pointed out that rescission alone may not resolve the unfavorable conditions which the Final Rule addressed, and the Commission stated that, if the system remains discriminatory in the absence of Decree 009–86, it would be prepared to act swiftly to reinstate the Final Rule on the basis of new findings that conditions unfavorable to shipping continue to exist.

Subsequent to the issuance of the Commission's March Notice, three agreements were filed with the Commission between Peruvian and Chilean-flag carriers.[14] Pursuant to these agreements, the Chilean-flag carriers would be granted associate status by the GOP and thereby given access to the Trade.

Summary of Comments

A. Executive Agencies

1. March 3, 1988 Letter

On March 3, 1988, Gregory Dole, Deputy Assistant Secretary for Policy and International Affairs ("DAS"), DOT, reported to the Commission on consultations between the USG and GOP, held February 25–26, 1988, regarding the GOP's implementation of Decree 036–82. DAS Dole reports that the GOP provided assurances that U.S. carriers will, through their equal access agreement, continue to have access to all cargo in the Trade on the same basis as Peruvian-flag carriers. Further, the DAS reports that the GOP had approved, by Ministerial Resolution of February 22, 1988, three agreements between Peruvian and Chilean-flag carriers which will accord Chilean-flag carriers access to all cargo on the same basis as Peruvian-flag carriers. The DAS states that, if the terms of these commercial agreements are acceptable, the Executive Agencies believe that the agreements will resolve the problems that the Chilean-flag carriers have had gaining access to the Trade. In addition, the DAS notes that during the consultations, the USG expressed hope to the GOP that similar commercial solutions would be found for other third-flag carriers to allow them to operate without restrictions.

Further, DAS Dole submits that the GOP indicated that the administration of the Peruvian waiver system was being evaluated so as to create a system with maximum flexibility. In addition, the FMC was advised that the GOP has set up a commission to review GOP merchant marine policy.

The DAS reports that the Executive Agencies are generally encouraged by the developments in the Trade, but states that it is premature for them to make a recommendation as to the disposition of the Final Rule.

2. March 31, 1988 Comments

The Executive Agencies state that as of the final day of the comment period two service agreements between Peruvian and Chilean-flag carriers had been filed with the FMC. They submit that these agreements appear to provide these Chilean-flag carriers access to the Trade. The Executive Agencies point out, however, that the access of other third-flag carriers to the Trade is uncertain.

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[8] Under the Final Rule, NAPSA's tariff, FMC No. 3, covering the U.S./Iquitos, Peru trade, would not be suspended because the Commission found this subtrade distinguishable from the Trade generally, and, therefore, entitled to different treatment. The Final Rule noted that the Commission did not receive any complaints regarding this subtrade. Further, it stated that there is no alternative to NAPSA's service in this subtrade. (*See* Docket No. 87–6, 52 FR 46362, December 7, 1987).

[9] The Final Rule states that authorized status shall be conferred upon a Peruvian-flag carrier upon that carrier's submitting to the Commission a certificate from the GOP stating unequivocally that no law, regulation or policy of the GOP will:

(i) Preclude any non-Peruvian-flag carrier from competing in the Trade on the same basis as any other carrier;

(ii) Result in less than meaningful and competitive access by any non-Peruvian-flag carrier, to cargo designated as reserved under Supreme Decree No. 009–86–TC; and

(iii) Impose any administrative burden, including but not limited to, the necessity to secure an authorization based on the national status of the carrier, or otherwise discriminate against any non-Peruvian-flag carrier in the Trade.

[10] Decree 004–88 was published in the Peruvian Official Gazette, "El Peruano," on January 25, 1988.

[11] In addition, Resolution No. 044–86 which excluded Chilean-flag carriers from certain Peru/third-country trades has been rescinded.

[12] The pre-1986 legal regime is based primarily on Decree 036–82.

[13] A petition for review of the Final Rule was filed by the Peruvian-flag carriers in the U.S. Court of Appeals for the District of Columbia Circuit ("Court") on January 29, 1988, *Compania Peruana de Vapores, et al. v. USA and FMC*, D.C. Cir. No 88–1073. That proceeding has been held in abeyance until May 31, 1988.

[14] These agreements are: Agreement No. 212–011180 between Neptuno and CSAV, filed March 16, 1988, effective April 30, 1988; Agreement No. 212–011186, as amended by Agreement No. 212–011186.001, between Santa and Empresa Maritima de Estrado ("Empremar"), filed March 29, 1988, effective May 13, 1988; and Agreement No. 212–011189 between CPV and Compania Chilena de Navegacion Interoceanica S.A. ("CCNI"), filed April 12, 1988, effective May 27, 1988.

Further, the Executive Agencies report that they received assurances that third-flag carrier access to the Trade, as well as other issues, will be addressed over the next few months by the Commission established to develop a new Peruvian merchant marine policy.

Based on the aforementioned developments, the Executive Agencies state that they do not believe sanctions are warranted at this time.

B. SCOT

SCOT contends that while the GOP's rescission of Decree 009–86 and the Resolution are positive steps, such action will not remove the conditions unfavorable to shipping in the Trade. SCOT adds, however, that as of March 31, 1988, none of the changes implemented by the GOP will have been in place for sufficient time to allow U.S. shippers to comment on their effect on the Trade.

SCOT states that three agreements between Peruvian and Chilean-flag carriers have been approved by the COP. It comments on the agreement between CSAV and Neptuno, the only agreement which had been filed with the FMC at the time SCOT drafted its comments. SCOT argues that the provisions of the CSAV-Neptuno service agreement do not appear to provide effective competition by the Chilean-flag carrier in the Trade. Further, SCOT believes that the agreement raises the question of whether any third-flag carrier would be given associate status without granting serious commercial concessions. The fact that CSAV can no longer participate in the profits of the U.S./Peru trade pursuant to the agreement, is said to indicate that CSAV's price of admission to the Trade was significant. SCOT contends that the conditions under which CSAV was readmitted will not remove unfavorable conditions as far as Chilean carriers are concerned.

Given the legislative regime now in place and the agreement between CSAV and Neptuno, SCOT maintains that conditions unfavorable to shipping in the Trade continue to exist and that no evidence submitted to date indicates otherwise. SCOT states that it would be premature for the Commission to take any action to stay or discontinue the investigation. It submits, however, that shippers would like an opportunity to comment further on conditions in the Trade after sufficient time has passed to allow them to assess GOP actions. A minimum of 90 days is said to be required to obtain any meaningful experience.

C. CSAV

CSAV directs the Commission's attention to its commercial agreement with Neptuno which has been approved by the GOP and filed with the FMC. CSAV reports that this agreement renders CSAV an associate carrier for purposes of Decree 036–82.

CSAV takes the position, therefore, that should the Commission determine that commercial settlements have made it desirable to suspend the proceeding and the Final Rule, it would have no formal objection to such action at this time. CSAV suggests, however, that it would be beneficial to shippers for the Commission to make a statement that its Final Rule could be reimposed in the event that new obstacles are placed on operations in the Trade or if the commercial settlements prove unworkable.

D. GLTL

GLTL states that it is meeting with CPV on April 20, 1988, to discuss potential cooperation and the terms of a free access agreement for cargoes moving between U.S. Great Lakes ports and Peru. GLTL advises that such a commercial agreement would confer associate status upon it and would resolve the concerns it previously raised in this proceeding. Absent such an agreement, GLTL asserts that its cargoes in the Trade would be subject to vessel manifest certificaton and waiver requirements pursuant to Decree 036–82.

It, therefore, requests that the Commission hold any further action in abeyance for a reasonable period of time to permit negotiations betwen CPV and GLTL and a determination as to the approvability of any agreement. GLTL states that it will promptly notify the Commission of the results of the April 20, 1988 negotiations.

GLTL subsequently informed the Commission by letter dated May 11, 1988 that representatives of GLTL and CPV had discussed the "framework for a proposed commercial agreement which, if approved by the Government of Peru and by the Commission, would confer associate status upon GLTL * * * and would resolve the concerns previously raised by GLTL in this proceeding." GLTL stated its expectation that a formal agreement would be concluded following action by CPV's Board of Directors on the proposal. GLTL also informed the Commission in that letter that the Peruvian Government has recently reaffirmed fines imposed on GLTL in connection with cargo carried in the Trade in 1984, and that imposition of these fines is being appealed through litigation in Peru.[15]

E. NAPSA

NAPSA reaffirms that no adverse conditions exist in the United States/Iquitos, Peru subtrade. It, therefore, requests that the Commission maintain its current policy permitting NAPSA free access to this subtrade. Further, NAPSA states that the rescission of Decree 009–86 should moot the controversy concerning the Trade generally.

F. Nedlloyd

Nedlloyd explains that it has an interest in this proceeding because it plans to institute a service between Chile and the United States on or about July 1, 1988. Nedlloyd states that it will attempt to offer services between Peru and the United States depending on the outcome of this proceeding and the actions taken by the GOP. It contends that the long term commercial viability of this proposed service depends on Nedlloyd's ability to serve Peru as part of its West Coast South America/United States service.

Nedlloyd expresses concern over the effects of the recent rescission of Decree 009–86 and the reestablishment of the cargo waiver system under Decree 036–82. It takes the position that the cargo waiver system under Decree 036–82 is a barrier to third-flag carrier entry into the Trade. Nedlloyd points out that if it wishes to operate in the Trade, it either must obtain a waive or seek associate status by entering into agreements with Peruvian-flag carriers. Nedlloyd finds neither of these options commercially attractive because they impose economic costs on the Trade in general and on Nedlloyd in particular. With regard to obtaining waivers, Nedlloyd asserts that Peruvian-flag carriers and their associates can schedule sailings so that it is virtually impossible for a third-flag carrier to qualify for a waiver.

Further, Nedlloyd maintains that there are potential costs, official and unofficial, of obtaining waivers. It states that it has experienced severe commercial difficulties dealing with the Peruvian cargo preference regime in the Peru/Far East trades and is not eager to

[15] GLTL's May 11, 1988 letter to the Commission was filed subsequent to the closing date of March 31, 1988 for the filing of comments in this proceeding. GLTL's comments filed on March 31, 1988, however, stated that a meeting of GLTL and CPV representatives was expected to occur on April 20, 1988 and that GLTL would promptly inform the Commission of the outcome of that meeting. The Commission therefore has accepted the May 11, 1988 letter which supplements GLTL's otherwise timely comments.

be exposed to future harm in its efforts to provide service in the Trade.

Nedlloyd also notes that, based on its experience, the option of obtaining associate status entails costs which distort the economics of a trade and extracts a "price of admission" from the third-flag carrier. Nedlloyd maintains that third-flag carriers should not be required to enter such agreements when there is no economic or commercial basis for doing so. It contends that these agreements have the effect of diminishing efficiency and price competitiveness of transportation providers.

Nedlloyd alleges that conditions unfavorable to shipping in the Trade continue to exist. It contends that Decree 036–82 inherently discriminates against non-Peruvian-flag carriers and favors Peruvian-flag and associate carriers. Nedlloyd submits that there is no reason to believe that this waiver regime will not have an injurious effect on carriers, shippers and the Trade, similar to the "authorization" system under Decree 009–86. Nedlloyd maintains that because it does not wish to become an associate carrier, Decree 036–82 will preclude it from operating in the Trade. It asserts that there should be no doubt that Decree 036–82 is inconsistent with free access to the Trade.

Nedlloyd recommends, therefore, that the Commission act swiftly to reinstate the Final Rule, with appropriate modifications, on the basis that conditions unfavorable to shipping continue to exist.

G. CPV, Neptuno and Santa

The Peruvian carriers allege that conditions have significantly changed in the Trade given the rescission of Decree 009–86. They contend that the decrees in existence prior to Decree 009–86 [16] and now reestablished, have restored the Trade to its prior state which the Commission has allegedly never found objectionable. Under these decrees, the Peruvian carriers state that only 50 percent of Peruvian import and export cargo is reserved to Peruvian-flag and associate carriers.

Further, noting that those parties supporting the Final Rule had argued that Decree 009–86 denied U.S. shippers the right to choose third-flag carriers, the Peruvian carriers assert that as a result of the three commercial agreements between Peruvian and Chilean-flag carriers, shippers will be able to choose Chilean-flag carriers. They also advise that the GOP has created a commission to further improve conditions in the Trade through its review of Peruvian maritime policy.

The Peruvian carriers contend, therefore, that given the changes in GOP law and the commercial agreements between Chilean and Peruvian-flag carriers, whatever basis may have existed for the Final Rule is no longer present. Further, they submit that the Final Rule casts uncertainty over the Trade, threatens diplomatic relations and courts retaliation. The Peruvian carriers submit that, substantially, all concerns expressed by interested parties have been resolved. They believe that whatever residual concerns or uncertainty exist do not justify continuation of the proceeding and it, therefore, should be terminated.

H. The Chamber

The Chamber notes the good faith efforts made by the GOP and USG to address the situation in the Trade through diplomatic means. It mentions that the repeal of Decree 009–86 and the joint service or space charter agreements between Peruvian and Chilean-flag carriers should result in improvements in the Trade and provide U.S. shippers with greater freedom of choice in U.S. trades. Further, the Chamber contends that the recent increase in U.S. exports to Peru could not have been achieved if conditions unfavorable to U.S. shippers existed.

The Chamber, therefore, supports reconsideration of the Final Rule. It believes that the Commission should now find that there is adequate service in the Trade. Further, it believes that the Commission should find that the GOP's rules and regulations permit U.S. shippers freedom to select the carriers of their choice and create conditions which are no more restrictive than those allegedly accepted by the FMC in most other U.S. trades.

The Chamber takes the position that because the conditions which caused the complaints to the FMC have been corrected, given the improvement in third-flag carrier access to the Trade and the good faith efforts by the GOP to accommodate shippers, the Commission should take no further action, but rather carefully monitor conditions in the Trade. Suspension of Peruvian-flag carriers' tariffs by the FMC allegedly would lead to retaliation by the GOP and suspension of the maritime trade. The Chamber submits that this would be extremely damaging to the relations between the two countries and contrary to U.S. economic and political objectives.

I. GSC

GSC submitted a copy of a letter sent to the Honorable Robin Tallon, which requests that the Congressman review the FMC's actions against Peruvian-flag carriers. This letter expresses hopes that the Congressman would support it in stopping any retaliation against Peruvian-flag carriers because such action could affect GSC's ability to operate in the future. GSC explains that it receives a substantial amount of raw materials from Peru because the U.S. does not have the quality of ore required for its process.

GSC advises that the GOP's cargo reservation system has never been a problem for it. GOP allegedly has granted it waivers whenever necessary. In this regard, GSC advises that it recently used an Ecuadorian-flag carrier for shipment of cargo. GSC contends that to restrict the Peruvian-flag vessels which it may employ in the Trade would inflate the cost of its operation.

J. Occidental

Occidental states that it was pleased with the FMC's decision to exclude the U.S./Iquitos, Peru trade from the proposed sanctions in the Final Rule. It maintains that this decision has enabled it to support its operations in that area. Further, Occidental states because it also has operations on the West Coast of Peru, it joins the Chamber in requesting that the Commission reconsider its proposed sanctions against Peru. Finally, Occidental believes that the GOP's repeal of Decree 009–86 and improved access to the Trade for third-flag carriers should allow the FMC to rescind its Final Rule.

K. SPCC

SPCC advises that if the proposed rule [17] was enacted, it would be forced to seek supplies from Europe and the Far East rather than the United States, and that copper bound for the U.S. would have to move through ports in Mexico or Canada prior to delivery in the U.S. SPCC contends that this would cause increased costs and delays.

SPCC opposes the suspension of Peruvian-flag carriers' tariffs. It asserts that the commercial agreements between Peruvian and Chilean-flag carriers address the concerns of the FMC because Chilean-flag carriers will be accorded associate status. SPCC takes the position, therefore, that the problems which brought about Commission action in the Trade no longer exist and that action by the

[16] Decree 012–70–TC of June 1970, 034–70–TC of December 1970, and 036–82–TC of September 1982.

[17] It is assumed that SPCC means the Final Rule.

Commission would be counterproductive.

Discussion

Uncertainty continues to exist as to the precise nature and operating characteristics of the shipping regime which will regulate traffic between the U.S. and Peru following the rescission of Decree No. 009–86 and the reestablishment of Decree 036–82 and other pre-1986 decrees and resolutions. We continue to be concerned about the terms upon which Chilean-flag carriers and other third-flag carriers will be gaining competitive access to the Trade pursuant to "commercial agreements" filed with the Commission. The impact of these agreements will not be known for some time. The comments on the Commission's March Notice reflect a wide range of views regarding third-flag access to the Trade given the reestablishment of the pre-1986 legal regime in Peru, and the commercial agreements filed. At the least, some of the comments call into question whether the agreements are commercially viable or were entered into solely as an accommodation to the GOP's cargo reservation and other decrees.

Nedlloyd is the only commenter that believes that the Commission should swiftly reinstate the Final Rule with necessary modifications, on the basis that conditions unfavorable to shipping continue to exist because third-flag carrier access to the Trade requires associate status or a waiver. While SCOT believes that unfavorable conditions continue to exist, and that the agreement between CSAV and Neptuno does not provide effective competitive access for CSAV, it states that its members will require at least 90 days to evaluate the effects of recent Peruvian actions on the Trade.

We note that the Chilean party to one of these agreements, CSAV, does not affirmatively propose or support any specific course of action, but states that it would not oppose suspension of the Final Rule. However, it suggests that accompanying such action should be a statement from the Commission that the Final Rule could be reimposed if necessary. Thus, it would appear, that CSAV is not particularly sanguine about the agreement it has entered into and which ostensibly will allow it access to the Trade.

While the Executive Agencies appear optimistic with respect to the problem of Chilean-flag carrier access to the Trade, they are not as certain as to the access of other third-flag carriers. They maintain, however, that given the developments in the Trade, sanctions are not warranted at this time.

GLTL suggests that the Commission hold any further action in abeyance until it has completed agreement negotiations with CPV. The prospective agreement between the two carriers would confer associate status on GLTL.

The Chamber, GSC, NAPSA, Occidental and SPCC believe that the problems which gave rise to the Final Rule have been resolved and, thus, oppose any further action by the Commission. The Peruvian carriers specifically request termination of the proceeding.

The pre-1986 legal regime now in place appears to reserve 50 percent, rather than 100 percent, of Peruvian traffic for Peruvian-flag and *associate* carriers. The remaining 50 percent is open to all carriers, including nonassociate carriers. However, under Decree 036–82, a non-associate carrier must obtain a waiver or cargo manifest certification to carry any portion of the unreserved cargo. The manner in which the "50 percent" reservation is to be administered is unclear in light of the requirements for waivers or manifest certifications on *all* non-Peruvian or non-associate shipments. Given the various requirements, it is possible that significant barriers to non-Peruvian-flag and non-associate carrier access to the Trade continue to exist.

The GOP has stated that it is reviewing its maritime policy in general and its waiver system in particular. It is reported that the GOP plans to apply its waiver system in as flexible a manner as possible.

Reinstatement of the Final Rule appears disfavored by all but one of the parties to this proceeding. The only party requesting immediate reinstatement of the Final Rule with appropriate modifications is a third-flag carrier which has not yet attempted to enter the Trade. With this one exception, the parties believe that the Commission should either terminate the proceeding or hold any further action in abeyance until the situation can be assessed. Reinstatement of the Final Rule would not, moreover, allow shippers the opportunity requested to evaluate the impact of the recent GOP actions and the Chilean and Peruvian-flag carrier agreements on the Trade. The parties which throughout this proceeding have urged Commission action to meet unfavorable conditions in the Trade are now requesting more time to evaluate the situation, and in the case of CSAV, stating that it would not formally object to a suspension of the proceeding.

The course of action suggested by SCOT and others, to hold the proceeding in abeyance for a reasonable period, will allow the Commission time to assess the impact of the recent developments in the Trade including the effect of the pre-1986 legal regime on third-flag carrier access to the Trade, the commercial agreements between Peruvian and Chilean-flag carriers, the anticipated agreement between CPV and GLTL and the GOP maritime policy review. This course of action, in one form or another, appears to be favored, or acceptable, to all but one of the commenters.

Conclusion

Although the Commission is anxious to achieve a resolution of the problems affecting the Trade, it does not appear that further Commission action *at this time* would favorably affect events or actions by the GOP which are moving forward, albeit slowly. The comments from shippers and the carriers presently active in the trade reflect a consensus that, as conditions presently exist, Commission action would be premature.

The Commission has already expressed herein its continued concern that impediments to the entry and operation of third-flag carriers on commercially viable terms may continue to exist, at the least as a part of the re-instated waiver and manifest certification system under Decree 036–82. Nevertheless, the practical workings and effects of that Decree are at present unclear to us, particularly in light of the new agreements among major parties in the Trade.

In order to assess the impact of these new factors, the Commission will hold this proceeding in abeyance for a further period of time. We anticipate that the GOP will have taken further action to clarify the status of laws and decrees affecting shipping in the Trade, including completion of the work of the Commision reviewing maritime policy, before the FMC resumes consideration of these matters.

Therefore, pursuant to section 19(1)(b) of the Merchant Marine Act, 1920, 46 U.S.C. app. 876(1)(b), Reorganization Plan No. 7 of 1961, 75 Stat. 870, and 46 CFR Part 585, this proceeding is held in abeyance pending further order of the Commission. Interested parties are invited to submit comments, views and information on or before August 31, 1988, concerning whether the conditions unfavorable to shipping in the U.S.-Peru Trade previously found in this proceeding continue to exist, whether other conditions unfavorable to shipping now exist as a result of actions, laws, decrees or regulations of the Government of Peru or carriers in the Trade, and what actions the

Commission should take to adjust or meet any such conditions unfavorable to shipping.

By the Commission.

Tony P. Kominoth,

Assistant Secretary.

[FR Doc. 88-12796 Filed 6-6-88; 8:45 am]

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INTERSTATE COMMERCE COMMISSION

49 CFR Part 1035

[Ex Parte No. 406]

Electronic Transmission of Freight Bills

AGENCY: Interstate Commerce Commission.

ACTION: Final rule; modification of existing rules.

SUMMARY: The Commission is clarifying its regulations governing rail carrier bills of lading by modifying 49 CFR Part 1035 to *expressly* authorize the use of electronic bills of lading (EBOL). This should eliminate any confusion concerning rail carriers' right to use EBOL.

DATE: This action will be effective June 7, 1988.

ADDRESS: Because the ICC is merely clarifying its existing regulations, prior notice and comment procedures are unnecessary under 5 U.S.C. 553(b)(A). However, the public is welcome to comment on the modified rules by writing to the Office of Proceedings, Deputy Director of Rail Section, Room 2144, Interstate Commerce Commission, Washington, DC 20423.

FOR FURTHER INFORMATION CONTACT: Joseph H. Dettmar, (202) 275-7245. [TDD for hearing impaired: (202) 275-1712.]

SUPPLEMENTARY INFORMATION: To eliminate any possible confusion or doubt that rail carriers may use electronic bills of lading (EBOL), the Commission is modifying its regulations at 49 CFR Part 1035 to authorize expressly the use of EBOL. In *Electronic Transmission of Loss and Damage Claims and Freight Bills*, 365 I.C.C. 581 (1982), *modified at* 367 I.C.C. 699 (1983), the Commission revised 49 CFR Parts 1051, 1008, and 1005 to expressly authorize motor carriers to use EBOL, but did not similarly modify the parallel rail regulation at 49 CFR Part 1035. The Commission explained that it was unnecessary to alter the rail regulation because, absent a clear prohibition against the use of EBOL's, rail carriers were already free to use them. It stated, *Electronic Transmission, supra*, 365 I.C.C. at 585:

> Various parties suggested that railroads * * * should also be included. Particularly, the AAR points out that there are no regulations in effect which either authorize or prohibit using electronic billing by computer and, as a result, many are already doing so.
>
> We agree that there does not appear to be any regulatory impediment to railroads * * * participating in electronic billing. For this reason, we see no need to adopt this suggestion.

Since then, because of the silence in the rail regulations on the use of EBOL, the Commission has received a number of inquiries from persons unsure of the propriety of rail carrier use of EBOL. To eliminate further confusion on this matter, the Commission is now revising its rail regulations at 49 CFR Part 1035, in the manner described in the Appendix hereto, expressly to authorize rail carriers to use EBOL.

The Commission adopts the revision to its rules set forth below, effective immediately.

Prior notice and public comment are unnecessary because this is merely a clarifying procedural change which preserves the *status quo* and has no substantial impact on the industry or the public. No person's legal obligations are affected by this action.

This action does not affect significantly the quality of the human environment or the conservation of energy resources.

List of Subjects in 49 CFR Part 1035

Maritime carriers, Railroads.

This action is taken under the authority of 49 U.S.C. 10321 and 5 U.S.C. 553.

Decided: May 27, 1988.

By the Commission, Chairman Gradison, Vice Chairman Andre, Commissioners Sterrett, Simmons, and Lamboley.

Noreta R. McGee,

Secretary.

Title 49, Part 1035 of the Code of Federal Regulations is amended as follows:

PART 1035—BILLS OF LADING

1. The authority citation for Part 1035 is revised to read:

Authority: 49 U.S.C. 10321 and 5 U.S.C. 553.

2. Section 1035.1 is amended by designating the existing two paragraphs as (b) and (c) and adding a new paragraph (a) to read as follows:

§ 1035.1 Requirement for certain forms of bills of lading.

(a) All bills of lading referred to in this Part may be either paper documents or electronically generated and/or transmitted bills of lading.

* * * * *

[FR Doc. 88-12754 Filed 6-6-88; 8:45 am]

BILLING CODE 7035-01-M

49 CFR Parts 1104 and 1115

[Ex Parte No. 475]

Designation of Office To Receive Petitions for Review of Agency Orders

AGENCY: Interstate Commerce Commission.

ACTION: Final rule.

SUMMARY: This rule designates the official who must be served with petitions for judicial review under 28 U.S.C. 2112(a), as amended by Pub. L. 100-236, 10 Stat. 1731 (1988). The Commission designates its General Counsel.

EFFECTIVE DATE: July 6, 1988.

FOR FURTHER INFORMATION CONTACT: Robert S. Burk, General Counsel, Interstate Commerce Commission, Washington, DC 20423, (202) 275-7312.

SUPPLEMENTARY INFORMATION: On January 8, 1988, Congress enacted Pub. L. 100-236, 101 Stat. 1731 (1988), which amends 28 U.S.C. 2112(a) governing the selection of the appropriate court when petitions for judicial review of agency orders are filed in more than one court of appeals. The amendments to 28 U.S.C. 2112(a) are intended to replace, in part, the "first-to-file" rule, and the resulting "race to the courthouse" when agency orders are issued. S. Rep. No. 263, 100th Cong., 1st Sess. 1, *reprinted in* 1988 U.S. Code Cong. & Admin. News 3198. The amendments take effect on July 6, 1988, 180 days after the date of enactment. Pub. L. 100-236, sec. 3, 101 Stat. 1731, 1732 (1988).

As amended, 28 U.S.C. 2112(a)(2) requires each agency to designate by rule the office and the officer who must receive petitions for review. The Commission designates the Office of General Counsel and the General Counsel and amends its Rules of Practice at 49 CFR 1104.1(a) and 49 CFR 1115.7 to reflect those designations.

Because this amendment to the Commission's Rules of Practice has no effect on the substantive rights of parties and is a procedure specifically required by statute, an opportunity for comment in advance is not necessary under 5 U.S.C. 553(b)(A) and the new rule may take effect on less than 30 days' notice under 5 U.S.C. 553(d)(3).

Environmental and Energy Considerations

The Commission certifies that this rule will not affect significantly the quality of the human environment or the conservation of energy resources.

List of Subjects

49 CFR Part 1104

Administrative practice and procedure.

49 CFR Part 1115

Administrative practice and procedure.

Decided: May 27, 1988.

By the Commission, Chairman Gradison, Vice Chairman Andre, Commissioners Sterrett, Simmons, and Lamboley.

Noreta R. McGee,

Secretary.

Title 49 of Parts 1104 and 1115 of the Code of Federal Regulations is amended as follows:

PART 1104—PLEADINGS, GENERALLY

1. The authority citation for 49 CFR Part 1104 continues to read:

Authority: 49 U.S.C. 10321; 5 U.S.C. 559.

2. Part 1104 is amended by revising § 1104.1(a) to read as follows:

§ 1104.1 Address and identification.

(a) Except as provided in § 1115.7, pleadings should be addressed to the "Secretary, Interstate Commerce Commission, Washington, DC 20423," and should designate the docket number and title of the proceeding, if known.

* * * * *

PART 1115—APPELLATE PROCEDURES

1. The authority citation for 49 CFR Part 1115 continues to read:

Authority: 49 U.S.C. 10321, 10322, and 10377; 5 U.S.C. 559.

2. Part 1115 is amended by adding § 1115.7, which shall read as follows:

§ 1115.7 Petitions for judicial review; mailing address.

Petitions for judicial review of final agency orders may be served on the Commission pursuant to 28 U.S.C. 2112(a) and be addressed to "General Counsel, Office of the General Counsel, Interstate Commerce Commission, Washington, DC 20423."

[FR Doc. 88-12755 Filed 6-6-88; 8:45 am]

BILLING CODE 7035-01-M

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 652

[Docket No. 70617-7239]

Atlantic Surf Clam and Ocean Quahog Fisheries

AGENCY: National Marine Fisheries Service (NMFS), NOAA, Commerce.

ACTION: Notice of area opening.

SUMMARY: NOAA issues this final notice to open the currently closed surf clam areas located offshore of Atlantic City, New Jersey, and Ocean City, Maryland, for harvesting. This action is taken because the majority of the surf clams located in these areas have attained the current legal minimum size of 5 inches. The intended effect is to allow the harvest of surf clams which have been protected and allowed to grow to produce greater yields.

EFFECTIVE DATE: July 3, 1988.

FOR FURTHER INFORMATION CONTACT: John G. Terrill, Surf Clam/Ocean Quahog Plan Coordinator, 617-281-3600, ext. 252.

SUPPLEMENTARY INFORMATION: The Fishery Management Plan for the Atlantic Surf Clam and Ocean Quahog Fisheries (FMP) is implemented by regulations appearing at 50 CFR Part 652. At meetings held in November 1986 and January 1987, the Mid-Atlantic Fishery Management Council (Council), requested that the Secretary of Commerce reopen the three closed areas designated as Atlantic City, Chincoteague, and Ocean City, with the exception that the Chincoteague, Virginia, closed area would be reopened to allow thinning of the surf clam beds, except for a 9-square-mile research area which would remain closed.

As required by § 652.23, the Secretary published notice of this proposed action (52 FR 4020, February 9, 1987) and requested comments on opening the three currently closed areas. Public hearings were held on February 13 and 14, 1987, at locations in New Jersey and Maryland. Comments favored opening each of the three areas, with consensus that all three areas should be opened at the same time and that the opening should not occur until after November 1987.

Before this action could be taken, a regulatory amendment was needed to make the surf clam size criteria for reopening areas consistent with the prevailing legal minimum surf clam size. Amendment 3 to the FMP specified that areas could be reopened once the average length of the dominant size class in the area to be reopened reached 5½ inches or greater. Amendment 5 to the FMP provided a mechanism for adjusting the legal minimum size within a range of 4¾ to 5½ inches. Under the provisions of Amendment 5, a notice was published (50 FR 46671, November 12, 1985) reducing the legal minimum surf clam size to 5 inches, with opportunity for public comment until December 31, 1985. After considering comments, and with the aim of reducing wasteful discards, the 5-inch minimum legal size limit was confirmed (51 FR 8326, March 11, 1986) and currently prevails.

A regulatory amendment (53 FR 4630, February 17, 1988) modified the closed area criteria by specifying that instead of 5½ inches, an area could be reopened if the average length of the dominant size class in that area was equal to or greater than the prevailing legal minimum size. A 1986 stock survey the (most recent survey) performed under contract by Rutgers University determined that the mean length for surf clams in the Ocean City area was 4.9 inches with a 0.32-inch standard deviation and the mean length in the Atlantic City area was 5.3 inches with a 0.48-inch standard deviation.

At the April 1988 Council meeting, the Council reconsidered the motion recommending that the Chincoteague area be reopened. The sentiment was that while there is justification for opening the area, there is a potential for a high discard of small clams with a resultant high mortality. An opinion was expressed that under the current method of effort control, vessel operators could not be selective on which beds to work and harvesting would be done with the intent to achieve the maximum yield in the least amount of time. The Council voted to wait to open the Chincoteague area until implementation of Amendment 8 to the FMP, at which time harvesters would be allowed to be more selective.

Areas

The areas reopened by this notice are defined as follows:

Atlantic City Closed Area—located between 3 and 9½ nautical miles offshore of Atlantic City, New Jersey. Part of the area was reopened in 1982.

Area currently closed:

Latitude	*Longitude*
39°15.5' N.	74°30.0' W.
39°28.5' N.	74°14.15' W.
39°27.2' N.	74°05.7' W.
39°17.62' N.	74°14.3' W.
39°11.6' N.	74°23.5' W.

Area reopened in 1982:

Latitude	*Longitude*
39°12.4' N.	74°22.3' W.
39°29.33' N.	74°22.37' W.
39°18.35' N.	74°13.6' W.
39°17.6' N.	74°14.3' W.

Ocean City Closed Area—located between 6 and 10 nautical miles offshore of Ocean City, Maryland.

Area currently closed:

Latitude	*Longitude*
38°17.0' N.	74°57.0' W.
38°20.5' N.	74°51.0' W.
38°19.0' N.	74°48.5' W.
38°12.5' N.	74°51.0' W.

Opening Date

In order to allow for sufficient notification and equitable access to the areas to be reopened, the opening date will be July 3, 1988, which is the first day of the third quarter.

Effort Control/Monitoring

Under § 652.23(b)(3), "the Secretary will control the harvest of surf clams from reopened areas separate from the management of the general fishery until the catch per unit of effort in the reopened area is comparable to the average catch per unit of effort in the general fishery." To achieve this goal, vessels operating in the two reopened areas will be limited to one trip of six hours' duration per quarter for each of the areas. These trips will be included among the regularly scheduled trips allotted for the third quarter.

Trips to be taken in the reopened areas must be indicated on the Letter of Authorization by writing either "Atlantic City" or "Ocean City" immediately following the scheduled trip day.

Written notification to NMFS must include this designation when scheduling trips for the third and subsequent quarters. Additionally, vessels working the reopened areas will be required to indicate in the "Area Fished" column of the vessel Fishing Trip Record (Shellfish) (NOAA Form 88-140) the name of the reopened area as well as the loran bearings of latitude/longitude coordinates.

Other Matters

This action is taken under the authority of 50 CFR Part 652 and is taken in compliance with Executive Order 12291.

(16 U.S.C. 1801 *et seq.*)

List of Subjects in 50 CFR Part 652

Fisheries.

Dated: June 2, 1988.

Richard H. Schaefer,

Director, Fisheries Conservation and Management, National Marine Fisheries Service.

[FR Doc. 88-12802 Filed 6-6-88; 8:45 am]

BILLING CODE 3510-22-M

Proposed Rules

Federal Register
Vol. 53, No. 109
Tuesday, June 7, 1988

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

Public Workshop for NRC Rulemaking on Maintenance of Nuclear Power Plants

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice of workshop.

SUMMARY: On March 23, 1988, the Commission published a final Policy Statement on Maintenance of Nuclear Power Plants. In the Policy Statement, the Commission stated it expected to publish a Notice of Proposed Rulemaking in the near future, and has directed the staff to develop such a Notice of Proposed Rulemaking. In order to solicit information and comment from the public and regulated industry early in the formulation of the proposed rule, NRC plans to conduct a workshop.

DATES: July 11–13, 1988.

ADDRESS: The Mayflower Hotel, 1127 Connecticut Avenue NW, Washington, DC 20036.

FOR FURTHER INFORMATION CONTACT: Moni Dey, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555. Telephone (301) 492–3730.

SUPPLEMENTARY INFORMATION: The following is the agenda for the workshop.

Day 1: General Session (9 am–5 pm).

1. Introduction and opening remarks by the Workshop Chairman.
2. Remarks by NRC Commissioner.
3. NRC Approach, Schedule and Options for Maintenance Rulemaking.
4. Presentations by the Public and Industry.

Statements and comments by the public and industry on items pertaining to the rulemaking are requested. These may be of a general or specific nature.

The following are specific questions and topics which are of interest and which the NRC desires to have input on:

—What approach should NRC take in developing a rulemaking on maintenance:

- Prescriptive?
- General Goals?
- Standardize Maintenance Practices?
- Performance Indicators?

–How should the rule address the various maintenance activities listed in the Policy Statement?

—What defines a good maintenance program?

- What industry standards are available for defining an effective maintenance program,
- How should the effectiveness of a maintenance program be measured/monitored?

Presentors are also welcome to address other areas related to the maintenance rulemaking.

5. Question/Answer Period.

Day 2: Working Group Sessions (9 am–5 pm).

The activities listed in the Commission Policy Statement on Maintenance of Nuclear Power Plants have been grouped into four major areas. There will be parallel sessions of four Working Groups in each of these areas to discuss how they could be addressed in a rule, regulatory guide and/or industry standard.

Working Group A: *Maintenance Technology*
(1) Corrective maintenance
(2) Preventive maintenance
(3) Predictive maintenance
(4) Surveillance
(5) Post-maintenance testing
(6) Others

Working Group B: *Maintenance Management, Planning, and Organization*
(1) Procedures
(2) Planning
(3) Scheduling
(4) Staffing
(5) Shift coverage
(6) Allocation of resources
(7) Personnel qualification and training
(8) Record keeping
(9) Management of contract maintenance services
(10) Management of spare parts, tools, facilities, and equipment qualifications
(11) QA/QC
(12) ALARA considerations (occupational exposures)
(13) Reporting requirements
(14) Others

Working Group C: Maintenance Monitoring, Assessment, and Effectiveness
(1) Equipment history and trending
(2) Surveillance
(3) Predictive maintenance
(4) Information feed-back loop
(5) Measures of overall maintenance program effectiveness
(6) Effective communications structure
(7) Industry/NRC data base
(8) Others

Working Group D: Effective Organizational Communications
(1) Communications between maintenance and: (a) Operations; (b) Corporate; (c) Corporate engineering and design.
(2) Incorporation of vendor maintenance recommendations
(3) Engineering support and modifications (e.g., cooperation, coordination, and support between maintenance group and the engineering/design group)
(4) Interface and communications with contract maintenance services

Note:

All four working groups would be asked to focus on the following objectives:

(1) Discuss the important issues for an effective maintenance program and the approach for addressing these issues in rulemaking,

(2) Provide information regarding acceptable ways to adequately address these issues and acceptance criteria that could be included in a rule, regulatory guide or industry standard,

(3) Provide information regarding industry's initiatives as they relate to each one of these issues and areas,

(4) Prepare a brief report summarizing highlights of their discussion (to be prepared by the working group chairman).

Each working group will be asked to address a specific set of questions related to its topic area.

Day 3: Final Session (9 am–12 noon).

1. Highlights of Working Group A: Working Group A Chairman.
2. Highlights of Working Group B: Working Group B Chairman.
3. Highlights of Working Group C: Working Group C Chairman.
4. Highlights of Working Group D: Working Group D Chairman.

5. General Comment Period.

6. Concluding remarks by Workshop Chairman.

Those members of the public who wish to attend the workshop should notify the contact listed above. In addition, those members of the public who wish to make a presentation on Day 1, or who wish to be a member of any of the Working Groups on Day 2 of the Workshop should indicate their preference to the contact listed above so that they can be added to the agenda. Early notification is recommended since requests will be processed as they are received.

Dated in Rockville, Maryland, this 1st day of June, 1988.

For the Nuclear Regulatory Commission.

Moni Dey,

Task Manager, Advanced Reactors & Generic Issues Branch, Division of Regulatory Applications, Office of Nuclear Regulatory Research.

[FR Doc. 88-12784 Filed 6-6-88; 8:45 am]

BILLING CODE 7590-01-M

SMALL BUSINESS ADMINISTRATION

13 CFR Part 121

Size Standard for Export Trading Companies and Export Management Companies

AGENCY: Small Business Administration (SBA).

ACTION: Proposed rule.

SUMMARY: SBA is proposing to establish a size standard of $10 million for "Export Trading Companies and Export Management Companies (ETCs/EMCs/)." Currently, SBA has no small business definition for such firms. Because of the increased interest in exporting and the uniqueness of these types of firms, SBA wishes to establish a size standard to clarify the size status of ETCs/EMCs. The intent of this rule is to determine which firms would be eligible for SBA's financial assistance and other programs.

DATE: Comments must be submitted on or before August 8, 1988.

ADDRESS: SEND ALL COMMENTS TO: Gary M. Jackson, Director, Size Standards Staff, U.S. Small Business Administration, 1441 L Street, NW., Room 601, Washington, DC 20416.

FOR FURTHER INFORMATION CONTACT:

Robert N. Ray, Economist, Size Standards Staff, (202) 653-6373;

Sheryl J. Swed, Director, Office of International Trade, (202) 653-7794.

SUPPLEMENTARY INFORMATION: Since the enactment of the "Export Trading Company Act" in 1982, Pub. L. 97-270, there has been interest in the formation of such companies. SBA has attempted to encourage exporting by small businesses, including but not limited to, ETCs/EMCs, through a variety of programs, such as:

- Export Revolving Lines of Credit to guarantee loans made by private lenders of up to $500,000, and in conjunction with the Export-Import Bank, of loans up to $1,000,000.
- Other regular business loans of up to $500,000 through the SBA's 7(a) Loan Guarantee Program.
- Business Development assistance tailored to meet the needs of exporters through counseling by volunteers (SCORE/ACE), Small Business Institutes, or Small Business Development Centers.
- Legal consultation including free initial consultations provided through an agreement between the Federal Bar Association's International Law Council and SBA.
- Export training, international trade missions, publications, and other services provided by SBA.

This assistance is not limited to firms formally organized or certified as ETCs under the "Export Trading Company Act" of 1982. It applies to any small firm which exports or intends to export. For purposes of this rule, the terms "EMC and ETC" are used interchangeably.

ETCs usually purchase goods from a manufacturer, take title, and sell abroad. Some, however, do not take title, but work on a commission and/or fee basis. ETCs act as the export arm for small and medium sized manufacturers. Such manufacturers are generally too small to set up their own export activities and look to ETCs to market their products abroad. Thus, ETCs can also act as intermediaries to facilitate the exports of small business. It is for this reason that SBA is interested in fostering ETCs and in developing a size standard for these types of businesses.

While export trading incorporates elements of both wholesaling and certain business services, like market research, product design, insurance, freight forwarding, etc. SBA believes it is sufficiently unique, and other possible size standards so inappropriate, that the ETC/EMC activity warrants its own size standard. Compared to conventional domestic wholesalers, ETCs perform many functions beyond wholesaling, yet typically do not handle the volumes of most wholesalers. They also provide more than export-related business services in that they often take title to goods and provide storage facilities. Thus the uniqueness of this activity and the special attention accorded it under the "Export Trading Company Act" lead SBA to propose a size standard for this activity.

When researching an industry for size standards purposes, SBA relies on generally accepted published statistical sources such the Census Bureau, Internal Revenue Service, SBA's Small Business Data Base, and similar sources for a description of the economic structure of the industry. Because ETCs do not comprise an industry in the sense of being recognized in the "Standard Industrial Classification Manual," the typical statistical sources do not collect data on the structure of this activity. Normally, data on the number of firms, average firm size by sales and employees, distribution and range of firm sizes, and primary line of business are essential in formulating a size standard (see 13 CFR 121.1).

As a substitute for these data, SBA has obtained information from secondary sources. These include: A 1980 survey by the National Association of Export Companies (NEXCO), a trade group; a survey conducted in 1983 by Coopers and Lybrand, an accounting firm; and "The Export Company Guidebook" on ETCs prepared in 1984 by Price Waterhouse and the Council for Export Trading Companies for the Commerce Department's International Trade Administration.

First, the NEXCO survey obtained results from 92 firms out of 134 NEXCO members. NEXCO found that the average volume of export sales ranged from $8 million to $17 million per firm with the $5-10 million size category, containing 19 firms, as the mode.

TABLE 1.—1980 EXPORT SALES VOLUME [1]

[By percentage of 90 NEXCO respondents; dollars in millions]

[1] Firm size	$1 or less	$1-3	$3-5	$5-10	$10-20	$20-50	Over $50
Percent	8.7	19.5	13.0	20.7	18.5	14.1	5.5

[1] "A Profile of the Export Trading Company Industry," NEXCO, New York, July 1981 Table 6, p. 11

Second, Coopers and Lybrand (C&L) composed a similar table based on 201 respondents out of 1178 which received surveys.

C&L's survey was broader in that it attempted to query all identifiable ETCs. Because NEXCO's "members represent many of the largest ETCs operating in the United States," [1] its data are biased upward. Due to larger sample size and more recent results, the C&L survey is probably more reliable. It shows that firms are smaller than NEXCO found (even with 13 percent inflation in the intervening years [2], and that the mode is lower than the $1 million size category. C&L's average firm size range is $4 million to $11 million.

[1] NEXCO, op. cit., p. 11.

[2] "Economic Report of the President, 1985," Implicit price deflators for GNP for exports, Table B-3, p. 237

TABLE 2.—PERCENT OF ETC'S BY FIRM SIZE CATEGORIES [1]

[By percent of firms; dollars in millions, annual revenues]

Firm sizes	$0-1	$1-2	$2-5	$5-10	$10-50	Over $50
Percent of firms	27	19	23	13	15	2
percent of revenues	2	3	9	11	48	28

[1] "Export Management Companies," R. Spiewak and K. Maritz, Coopers & Lybrand, Washington, D.C., June 1984, Table 2, p.7, Percent of Revenues, SBA estimate.

C&L also obtained results on firm size by employees. Average employment was between 8 and 15 employees. One-third of the firms had four or fewer employees, the model size category. Average sales per employee is estimated at $600,000, (1983 dollars).[3]

According to the C&L study, 25 percent of ETCs revenues are accounted for by firms in the under $10 million sales size category. Typically, an ETC of $10 million in sales would have one foreign office, staffed by no more than four employees, in addition to one domestic office; and above $10 million in annual sales, the firm would add a second foreign office.

[3] Separately, the U.S. Dept. of Commerce estimated per employee sales volume of $400,000 to $850,000 per year. "The Export Company Guidebook", March 1984, p. 34.

TABLE 3.—PERCENT OF EMPLOYEES EMPLOYED BY ETC'S OF VARIOUS FIRM SIZES [1]

Firm size	1-4	5-9	10-24	25-49	/Over 50
Percent of employees	37	29	22	6	/6

[1] Coopers & Lybrand, op. cit., Table 3, p. 8.

Third, the Price Waterhouse/Council for "Export Trading Companies Guidebook" was published by the U.S. Department of Commerce (DoC) in 1984. The Guidebook identifies three categories of ETC's by size of trading volume; these are:

- Major trading entities, typically *Fortune* 1,000 companies such as Sears World Trade, Inc., General Electric Trading Company, and others.
- Moderately sized "free standing" trading entities. There are a small number of these which each export about $50 million to $80 million per year.
- Small export trading companies of which there are an estimated 2,000 such firms. At $6.5 million in volume, an ETC becomes "viable * * * in terms of manpower and potential trading flexibility," the Guidebook states. Employees would number 10 to 15 persons at this level of trading volume. These small ETCs average $3 million in annual volume; this is too low to achieve the minimum threshold for viability, the Guidebook explains.

This last category is of most interest for size standards purposes. Using the range of sales per employee for ETCs from the guidebook—$400,000 to $850,000 per year—and the minimum viable size of 10 to 15 employees described above, yields a range of ETC sizes of $4 million to $8.5 million for a 10-employee ETC and $6 million to $12.8 million for a 15-employee ETC. These size firms may be considered minimum viable sizes with the range of sales, $4 million to $12.8 million, reflecting the different types of goods and services which would be exported.[4]

Because of the lack of regular economic statistics, SBA in advance of this proposed rule contacted ETC trade groups and others to obtain a better picture of the industry.[5] SBA was interested especially in three factors—the number of ETCs, the unit of measurement of firm size, and an opinion of what the size standard should be. First, there seems to be general agreement that there are about 1300 ETCs with estimates ranging from 1200 to 1500 firms.

Second, SBA attempted, through contracting various sources and attending conferences on export trading companies, to solicit opinions as to the measurement and appropriate level of firm size. Most sources favored using sales dollars, although employees and profits were also mentioned. Occasionally, sources recommended specific size standards. Two recommended $10 million, one $25 million, and one $100 million.

Based on the above information, SBA is proposing to establish a size standard of $10 million. This level is being proposed because it is within the range of viable firm size for an ETC as discussed in the DoC's Guidebook, and because it reflects those sizes of firms discovered in the NEXCO and Coopers & Lybrand surveys.

Because not all ETCs take title to the goods exported, in computing annual receipts of the firm, SBA will also include revenues from other sources including commissions and fees. For Example, if an ETC sold $4 million of goods for which it has title, received $800,000 in brokerage commissions and $200,000 in consulting fees, then its receipts would be $5 million.

SBA's definition of export trading or export management company is proposed to draw on the "Export Trading Company Act" of 1982 (15 USCS & 4002(a) (3) & (4)). The definition proposed here differs from the Act in that non-profit firms are not included, and the term "primarily engaged" is added to conform to similar SBA regulations for financial assistance. While not made explicit in the ETCs definition, when applying for financial assistance, ETC must conform to the normal SBA finance regulations (13 CFR Part 120). This means, for example, that a firm primarily engaged in export financing or currency dealing would not be eligible for financial assistance. If these activities, however, were merely incidental to general exporting, then the applicant would be eligible under the financial assistance regulations.

For lack of a specific size standard for ETCs, SBA had been using the size standard for wholesale trade, 500 employees, since changed to 100 employees as of August 11, 1986. The impact of this rule would be to change the effective size standard from 100 employees to $10 million in receipts. This would reduce the number of ETCs regarded as small business. However, since SBA estimates there are 225 ETCs between the presently used size standard of 100 employees and the proposed one of $10 million,[6] and typically only a small percent of firms out of any population are likely to use SBA assistance, the impact is not expected to be great. For example, the number of export revolving line of credit loans has averaged 20 per year for the past 4 years.

Other Federal agencies which have small business export assistance include the Overseas Private Investment Corporation. Since this corporation, however, has elected not to use the SBA's size standards, the proposed change if finalized, would not be the cause of any impact.

Another agency is the Export-Import Bank which does use the SBA's size standards for its export credit program. This program is primarily used to facilitate the export of U.S. manufactured products. As such even if an ETC is involved in the transaction, the size standard applied by the bank is the one for the manufacturer, not the ETC. Since ExIm's small business credit (64 loans and $23 million in credit for FY 1985) goes almost entirely to manufacturers, a change in the ETC size standard would have little impact.

Therefore, SBA certifies that this regulation, if made final, will not have a significant economic impact on a substantial number of small entities within the meaning of the Regulatory Flexibility Act, 5 U.S.C. 601 *et sequitur*.

SBA also certifies that this regulation is a nonmajor rule as defined by Executive Order No. 12291, in that it is not expected to have an impact of over $100 million per year. The amount of SBA assistance available for ETCs is far less than $100 million. In addition, this

[4] For example, an ETC dealing in medical equipment may have fewer sales per employee than one dealing in sporting goods, which are a mass-market product.

[5] Some of the sources questioned were the Council on Export Trading Companies, Washington, DC; Overseas Sales and Marketing Assn., Chicago; American Export/Import Assn., New York; National Assn. of Export Companies, New York; Coopers & Lybrand, Washington, DC; U.S. Dept. of Commerce, Office of Export Trading Companies, Washington, DC.

[6] Estimated by assuming 1500 total ETCs' From Table 2, using 15% of firms between $10 million and $50 million sales, the approximate equivalent of 100 employees, yields 225 firms.

regulation is not likely to result in a major increase in costs or prices, or have a significant adverse impact on the U.S. economy.

SBA also certifies that this regulation contains no reporting or recordkeeping requirements subject to the Paperwork Reduction Act, 44 U.S.C., Chapter 35. This rule defines the maximum size firm in the industry which may be eligible for SBA assistance. The legal basis for the proposal is sections 3(a) and 5(b) of the Small Business Act, 15 U.S.C. 632(a) and 634(b). There are no Federal rules which duplicate, overlap, or conflict with the proposed rule.

List of Subjects in 13 CFR Part 121

Administrative practice and procedure, Government procurement, Government property, Grant Programs business, Loan programs-business, Reporting and recordkeeping requirements, Small Business.

Accordingly, SBA proposes to amend Part 121 of 13 CFR as follows:

PART 121—[AMENDED]

1. The authority citation for Part 121 of 13 CFR would continue to read as follows:

Authority: Secs. 3(a) and 5(b)(6) of the Small Business Act, as amended, 15 U.S.C. 632(a) and 634(b)(6).

2. Paragraph (i) would be added to § 121.4 to read as follows:

§ 121.4 Small business for financial programs.

* * * * *

(i) For purposes of financial assistance or other assistance, an "export trading company" is a small business if it has average annual receipts not exceeding $10 million for its preceding 3 fiscal years.

(1) For purposes of these regulations, the term "export trading company" means a person, partnership, corporation, association, or similar organization, operated for profit, which does business under the laws of the United States or any State, and which is organized for and primarily engaged in:

(i) Exporting goods or services produced in the United States, or

(ii) Facilitating the exportation of goods or services produced in the United States by providing one or more export trade services.

(2) An export trading company includes for all purposes under these regulations an export management company. To be an export trading company under these regulations, a firm need not qualify as an trading company under the "Export Trading Company Act" of 1982, Pub. L. 97-270.

(3) The term "Export Trade Services" as used in this part, includes but is not limited to, consulting, international market research, advertising, marketing, insurance, product research design, legal assistance, and transportation, including trade documentation and freight forwarding, communication and processing of foreign orders to and for exporters and foreign purchasers, warehousing, foreign exchange, financing and taking title to goods when provided in order to facilitate the export of goods or services produced in the United States.

(4) A small export trading company as defined herein is not eligible for SBA's financial assistance if it is otherwise ineligible under § 120.101-2 of these regulations governing types of business eligible for financial assistance.

James Abdnor,

Administrator, U.S. Small Business Administration.

Date: May 25, 1988.

[FR Doc. 88-12501 Filed 6-6-88; 8:45 am]

BILLING CODE 8025-01-M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21 and 23

[Docket No. 057CE, Notice No. 23-ACE-42]

Special Conditions; Gyroflug Model SC-01 Speed Canard

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed special conditions.

SUMMARY: This notice proposes special conditions for the Gyroflug Ingenieurgesellschaft mbH Model SC-01 Speed Canard airplane. The Gyroflug Model SC-01 will have novel or unusual design features when compared to the state of technology envisaged in the airworthiness standards of Part 23 of the Federal Aviation Regulations (FAR). These novel and unusual design features include the aerodynamic configuration of the airplane, the location of the engine and propeller, and the use of composite materials for primary flight structure, for which the regulations do not contain adequate or appropriate airworthiness standards. This notice contains the additional safety standards which the Administrator considers necessary to establish a level of safety equivalent to that provided by the airworthiness standards of Part 23.

DATE: Comments must be received on or before October 5, 1988.

ADDRESS: Comments on this proposal may be mailed in duplicate to: Federal Aviation Administration, Office of the Regional Counsel, ACE-7, Attention: Rules Docket Clerk, Docket No. 057CE, Room No. 1558, 601 East 12th Street, Kansas City, Missouri 64106. All comments must be marked: Docket No. 057CE. Comments may be inspected in the Rules Docket weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Bobby W. Sexton, Aerospace Engineer, Standards Office (ACE-110), Aircraft Certification Division, Central Region, Federal Aviation Administration, Room 1656, 601 East 12th Street, Federal Office Building, Kansas City, Missouri 64106; telephone (816) 426-5688.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of these special conditions by submitting such written data, views, or arguments as they may desire. Communications should identify the regulatory docket or notice number and be submitted in duplicate to the address specified above. All communications received on or before the closing date for comments specified above will be considered by the Administrator before taking further rulemaking action on this proposal. Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a self-addressed, stamped postcard on which the following statement is made: "Comments to Docket No. 057CE." The postcard will be date stamped and returned to the commenter. The proposals contained in this notice may be changed in light of the comments received. All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested parties. A report summarizing each substantive public contact with FAA personnel concerned with this rulemaking will be filed in the docket.

Type Certification Basis

The type certification basis for the Gyroflug Model SC-01 airplane is as follows: Part 21 of the Federal Aviation Regulations (FAR), § 21.29; Part 23 of the FAR, effective January 9, 1965, including amendments 23-1 through 23-25; Part 36 of the FAR, effective December 1, 1969, as amended by amendments 36-1 through the amendment effective on the date of type certification; exemptions, if any; and the special conditions that may result from this proposal.

Background

On January 27, 1984, Gyroflug Ingenieurgesellschaft mbH, Flughafen, 7570 Baden-Baden Oos, West Germany, filed an application to the FAA Brussel's Office for U.S. type certification for its Model SC–01 Speed Canard airplane. The Gyroflug Model SC–01 is a small, two-place, composite structure, canard configuration airplane with a pusher propulsion system. It is powered by a 116-horsepower Avco Lycoming 0–235–P2A reciprocating engine and the airplane has a maximum takeoff weight of 1,500 pounds. The airplane received German type certification on September 30, 1983.

Special conditions may be issued and amended, as necessary, as part of the type certification basis if the Administrator finds that the airworthiness standards designated in accordance with § 21.17(a)(1) do not contain adequate or appropriate safety standards because of novel or unusual design features of an airplane. Special conditions, as appropriate, are issued in accordance with § 11.49, after public notice as required by §§ 11.28 and 11.29(b), effective October 14, 1980, and will become part of the type certification basis, as provided by § 21.17(a)(2).

The proposed type design of the Model SC–01 airplane contains a number of novel or unusual design features not envisaged by the applicable Part 23 airworthiness standards. Special conditions are considered necessary because the airworthiness standards of Part 23 do not contain adequate or appropriate safety standards for the novel or unusual design features of the Model SC–01 airplane.

The Model SC–01 airframe is made of composite material and is assembled by the extensive use of bonding. This material and its assembly is completely different from the typical semi-monocoque aluminum airframes that have been predominant since the early 1940's. Composite materials of the type used on the Model SC–01 airplane are generally not susceptible to initiation of fatigue cracks by the application of repetitive loads, but are susceptible to damage in the form of cracks, breaks, and delaminations from intrinsic and discrete sources growing under application of repetitive loads. Because of this and other factors, the FAA has determined that the wing fatigue requirements of § 23.572 are inadequate to assure that composite material structure can withstand the repeated loads of variable magnitude expected in service.

The use of composite materials and extensive bonding of these materials in primary flight structure is a novel and unusual design feature with respect to the type of airplane construction envisaged by the existing airworthiness standards of Part 23. Because the requirements of Part 23 do not require the level of subsidiaries necessary for composite material structure, a special condition is proposed to include the necessary airworthiness standards as a part of the type certification basis for the Model SC–01 airplane. This special condition is proposed to assure that a level of safety exists for airplanes made from bonded composite materials equivalent to those existing for aluminum airplanes.

The proposed special condition will require the wings and other composite structural components critical to safe flight be evaluated by damage tolerance criteria. The damage consideration includes principal structural elements, such as the wing, wing carry-through, wing attaching structure, fuselage, and the vertical and horizontal stabilizers and their carry-through structures, since failure of these structures could have catastrophic results. When damage tolerance is shown to be impractical, the proposed special condition is worded to permit approval, based on safe-life testing. Metal details may continue to be evaluated to the fatigue requirements of § 23.572.

Damage tolerance criteria for composite structure, in combination with the existing material requirements of Part 23, such as §§ 23.603 and 23.613, will provide a level of safety for the composite material airframe structure used in the Model SC–01 airplane equivalent to that required by the airworthiness standards of Part 23.

In addition to those components requiring fatigue/damage tolerance evaluations, other components that are critical to flight safety, such as moveable control surfaces and wing flaps, must also be protected against loss of strength or stiffness. Protection conventionally is provided through design and inspection. Since composite material strength is susceptible to manufacturing defects and damage from discrete sources, including lightning strikes, process controls and inspectability are limited; therefore, structures design must provide for these limits with adequate protection allowances.

The lack of adequate service experience with composite material structures in airplanes type certificated to the airworthiness standards of Part 23, the unusual mechanical properties characteristics, and the experience with composite material structural bonding, to date, necessitate proposing special conditions to assure an appropriate level of safety for the Model SC–01 airframe structure. These proposed special conditions are intended to require: (1) Accounting for environmental effects; i.e., temperature and humidity on material mechanical properties in all structural substantiation analyses and tests, (2) limit load residual strength with impact damage from discrete sources; (3) ability to carry ultimate load with realistic intrinsic and discrete impact damage at the threshold of detectability, and (4) design features to prevent disbonds greater than the disbonds for which limit load capability has been shown. Proof-testing of each production component to limit load and reliance on manufacturing quality control procedures between limit and ultimate load may be used in lieu of "design features," provided each bonded is subjected to its critical design limit load during the proof testing. Acceptable non-destructive testing techniques do not yet exist in state-of-the-art composite technology to reliably identify weak bonds. However, proof-testing of each production article may be discontinued if such tests are developed and accepted by the FAA.

Because the composite material and bonding may require preventive maintenance and inspection procedures different from those commonly utilized for aluminum airframes, the proposed special condition requires that instructions for continued airworthiness be established in addition to those required by § 23.1529.

The forward-mounted lifting surface, i.e., canard, of the Model SC–01 incorporates aerodynamic control surfaces with function as elevators for longitudinal (pitch) control of the airplane. With this configuration, the forward lifting surface has a significant effect on the lift distribution of the main wing and Part 23 does not currently provide strength requirements which adequately or appropriately address the forward/main wing configuration. In addition, Part 23 does not adequately or appropriately address requirements for longitudinal control surfaces attached to the trailing edge of the forward wing. The forward lifting surface on the airplane is subject to different structural loads from those airplanes with aft-mounted empennages. Existing Part 23 requirements specifically address only horizontal tail surfaces. The forward-mounted horizontal lifting surface, like the one chosen for the Model SC–01 design was not envisioned when Part 23 was promulgated. A special condition is proposed to clarify and broaden the existing Part 23 requirements to account

for the airplane loads associated with the novel or unusual forward lifting surface design.

Additionally, Model SC–01 has vertical extensions at the end of the main wing which act as vertical stabilizers and include rudders. The unusual aerodynamic configuration resulting from the use of these vertical stabilizers and the forward wing lifting surface; i.e., forward wing, combined with the aft-facing pusher propeller are novel and unusal when compared to the aerodynamic configuration envisioned by the airworthiness standards of Part 23. Depending upon the preferred terms of "winglets," "tip fins," or "tip sails" of a particular manufacturer, the vertical surfaces at the ends of the main wing perform substantially the same functions of directional stability, and, in some cases, directional control. Part 23 does not adequately or appropriately address requirements for vertical surfaces providing directional stability and control when these surfaces are located at the ends of the main wing. Therefore, the FAA is proposing a special condition to ensure adequate strength requirements for this novel or unusual design feature.

The aft-mounted propeller of the selected configuration may be susceptible to contact with the runway surface at the maximum pitch attitude attainable during takeoff and landing. This is an unusual design feature different from the tractor configuration envisioned by the airworthiness standards of Part 23. Therefore, a special condition is proposed to provide adequate ground clearance for the propeller. If a tail wheel or energy absorbing device is provided to show compliance with the special condition, as proposed, the FAA proposes to require that appropriate design loads be established for the energy absorbing device and that the energy absorbing device and its supporting structure be designed to support those loads.

Since the aft location of the propeller on the Model SC–01 is an unconventional design feature, passenger and ground personnel may be less aware of the proximity of the propeller blades. A special condition is proposed to require the necessary visibility of the propeller disc corresponding to similar requirements of Parts 27 and 29 concerning the conspicuity of the tail rotor.

List of Subjects in 14 CFR Parts 21 and 23

Aircraft, Air transportation, Aviation safety, Safety.

PARTS 21 AND 23—[AMENDED]

The authority citation for these special conditions is as follows:

Authority: Secs. 313(a), 601, and 603 of the Federal Aviation Act of 1958; as amended (49 U.S.C. 1354(a), 1421, and 1423); 49 U.S.C. 106(g) (Revised Pub. L. 97–449, January 12, 1983); 14 CFR 21.16 and 21.17; and 14 CFR 11.28 and 11.29(b).

The Proposed Special Conditions

Accordingly, the Federal Aviation Administration proposes the following special conditions as a part of the type certification basis for the Gyroflug Model SC–01 series Airplanes:

1. Evaluation of Composite Structure

In lieu of complying with § 23.572, and in addition to the requirements of §§ 23.603 and 23.613, airframe structure, the failure of which would result in catastrophic loss of the airplane, in each wing, wing carry-through, wing attaching structure, fuselage, wing mounted vertical stabilizer, wing flap, and moveable control surfaces must be evaluated to damage tolerance criteria prescribed in paragraphs (a) through (i) of this special condition, unless shown to be impractical. In cases shown to be impractical, the aforementioned structure must be evaluated in accordance with the criteria of paragraphs (a) and (j) of this special condition. Where bonded joints are used, the structure must also be evaluated in accordance with the residual strength criteria in paragraph (g) of this special condition.

(a) It must be demonstrated by tests, or by analysis supported by tests, that the structure is capable of carrying ultimate load with impact damage. The level of impact damage considered need not be more than the established threshold of detectability considering the inspection procedures employed.

(b) The growth rate of damage that may occur from fatigue, corrosion, intrinsic defects, manufacturing defects; e.g., bond defects, or damage from discrete sources under repeated loads expected in service; i.e., between the time at which damage becomes initially detectable and the time at which the extent of damage reaches the value selected by the applicant for residual strength demonstration, must be established by tests or by analysis supported by tests.

(c) The damage growth, between initial detectability and the value selected for residual strength demonstrations, factored to obtain inspection intervals, must permit development of an inspection program suitable for application by operation and maintenance personnel.

(d) Instructions for continued airworthiness for the airframe must be established consistent with the results of the damage tolerance evaluations. Inspection intervals must be set so that after the damage initially becomes detectable by the inspection method specified, the damage will be detected before it exceeds the extent of damage for which residual strength is demonstrated.

(e) Loads spectra, load truncation, and the locations and types of damage considered in the damage tolerance evaluations must be documented in test proposals.

(f) Each wing, fuselage, wing carry-through, wing attaching structure, wing flap, moveable control surface, and wing-mounted vertical stabilizer structure must be shown by residual strength tests, or analysis supported by residual strength tests, to be able to withstand critical limit flight loads, considered as ultimate loads, with the extent of damage consistent with the results of the damage tolerance evaluations.

(g) In lieu of a non-destructive inspection technique which assures ultimate strength of each bonded joint, the limit load capacity of each bonded joint critical to safe flight must be substantiated by either of the following methods used singly or in combination:

(1) The maximum disbonds of each bonded joint consistent with the capability to withstand the loads in paragraphs (f) and (g) of this special condition must be determined by analysis, tests, or both. Disbonds of each bonded joint greater than this must be prevented by design features.

(2) Proof testing must be conducted on each production article which will apply the critical limit design load to each critical bonded joint.

(h) The effects of material variability and environmental conditions; e.g., exposure to temperature, humidity, erosion, ultraviolet radiation, and/or chemicals, on the strength and durability properties of the composite materials must be accounted for in the damage tolerance evaluations and in the residual strength tests.

(i) The airplane must be shown by analysis to be free from the flutter to V_D with the extent of damage for which residual strength is demonstrated.

(j) For those structures where the damage tolerance method is shown to be impractical, the strength of such structures must be demonstrated by tests, or analysis supported by tests, to be able to withstand the repeated loads

of variable magnitude expected in service. Impact damage in composite material components which may occur must be considered in the demonstration. The impact damage level considered must be consistent with detectability by the inspection procedures employed.

2. Loads

(a) In addition to the requirements of § 23.301, paragraph (b), the following shall be required: Methods used to determine load intensities and distribution over the various aerodynamic lifting and control surfaces must be validated by flight test measurements unless the methods used for determining those loads are shown to be reliable or conservative for the configuration under consideration.

(b) In lieu of § 23.301, paragraph (d), the following applies: The forward lifting surface of a canard or tandem wing configuration must meet all of the requirements of Part 23, Subpart C—Structure, applicable to a wing.

(c) In lieu of § 23.331, the following apply:

(1) The appropriate balancing loads must be accounted for in a rational or conservative manner when determining forward and main wing loads and linear inertia loads corresponding to any of the symmetrical flight conditions specified in §§ 23.333 through 23.341.

(2) The incremental forward wing loads due to maneuvering and gusts must be reacted by the angular inertia of the airplane in a rationale or conservative manner.

(3) Mutual influence of the aerodynamic surfaces must be taken into account when determining flight loads.

(d) In addition to the gust load requirements of § 23.341, the following applies: The gust loads for a canard or tandem wing configuration must be computed using a rational analysis considering the gust criteria of § 23.333(c), or may be computed in accordance with § 23.341 provided the resulting load factors are shown to be conservative with respect to the gust criteria of § 23.333(c).

(e) In lieu of the balancing loads requirements of § 23.421, the following apply:

(1) A horizontal surface balancing load is a load necessary to maintain equilibrium in any specified flight condition with no pitching acceleration.

(2) Horizontal balancing surfaces must be designed for balancing loads occurring at any point on the limit maneuvering envelope and in the flap conditions specified in § 23.345. The distribution in figure B6 of Appendix B of Part 23 may be used only on aft-mounted horizontal stabilizing surfaces unless its use elsewhere is shown to be conservative.

(f) In lieu of the maneuvering load requirements of § 23.423, the following apply:

(1) Each horizontal surface with pitch control must be designed for maneuvering loads imposed by the following conditions:

(i) A sudden movement of the pitching control at V_A, to (1) the maximum aft movement, and (2) to the maximum forward movement, as limited by the control stops, or pilot effort, whichever is critical.

The average loading of B23.11 of Appendix B and the distribution in figure B7 of Appendix B may be used only on aft-mounted horizontal stabilizing surfaces unless its use elsewhere is shown to be conservative.

(ii) A sudden aft-movement of the pitching control at speeds above V_A, followed by a forward movement of the pitching control resulting in the following combinations of normal and angular acceleration:

Condition	Normal acceleration (n)	Angular acceleration (radian/sec.^{2})
Nose up pitching.	1.0	$+39\ n_m\ (n_m - 1.5)/V$
Nose down pitching.	n_m	$+39\ n_m\ (n_m - 1.5)/V$

where—

(a) n_m = positive limit maneuvering load factor used in the design of the airplane; and

(b) V = initial speed in knots

(2) The condition in this section involve loads corresponding to the loads that may occur in a "checked maneuver", i.e., a maneuver in which the pitching control is suddenly displaced in one direction and then suddenly moved in the opposite direction. The deflection and timing of the "checked maneuver" must avoid exceeding the limit maneuvering load factor. The total horizontal surface load for both down-load and up-load conditions is the sum of the balancing loads at V and the specified value of the normal load factor, n, plus the maneuvering load increment due to the specified value of the angular acceleration. The maneuvering load increment in figure B2 of Appendix B and the distribution in figure B7 for nose-up pitching and in figure B8 for nose-down pitching of Appendix B may be used only on airplane configurations with aft-mounted surfaces unless their use elsewhere is shown to be conservative.

(g) In lieu of the gust loads requirements of § 23.425, the following apply:

(1) Each horizontal surface, other than the main wing, must be designed for loads resulting from—

(i) Gust velocities specified in § 23.333(c) with the flaps retracted; and

(ii) Positive and negative gusts of 25 feet per second (f.p.s.) nominal intensity at V_F corresponding to the flight conditions specified in § 23.345(a)(2).

(2) When determining the total load on the horizontal surfaces for the conditions specified in subparagraph (g)(1) of this special condition, the initial balancing loads for steady unaccelerated flight at the pertinent design speeds, V_F, V_C, and V_D must first be determined. The incremental load resulting from the gusts must be added to the initial balancing load to obtain total load.

(h) In lieu of unsymmetrical load requirements of § 23.427, the following apply:

(1) Horizontal surfaces, other than the main wing, and their supporting structure must be designed for unsymmetrical loads arising from yawing and slipstream effects, in combination with the loads prescribed for the flight conditions set forth in paragraphs (e) through (g) of this special condition.

(2) In the absence of more rational data:

(i) 100 percent of the maximum loading from the symmetrical flight conditions may be assumed on the surface on one side of the plane of symmetry; and

(ii) The following percentage of that loading must be applied to the opposite side:

Percent = 100—10 (n-1), where n is the specified positive maneuvering load factor, but this value may not be more than 80 percent.

(3) The vertical and horizontal surfaces and their supporting structures must be designed for combined vertical and horizontal surface loads resulting from each prescribed flight condition taken separately.

(i) In the absence of specific requirements for wing mounted vertical stabilizers, the following apply: Vertical stabilizers mounted on the wing must meet the applicable requirements of §§ 23.441, 23.443, and, in lieu of a more rationale method, § 23.445 for vertical tail surfaces. The effect of these surfaces

on the spanwise loading of the wing must also be accounted for.

3. Propeller Ground Clearance

In addition to the propeller clearance requirements of § 23.925, the following apply:

(a) The airplane must be designed such that the propeller will not contact the runway surface when the airplane is in the maximum pitch attitude attainable during normal takeoffs and landings; and

(b) If a tail wheel, bumper, or an energy absorption device is provided to show compliance with paragraph (a) of this special condition, the following apply:

(1) Suitable design loads must be established for the tail wheel, bumper, or energy absorption device; and

(2) The supporting structure of the tail wheel, bumper, or energy absorption device must be designed to withstand the loads established in subparagraph (b)(1) of this special condition and inspection/replacement criteria must be established for the tail wheel, bumper, or energy absorbing device and provided as part of the information required by § 23.1529.

4. Propeller Marking

In the absence of specific regulations, the propeller must be marked so that the disc is conspicuous under normal daylight ground conditions.

Issued in Kansas City, Missouri on May 18, 1988.

Paul K. Bohr,

Director, Central Region.

[FR Doc. 88-12732 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

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14 CFR Part 71

[Airspace Docket No. 88-AGL-13]

Proposed Control Zone Establishment; Waukegan, IL

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: This notice proposes to establish the Waukegan, IL, airport control zone to serve Waukegan Regional Airport, Waukegan, IL. This results from the establishment of an Air Traffic Control Tower (ATCT) at Waukegan, IL, which is expected to be commissioned in October 1988. The intended effect of this action is to ensure segregation of the aircraft using approach procedures in instrument conditions from other aircraft operating under visual weather conditions in controlled airspace.

DATE: Comments must be received on or before July 12, 1988.

ADDRESS: Send comments on the proposal in triplicate to: Federal Aviation Administration, Regional Counsel, AGL-7, Attn: Rules Docket No. 88-AGL-13, 2300 East Devon Avenue, Des Plaines, Illinois 60018.

The official docket may be examined in the Office of the Regional Counsel, Federal Aviation Administration, 2300 East Devon Avenue, Des Plaines, Illinois.

An informal docket may also be examined during normal business hours at the Air Traffic Division, Airspace Branch, Federal Aviation Administration, 2300 East Devon Avenue, Des Plaines, Illinois.

FOR FURTHER INFORMATION CONTACT: Harold G. Hale, Air Traffic Division, Airspace Branch, AGL-520, Federal Aviation Administration, 2300 East Devon Avenue, Des Plaines, Illinois 60018, telephone (312) 694-7360.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested parties are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments as they may desire. Comments that provide the factual basis supporting the views and suggestions presented are particularly helpful in developing reasoned regulatory decisions on the proposal. Comments are specifically invited on the overall regulatory, economic, environmental, and energy aspects of the proposal. Communications should identify the airspace docket and be submitted in triplicate to the address listed above. Commenters wishing the FAA to acknowledge receipt of their comments on this notice must submit with those comments a self-addressed, stamped postcard on which the following statement is made: "Comments to Airspace Docket No. 88-AGL-13." The postcard will be date/time stamped and returned to the commenter. All communications received before the specified closing date for comments will be considered before taking action on the proposed rule. The proposal contained in this notice may be changed in the light of comments received. All comments submitted will be available for examination in the Rules Docket, FAA, Great Lakes Region, Office of Regional Counsel, 2300 East Devon Avenue, Des Plaines, Illinois, both before and after the closing date for comments. A report summarizing each substantive public contact with FAA personnel concerned with this rulemaking will be filed in the docket.

Availability of NPRM's

Any person may obtain a copy of this Notice of Proposed Rulemaking (NPRM) by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 426-8058. Communications must identify the notice number of this NPRM. Persons interested in being placed on a mailing list for future NPRM's should also request a copy of Advisory Circular No. 11-2, which describes the application procedure.

The Proposal

The FAA is considering an amendment to § 71.171 of Part 71 of the Federal Aviation Regulations (14 CFR Part 71) to establish a control zone near Waukegan, IL.

The airspace required would lower the floor of controlled airspace from 700 feet above the surface down to the surface within a five statute mile radius of the geographic center of Waukegan Regional Airport, Waukegan, IL. The control zone would be effective during the specific dates and time established in advance by a Notice to Airmen. The effective date and time would thereafter be continuously published in the Airport/Facility Directory.

In addition, aeronautical maps and charts will reflect the defined area which will enable other aircraft to circumnavigate the area in order to comply with applicable visual flight rule requirements.

Section 71.171 of Part 71 of the Federal Aviation Regulations was republished in Handbook 7400.6D dated January 4, 1988.

The FAA has determined that this proposed regulation only involves an established body of technical regulations for which frequent and routine amendments are necessary to keep them operationally current. It, therefore—(1) is not a "major rule" under Executive Order 12291; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and (3) does not warrant preparation of a regulatory evaluation as the anticipated impact is so minimal. Since this is a routine matter that will only affect air traffic procedures and air navigation, it is certified that this rule, when promulgated, will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

List of Subjects in 14 CFR Part 71

Aviation safety, Control zones.

The Proposed Amendment

Accordingly, pursuant to the authority delegated to me, the Federal Aviation Administration proposes to amend Part 71 of the Federal Aviation Regulations (14 CFR Part 71) as follows:

PART 71—[AMENDED]

1. The authority citation for Part 71 continues to read as follows:

Authority: 49 U.S.C. 1348(a), 1354(a), 1510; E.O. 10854; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); 14 CFR 11.69.

§ 71.171 [Amended]

2. Section 71.171 is amended as follows:

Waukegan, IL [New]

Within a five (5) mile radius of the Waukegan Regional Airport, Waukegan, IL, (Lat. 42°25'20" N., Long. 0 87°52'04" W.). The control zone is effective during the specific dates and times established in advance by a Notice to Airmen. The effective date and time will thereafter be continuously published in the Airport/Facility Directory.

Issued in Des Plaines, Illinois, on May 25, 1988.

Teddy W. Burcham,

Manager, Air Traffic Division.

[FR Doc. 88-12726 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

CONSUMER PRODUCT SAFETY COMMISSION

16 CFR Parts 1500 and 1501

Toys and Articles Intended for Children Under Three Years of Age Which Present Choking, Aspiration, Or Ingestion Hazards Because of Small Parts; Request for Comments and Information

AGENCY: Consumer Product Safety Commission.

ACTION: Advance notice of proposed rulemaking.

SUMMARY: On basis of available information, the Commission has reason to believe that unreasonable risks of death and injury may be associated with some toys and articles intended for children under three years of age because of small parts. The toys and children's articles under consideration comply with all requirements enforced by the Commission but nevertheless have parts which may be small enough to present choking, aspiration, or ingestion hazards to children under three.

This advance notice of proposed rulemaking begins a rulemaking proceeding under the authority of the Federal Hazardous Substances Act. One outcome of the proceeding could be the amendment of existing requirements for toys and articles intended for children under three years of age to address risks of injury associated with small parts that present choking, aspiration, or ingestion hazards. Additionally, the Commission is considering the possibility that an existing voluntary standard might be modified or a new one developed to address the risks of injury described in this notice.

The Commission solicits written comments from all interested persons on the risks of injury and regulatory alternatives discussed in this notice, and other possible means to address those risks of injury. The Commission particularly desires to receive technical and medical data and other information relevant to (1) the possible need for amendment of the small parts regulations; (2) an appropriate modification of the present test for determining if toys or articles intended for children less than three years of age are banned because of small parts; and (3) the economic impact of amending the small parts regulations. Additionally, the Commission invites all interested persons to submit an existing standard or a statement of intent to modify or develop a voluntary standard to address the risks of injury described in this notice.

DATE: Written comments and submissions in response to this notice must be received by the Commission by August 8, 1988.

ADDRESS: Comments should be mailed, preferably in five (5) copies, to the Office of the Secretary, Consumer Product Safety Commission, Washington, DC 20207, or delivered to the Office of the Secretary, Consumer Product Safety Commission, Room 528, 5401 Westbard Avenue, Bethesda, Maryland; telephone (301) 492-6800.

FOR FURTHER INFORMATION CONTACT: Elaine A. Tyrrell, Project Manager, Office of Program Management and Budget, Consumer Product Safety Commission, Washington, DC 20207; telephone (301) 492-6554.

SUPPLEMENTARY INFORMATION:

A. Background

At the age of about four months, most infants acquire the ability to bring objects to their mouths and to suck on them. At about the same age, infants begin to explore their surroundings by putting objects in their mouths, and gum objects in an attempt to relieve teething pains. Many infants and young children continue to put objects in their mouths indiscriminately until they are about three years old. Infants gradually develop skills which enable them to prevent objects from entering and remaining in their throats, but until children are about three years old many are not able to remove or expel an object from their own throat or mouth. For this reason, children under the age of three are particularly susceptible to injuries which result when objects are swallowed or become lodged in the mouth or throat.

In 1979, the Commission issued regulations under provisions of the Federal Hazardous Substances Act (FHSA) (15 U.S.C. 1261 *et seq.*) to ban certain toys and other articles intended for children under three years of age which present unreasonable risks of injury because of small parts. Those regulations are codified at 16 CFR 1500.18(a)(9) and Part 1501, and are intended to address the following risks of death and injury:

(1) Asphyxiation from lodgment of an object in the throat resulting in blockage of air to the lungs;

(2) Asphyxiation from obstruction of the airway by a foreign object or vomit;

(3) Aspiration of an object into a bronchus or a lung; and

(4) Cuts or penetration wounds to internal organs from sharp or pointed objects which have been swallowed.

The regulation codified at 16 CFR 1500.18(a)(9) bans any toy or other article intended for children under three years of age which persents a choking, aspiration, or ingestion hazard because of small parts, and which is introduced into interstate commerce after January 1, 1980. The regulation codified at 16 CFR Part 1501 describes certain types of products which are subject to the banning rule codified at § 1500.18(a)(9); lists certain other types of products which are specifically exempted; and provides a test method for determining whether an article presents a choking, aspiration, or ingestion hazard because the article itself, or any part which could be detached or broken off during normal or reasonably foreseeable use, is too small.

Section 1501.2(a) of the regulation contains a list of products which the Commission considers to be intended for children under three years of age. This list is illustrative, but not all-inclusive. Among the products listed in § 1501.2 are squeeze toys, teethers, crib exercisers, crib mobiles, pull and push toys, pounding toys, blocks and stacking sets, stuffed animals and other figures, dolls intended for children under three

such as baby dolls, rag dolls, and bean bag dolls, and infant and juvenile furniture intended for children under three such as cribs, playpens, strollers, and carriages.

In addition to the product types listed in § 1502.2(a), the banning rule codified at § 1500.18(a)(9) is also applicable to any other toys or articles which are intended to be entrusted to or used by children under three years of age. Section 1501.2(b) lists the factors which are relevant when deciding whether a particular product not listed in § 1501.2(a) is subject to the banning rule. Those factors include the manufacturer's stated intent on labeling and elsewhere, if reasonable; advertising, promotion, and marketing of the product; and whether the product is commonly recognized as one intended for children under three years of age.

Section 1501.3 of the regulation exempts ten categories of products from the banning rule. Two of the exempted products are rattles and pacifiers which are subject to other FHSA regulations containing requirements to address risks of injury presented by small parts. Rattles are subject to regulations codified at 16 CFR 1500.18(a)(15) and Part 1510; pacifiers are subject to regulations codified at 16 CFR 1500.18(a)(8) and Part 1511.

Other categories of exempt products include books and articles made from paper; writing materials such as crayons, chalk, pencils, and pens; children's clothing and accessories, such as shoe lace holders and buttons; grooming, feeding, and hygiene products such as diaper pins, barrettes, toothbrushes, drinking glasses, dishes and eating utensils; and phonograph records. These products were exempted because the Commission determined that their functional, educational, or other value outweighed any possible hazard from small parts.

Modeling clay and similar products, and finger paints, water colors, and other paint sets were exempted because they cannot be manufactured so that small bits will never separate from these items. Finally, balloons were exempted from the products subject to the banning rule because the Commission concluded that balloons cannot be subject to this regulation without being banned entirely.

Section 1501.4 sets forth the test used to determine if a toy or article intended for children under three is banned because of small parts. The apparatus used in this test is a hollow truncated cylinder having an interior diameter of 1.25 inches, a minimum interior depth of 1.0 inches, and maximum interior depth of 2.25 inches. See Figure 1.

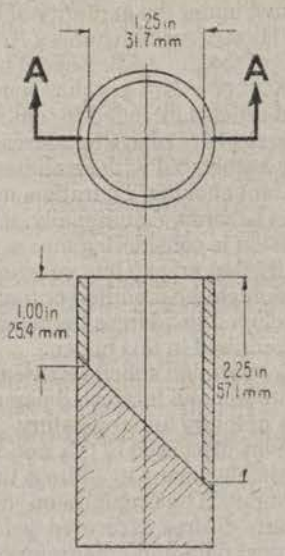

FIG 1—SMALL PARTS CYLINDER

The product to be tested is placed in the test cylinder and must be large enough not to fit entirely within the cylinder. Any detachable component is tested in the same manner. If neither the product nor any detachable component fits entirely within the test cylinder, the product is subjected to the applicable "use and abuse" procedure codified at 16 CFR 1500.51 and 1500.52, with the exception of the bite tests specified at §§ 1500.51(c) and 1500.52(c). Any component or piece that becomes separated from the product during use and abuse testing is tested individually by placing it in the cylinder. (Paper and pieces of fabric, yarn, fuzz, elastic, or string that separate during use and abuse testing are not tested in the cylinder; this aspect of the test is clarified in a Commission statement of interpretation published in the **Federal Register** of May 27, 1988, 53 FR 19281.) If the entire product, any detachable component, or any component or any piece which separates during use and abuse testing fits entirely within the cylinder, the product is banned if it is intended for use by children under three years of age.

The Commission issued the small parts regulation to reduce unreasonable risks of injury to children under three years of age from choking on, aspirating, or ingesting toys or articles intended for their use. The Commission recognized, however, that by restricting the scope of the regulation to items intended for children under three, it would not eliminate all choking, aspiration, or ingestion hazards to children associated with small objects. See the **Federal Register** notice of June 15, 1979; 44 FR 34892.

In 1983, the Commission's Directorate for Epidemiology published a human factors analysis of 195 incidents in which children ranging in age from one month to four years old choked to toys or children's products. Thirty-seven of these incidents resulted in deaths of children. All of the incidents considered in this study were selected because they involved items which were too large to fit entirely within the test cylinder specified by Part 1501.

The incidents occurred from 1973 through 1983. More than half of these incidents involved products in two categories exempted from the small parts regulations: Rattles and pacifiers. Rattles were involved in 97 of the choking incidents, including 14 which resulted in death. Pacifiers were involved in nine incidents, including three fatalities.

One purpose of the 1983 analysis was to identify common characteristics, such as size and shape, of the items involved in the selected choking incidents. Another purpose of the analysis was to determine the interaction of the anatomy and behavior of the children with the characteristics of the products involved in an attempt to determine why choking incidents resulted. This analysis also examined the requirements of the Commission's regulations applicable to rattles, pacifiers, and toys and articles intended for children under three years of age in an attempt to determine if a single test apparatus and procedure could be developed to identify a choking hazard presented by any type of toy or product intended for children younger than three.

The 1983 report outlined proposals for such a test. One approach proposed by the 1983 report was to prohibit all toys or articles intended for children less than three years of age which could enter a child's mouth and extend far enough to block passage of air to the lungs. This approach proposed a test fixture having an opening 1.68 inches in diameter, and a depth of 1.18 inches. See Figure 2. The report stated that mandatory requriements based on this approach would have prohibited the sale of all but five of the items involved in the 195 choking incidents selected for analysis. The report observed, however, that mandatory requirements based on such an approach would require substantial modifications of many toys then on the market.

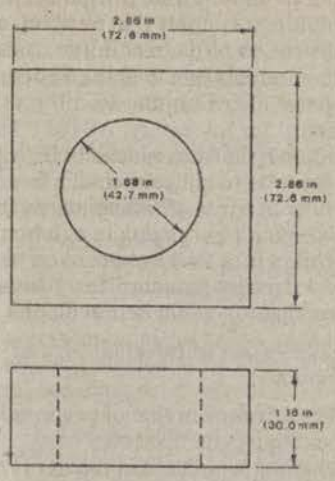

FIG. 2 – TEST FIXTURE

Since 1983, the Commission's Directorate for Epidemiology has collected additional information about injuries to children which have resulted from choking on, aspirating, or ingesting toys and other children's products with small parts. This information has been obtained through the National Electronic Injury Information Surveillance System (NEISS), in-depth investigations, death certificates, consumer complaints, newspaper and magazine articles, and reports from coroners and medical examiners.

During fiscal year 1988 (October 1, 1987 through September 30, 1988), the Commission staff is conducting a special study of choking incidents involving toys and children's products which are treated at emergency rooms of NEISS participating hospitals. Follow-up investigations of selected incidents treated at NEISS particpating hospitals will obtain detailed information about the children and products involved, and the accident scenarios. The special study will yield data which can be used to make statistically valid estimates of the total number of children in the United States who sustain injuries from choking incidents which require emergency room treatment during a specific time period. The staff will also obtain anecdotal information about choking incidents associated with toys and children's products from death certificates, consumer complaints, periodicals, reports from coroners and medical examiners, and investigations of some accidents reported by these sources. During fiscal year 1989, the staff will prepare an anaysis of the information obtained from the special study and other sources in an effort to define more precisely the nature and scope of choking, aspiration, and ingestion hazards associated with toys and children's products.

B. Petition

By letter dated April 20, 1987, the Consumer Federation of America and the New York State Attorney General's Office petitioned the Commission to amend the small parts regulation by modifying the test apparatus specified by 16 CFR Part 1501. The petition (HP 87–1) requested the Commission to amend Part 1501 to prescribe a test which would ban any toy or article intended for children under three years of age having a diameter less than 1.68 inches. The petition asserted that the requested amendment of Part 1501 was needed to prevent choking incidents involving toys and articles intended for children under three years of age which had resulted in deaths and injuries. The petition cited the 195 incidents discussed in the 1983 human factors analysis issued by the Commission's Directorate for Epidemiology, and other information obtained from the Commission about deaths and injuries to children from choking incidents involving toys and children's products.

The Commission staff prepared briefing materials for consideration by the Commission when deciding whether to grant or deny the petition. The breifing materials included information about current activities to address choking hazards presented by toys and children's products and comments on the injury information cited in the petition. The staff observed that the 195 choking incidents considered in the 1983 analysis, 49 involved products with diameters smaller than the 1.25 inch interior diameter currently specified for the test cylinder but which passed the small parts test, and 71 were associated with products which are not currently prohibited by either mandatory requirements or provisions of a voluntary standard for toy safety to address choking hazards. The latter 71 choking incidents included 14 fatalities, three of which occurred outside the United States. The briefing materials also contained information about the various types of toys and children's products intended for children under three years of age, the annual volume of sales of such products, and possible costs to manufacturers and importers of such products if the Commission amended the small parts regulations.

After consideration of the petition and supporting information provided by the petitioners, the briefing materials and an oral briefing by the Commission staff, and other information, the Commission voted on February 3, 1988, to deny the petition. The Commission took this action after deciding that available information does not support the specific modification of the test in Part 1501 requested by the petitioners.

Nevertheless, the Commission concluded that some change to the small parts regulations may be needed to reduce choking hazards associated with toys and articles intended for children under three years of age. The Commission voted to publish an advance notice of proposed rulemaking to begin a proceeding which may result in the amendment of the small parts regulations, and to solicit information relevant to such a proceeding. The Commission particularly desires to obtain technical and medical data and other information relevant to:

(1) The possible need for amendment of the small parts regulations;

(2) An appropriate modification of the provisions of Part 1501, including the test procedures as well as test apparatus and the products excluded from the small parts rule, to eliminate or reduce unreasonable risks of death and injury associated with toys and articles intended for children under three years of age which present choking, aspiration, or ingestion hazards;

(3) The economic impact of amending the small parts regulations, including information about the various types of toys and children's products which may be affected by an amendment of those regulations, the annual volume of sales of those products and the number of units affected, and the costs of such an amendment to manufacturers and importers.

C. Statutory Authority

This proceeding is conducted under provisions of the Federal Hazardous Substances Act (FHSA) (15 U.S.C. 1261 *et seq.*). Section 2(f)1(D) of the FHSA (15 U.S.C. 1261(f)1(D)) defines the term "hazardous substance" to include "[a]ny toy or other article intended for use by children" which the Commission determines by regulation to present "an electrical, mechanical, or thermal hazard." Section 2(s) of the FHSA provides that an article may be determined to present a "mechanical hazard" if in normal use or reasonably foreseeable use or abuse it presents an unreasonable risk of personal injury or illness because the article or any of its parts may be aspirated or ingested. The Commission may make its determination that a toy or childrens' article presents a mechanical hazard by issuance of a regulation in accordance

with provisions of sections 3 (e) through (i) of the FHSA (15 U.S.C. 1262 (e) through (i)). A toy or children's article which has been determined by regulation to present a mechanical hazard is a "banned hazardous substance" as that term is defined by section 2(q)(1)(A) of the FHSA (15 U.S.C. 1261(q)(1)(A)) and may not be imported into or sold in the United States. See Section 4(a) of the FHSA (15 U.S.C. 1263(a)).

The first step in a proceeding under provisions of section 3 (e) through (i) of the FHSA to issue a rule declaring that a toy or children's article presents a mechanical hazard is the publication of an advance notice of proposed rulemaking (ANPR) in accordance with section 3(f). If after considering comments received in response to the ANPR the Commission decides to continue the proceeding, section 3(h) of the FHSA requires publication of the text of the proposed rule and a preliminary regulatory analysis of the proposal including a description of potential benefits and potential costs of the proposal. If the Commission issues a final rule, it must publish a third notice which sets forth the text of the final rule, a summary of significant issues raised by comments on the proposal, a final regulatory analysis including a description of potential benefits and potential costs, as well as specified findings about voluntary standards and the relationship of the costs and the benefits of the rule.

D. The Products and Risks of Injury

This proceeding is concerned with all toys and other articles intended for children under three years of age which present choking, aspiration, or ingestion hazards because of small parts. All such toys and children's products, including those specifically exempted from the small parts regulations by 16 CFR 1501.3, and those complying with all requirements of 16 CFR 1500.18(a) (8), (9), and (15), and Parts 1501, 1510, and 1511 to address hazards from small parts are within the scope of this proceeding.

This proceeding is concerned with unreasonable risks of death and injury which may occur when a child under three years of age asphyxiates or is otherwise injured from the aspiration or ingestion of a toy or children's article, or any part thereof, intended to be entrusted to or used by children in that age group. These risks of injury are discussed in detail under the heading "Background" in this notice.

E. Voluntary Standard

The Commission is aware of only one voluntary standard applicable to the products and risks of injury with which this proceeding is concerned. That standard was revised in 1986 (following the 1983 CPSC study). It is published by the American Society for Testing and Materials and is designated F 963–86, Standard Consumer Safety Specification on Toy Safety.

This voluntary standard has provisions intended to address a variety of hazards presented by a wide range of toys and children's products, some of which are intended for children as old as 14 years of age. However, this standard does include provisions intended to address choking, aspiration, and ingestion hazards from small parts of toys and articles intended for children under three years of age.

The voluntary standard includes the same small parts requirements for toys and products intended for children under three years of age as those codified at 16 CFR Part 1501. The voluntary standard also includes the same requirements for rattles as those codified at Part 1510, and the same requirements for pacifiers as those at Part 1511. Moreover, the voluntary standard imposes the following additional requirements:

(1) All teethers and squeeze toys are tested in accordance with the test for rattles set forth in Part 1510; and

(2) All rattles, teethers, and squeeze toys with nearly spherical, hemispherical, or circular flared ends are subjected to a supplementary test to identify those articles which could penetrate far enough into an infant's mouth to block passage of air to the lungs. This supplementary test uses a test fixture similar to the apparatus illustrated in Figure 2 of this notice.

F. Regulatory Alternatives Under Consideration

The Commission decided to begin this proceeding after it denied a petition requesting amendment of Part 1501 to prescribe a test which would ban any toy or product intended for children under three years of age having a diameter less than 1.68 inches. The Commission concluded that available information did not support the specific change requested by the petition.

In this proceeding, the Commission is considering any modification of the provisions of 16 CFR 1500.18(a)(9) and Part 1501 which can be supported by information currently available or developed during the course of this proceeding. The Commission may reconsider the specific change requested by the petition if information becomes available to support that particular modification of the test in Part 1501.

The Commission is also considering the possibility that the voluntary standard for toy safety, ASTM F 963–86 could be revised to reduce even further the hazards to children under three years of age from choking on, aspirating, or ingesting toys or products intended for children of that age group, or that a new voluntary standard to address those hazards might be developed.

G. Solicitation of Information and Comments

This advance notice of proposed rulemaking is the first step of a proceeding which could result in amendment of existing regulations prescribing requirements for toys and articles intended for children under three years of age to address risks of injury from choking on, aspirating, or ingesting small parts. All interested person are invited to submit to the Commission:

(1) Written comments concerning the risk of injury discussed in this notice; the regulatory alternatives being considered by the Commission to address those risks; and other possible alternatives to address those risks.

(2) Any existing standard or portion of an existing standard which could be published as a proposed amendment of the small parts regulations.

(3) A statement of intent to modify or develop a voluntary standard to address the risks of injury discussed in this notice, together with a description of the plan for modification or development of that standard.

Any plan submitted with a statement of intent to modify or develop a voluntary standard should include, to the extent possible, a description of how interested groups and persons will be notified that a proceeding to modify or develop a voluntary standard is under way; a description of how the views of interested groups and persons will be addresed in the development of the standard; a detailed discussion of how the modification or development of the standard will proceed; a realistic estimate of the length of time that will be required to modify or develop the standard; a list of persons expected to participate in the modification or development of the standard, together with information about their backgrounds and experience; and a description of any facilities or equipment that will be used during the project.

All comments and submissions should be addressed to the Office of the

Secretary, Consumer Product Safety Commission, Washington, DC 20207, and received not later than August 8, 1988.

Dated: June 1, 1988.

Sadye E. Dunn,

Secretary, Consumer Product Safety Commission.

Reference Documents

The following documents contain information relevant to this rulemaking proceeding and are available for inspection at the Office of the Secretary, Consumer Product Safety Commission, Room 528, 5401 Westbard Avenue, Bethesda, Maryland:

1. **Federal Register** notice of June 15, 1979 (44 FR 34892) entitled Method for Identifying Toys or Other Articles Intended for Use by Children Under 3 Years of Age Which Present Choking, Aspiration, or Ingestion Hazards.

2. Briefing materials on Petition HP 87-2 for amendment of the small parts regulation, dated December 7, 1978. The TABS are listed separately below.

3. TAB A—(1) Memorandum from James V. Lacy, General Counsel, and Stephen Lemberg, Assistant General Counsel, dated May 6, 1987, entitled Petition to Amend Small Parts Regulations; (2) Petition from the New York Attorney General and Consumer Federation of America to amend the small parts test, and attachments: Letter from Bernard P. Dreyer, M.D., Associate Professor of Clinical Pediatrics, New York School of Medicine, to Phyllis Spaeth, New York State Department of Law, dated Janaury 15, 1987; Human Factors Analysis—Choking Incidents in Children, by Shelley Waters Deppa, Directorate for Epidemiology, Consumer Product Safety Commission.

4. TAB B—Memorandum from Deborah Tinsworth, EPHA, to Elaine A. Tyrrell, EXPM, dated November 13, 1987, entitled FY 88 Choking Hazards Project.

5. TAB C—Memorandum from Deborah Tinsworth, EPHA, to Elaine A. Tyrrell, EXPM, dated November 12l, 1987, entitled Small Parts Petition HP 87-2.

6. TAB D—Memorandum from Shelley Waters Deppa, EPHF, to Elaine A. Tyrrell, EX-PB, dated November 1, 1987, entitled Human Factors Input to Small Parts Petition Breifing Package.

7. TAB E—Memorandum from Terrance R. Karels, ECSS to Elaine A. Tyrrell, EX-P, dated November 10, 1987, entitled Small Parts Petition—HP 87-2.

8. TAB-F—(1) Memorandum from Alfred L. Roma, AEDFO, to Elaine A. Tyrrell, OPMB, dated November 30, 1987, entitled Briefing Package on Petition HP 87-1—Amend the Small Parts Regulations. (2) Memorandum from Robert D. Verhalen, AEDEP, to Elaine A. Tyrrell, OPMB, dated November 30, 1987, entitled Epidemiology Position on Petition HP 87-2 Amend the Small Parts Regulation. (3) Memorandum from Warren J. Prunella, AEDEC, to Douglas L. Noble, OPMB, dated November 30, 1987, entitled Petition HP 87-2 to Amend the Small Parts Regulation. (4) Memorandum from Andrew G. Ulsamer, AEDHS, to Elaine A. Tyrrell, dated December 1, 1987, entitled Small Parts Petition. (5) Memorandum from David Shiflett, OIPA, to Elaine A. Tyrrell, OPMB, dated November 30, 1987, entitled Petition HP 87-2 to Amend the Small Parts Regulation. (6) Memorandum from Walter Hobby, OPE, to Elaine A., Tyrrell, OPMB, dated November 30, 1987, entitled Petition HP 87-2 to Amend the Small Parts Regulation. (7) Memorandum from William W. Walton, AEDES, to Elaine A. Tyrrell, EX-PB, dated November 30, 1987, entitled Petition HP 87-2 to Amend the Small Parts Regulation. (8) Memorandum from David Schmeltzer, AEDCA, to Elaine A. Tyrrell, OPMB, dated December 4, 1987, entitled Small Parts Petition—AEDCA Recommendation. (9) Memorandum to the File for Douglas Noble, OPMB, dated December 4, 1987, entitled Petition HP 87-2 to Amend 16 CFR 1501.4.

9. Standard Consumer Safety Specification on Toy Safety, ASTM F 963-86, published by the American Society for Testing and Materials.

[FR Doc. 88-12716 Filed 6-6-88; 8:45 am]

BILLING CODE 6355-01-M

DEPARTMENT OF THE TREASURY

Customs Service

19 CFR Part 134

Country of Origin Marking of Fruit Juice Containers

AGENCY: Customs Service, Treasury.

ACTION: Proposed interpretive rule.

SUMMARY: This document proposes a change to the Customs Service's interpretation of country of origin marking rules as they are applied to containers of fruit juice made with imported juice concentrate. Customs has been allowing a method of marking known as "major supplier marking" for containers of orange juice since February 1, 1987. Marking requirements, and the applicability of major supplier marking, are being extended to other fruit juices as of June 7, 1989, by another Customs document published in today's **Federal Register**. Major supplier marking stipulates that if a processor obtains 75 percent or more of its imported concentrate from one source country, only that source country need be disclosed. Otherwise, if no single source accounts for 75 percent or more of the concentrate, than all source countries must be disclosed.

Customs has been asked to consider whether major supplier marking provides the level of information to consumers that was contemplated by the country of origin marking laws, as codified in the Tariff Act of 1930, as amended. Because of comments submitted in response to a prior **Federal Register** notice addressing the marking of apple juice and other fruit juices made from concentrate, and because of concerns that have been raised regarding public health, Customs has declined to consider further the merits of major supplier marking. The comments submitted indicated that major supplier marking may not provide adequate information to consumers of imported apple juice because of the wide variety of sources and the frequency of the changes in those sources. The public health concern also raises potential issues regarding major supplier marking of fruit juices. Customs has been told that certain pesticides, banned in the U.S. because they can cause illness, may be reaching the U.S. because the pesticides were used on foreign fruit which is the source of imported concentrates. If major supplier marking for fruit juice concentrate were not allowed, and all countries of origin of fruit juice concentrate are listed on juice containers, it is alleged that the Food and Drug Administration would be better able to trace imported concentrate that may contain pesticides, and that consmers could better protect themselves from potential health threats.

Accordingly, Customs is now proposing that all fruits made from foreign concentrate be required to be labeled to indicate all actual sources of concentrate contained in the particular package of juice. If the proposed rule is adopted, all fruit juice concentrate processors, including processors of orange juice, will no longer be allowed to use major supplier marking. Written comments are invited on this proposal.

DATE: Comments must be received on or before August 8, 1988.

ADDRESS: Comments (preferably in triplicate) should be submitted to and may be inspected at the Regulations and Disclosure Branch, Room 2324, U.S. Customs Service, 1301 Constitution Avenue NW., Washington, DC 20229.

FOR FURTHER INFORMATION CONTACT: John Doyle, Office of Regulations & Rulings, (202-566-5765).

SUPPLEMENTARY INFORMATION:

Background

In a ruling dated September 4, 1985 (C.S.D. 85-47, 19 Cust. Bull. No. 39 at 21), the Customs Service held that containers of orange juice in frozen concentrated or reconstituted forms which contain foreign concentrate must be labeled to comply with the country of origin marking requirements of section 304, Tariff Act of 1930, as amended (19

U.S.C. 1304). The ruling was based on the determination that the foreign concentrate which is imported into the U.S. and used in the production of frozen concentrated or reconstituted orange juice is not substantially transformed after undergoing further processing in the U.S. involving blending with other batches of orange concentrate; addition of water, oils, and essences; pasteurization or freezing; and repacking. In *National Juice Products Association* v. *United States*, CIT Slip Op. 86–13 (Jan. 30, 1986), the Court of International Trade held that C.S.D. 85–47 was substantially valid.

On March 19, 1986, Customs held in Ruling No. 729410 (C.S.D. 86–19, 20 Cust. Bull. No. 33 at 17) that orange juice containers would meet the marking requirements if only the major foreign sources of the imported product were listed ("major supplier marking"). Under current practice, major supplier marking permits an orange juice processor that obtains 75 percent or more of its imported concentrate from one country to disclose only that source. If there is no one source country supplying 75 percent or more of the imported concentrate, all foreign countries from which the concentrate is derived must be disclosed.

Noting that orange juice imports are principally from a single country and that sources of supply remain constant, Customs permitted major supplier marking of orange juice based on the conclusion that in most cases such marking would be both accurate and informative. Customs believed that in these circumstances major supplier marking would serve the statutory requirement that the ultimate purchaser be informed of the country of origin, notwithstanding that the origin of a minority portion of the concentrate might not be disclosed. Customs also believed that this approach would facilitate compliance with the marking statute by eliminating the need to identify and disclose the names of those countries that supply a very small quantity of orange juice concentrate.

On June 25, 1986, Customs published T.D. 86–120 in the **Federal Register** (51 FR 23045), informing the public that frozen concentrated and reconstituted orange juice products containing imported concentrate were required to bear lables marked for country of origin by February 1, 1987. The notice of the decision announced that Customs had considered the comments submitted in response to an earlier notice, published in the **Federal Register** on March 3, 1986 (51 FR 7285), and that requiring country of origin marking for these products was consistent with the court decision in *National Juice Products*.

Other Fruit Juices

On July 30, 1986, Customs announced in a **Federal Register** notice (51 FR 27195) that the principles set forth in C.S.D. 85–47 and supported by the court in *National Juice Products* were to be applicable to containers of other fruit juices containing imported concentrate as well as to those of orange juice. In other words, imported fruit juice concentrate which is imported into the U.S. and used in the production of reconstituted fruit juice is not substantially transformed after undergoing further processing in the U.S. involving blending with other batches of concentrate, addition of water, oils and essences, pasteurization or freezing, and repacking. Accordingly, pursuant to the notice, all frozen concentrated or reconstituted fruit juices made from imported concentrate and so processed will be required to be marked to indicate the country of origin. In addition, the notice announced that the certification requirements set forth in §134.25, Customs Regulations (19 CFR 134.25), would be applicable. The notice sought public comments for the purpose of establishing an effective date.

Another document, published in today's **Federal Register**, discusses the comments that were received concerning the establishment of an effective date and sets forth the effective date. Because major supplier marking has been allowed for imported orange juice products, and because processors of other juices reasonably may have expected that major supplier marking would apply to them as well, Customs, for reasons of fairness, states in that document that the juice processors may meet the marking requirements by using major supplier marking. However, while major supplier marking has been approved for the time being, Customs has been urged by comments received in response to the July 30, 1986, notice to question whether major supplier marking adequately meets the requirements of the marking statute.

Major Supplier Marking

Many of the comments received in response to the July 30, 1986 notice discussed the feasibility of major supplier marking for fruit juices, other than orange juice, made from imported concentrate. Most of the comments concerned the apple juice. These comments stated that apple juice concentrate is imported in large quantities from many countries, that the relative quantities imported from these countries vary greatly from year to year and season to season, and that processing in the U.S. often requires that apple juice from a variety of sources be blended to achieve desired characteristics. Because of these factors, many commenters on behalf of the domestic apple industry stated that marking that lists the name of a single country that accounts for the origin of 75 percent of a product and does not list all countries from which the product in a particular container is derived is meaningless. On the other hand, because of the same factors, many commenters on behalf of the processors of apple juice concentrate claimed that major supplier marking is as informative for apple juice concentrate as it is for orange juice concentrate, and that it would be economically prohibitive to require containers of apple juice concentrate to be marked to indicate all sources of concentrate or juice within a container.

The U.S House of Representatives Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce has urged Customs to adopt specific country of origin marking of fruit juice containers for public health reasons. The subcommittee has told Customs that a number of pesticides banned in the U.S. are routinely applied to crops overseas, particularly in developing countries. The subcommittee pointed out that listing of all countries of origin of juice concentrate on juice containers would facilitate better monitoring and tracing of imported juice and juice concentrate and would allow consumers to protect themselves from potential health threats.

Uniformity of Marking for all Fruit Juices

Although many of the comments received by Customs address the adequacy of major supplier marking with respect to apple juice products, the same question clearly applies to other juice products as well; that is, whether the origin disclosure made by major supplier marking satisfies the requirements of the law. Moreover, the public health concerns raised with respect to apply juice are equally applicable to other fruit juices.

Accordingly, Customs proposes to require that all fruit juices made from foreign concentrate, including orange juice, be labeled to indicate all actual sources of concentrate contained in a particular package of juice. For example, if a can of juice contains a blend of concentrate from three foreign countries, all three countries must be indicated on

the label. This proposal encompasses all fruit juice concentrate which undergoes processing in the U.S. similar to the processing described in C.S.D. 85–47; *i.e.*, blending with other batches of concentrate; addition of water, oils, and essences; pasteurization or freezing; and repacking. If the proposed rule is adopted, processors of apple juice and other fruit juices, including those of orange juice, that use imported concentrate would no longer be allowed to use major supplier marking.

Comments

All public comments submitted on this issue will be considered before a final determination is reached regarding the method of marking that will be required for fruit juices. Customs will consider any written comments timely submitted. Comments submitted will be available for public inspection in accordance with the Freedom of Information Act (5 U.S.C. 552), §1.4, Treasury Department Regulations (31 CFR 1.4), and § 103.11(b), Customs Regulations (19 CFR 103.11(b)), between 9 a.m. and 4:30 p.m. on normal buisness days, at the Regulations and Disclosures Law Branch, Room 2324, U.S. Customs Service Headquarters, 1301 Constitution Avenue NW., Washington, DC 20229.

Drafting Information

The principal author of this document was Harold M. Singer, Office of Regulations and Rulings, U.S. Customs Service. However, personnel from other offices participated in its development.

Edward F. Kwas,

Acting Commissioner of Customs.

May 11, 1988.

Approved:

Francis A. Keating, II,

Assistant Secretary of the Treasury.

[FR Doc. 88–12783 Filed 6–6–88; 8:45 am]

BILLING CODE 4820-02-M

DEPARTMENT OF COMMERCE

Patent and Trademark Office

37 CFR Part 10

[Docket No. 80340–8040]

Practice Before the Patent and Trademark Office; Government Employees

AGENCY: Patent and Trademark Office, Commerce.

ACTION: Notice of proposed rulemaking.

SUMMARY: This notice of proposed rulemaking sets forth changes that the Patent and Trademark Office (PTO) is proposing to the rules governing admission of Government employees to practice before the PTO in patent cases. Those rules presently permit officers and employees of the Government to be registered only if their official duties include preparation and prosecution of patent applications. A recent decision of the U.S. District Court for the District of Columbia has held that these rules are partially invalid. By this notice of proposed rulemaking, the PTO intends to conform the rules to the court's decision and to eliminate an "inactive" status designation of registered attorneys and agents who became employed by the Government, but do not engage in the preparation and prosecution of patent applications.

DATES: Comments must be submitted on or before August 9, 1988.

ADDRESS: Address written comments to Box 8, Commissioner of Patents and Trademarks, Washington, DC 20231 marked to the attention of Nancy C. Slutter.

FOR FURTHER INFORMATION CONTACT: Nancy C. Slutter by telephone at (703) 557–4035 or by mail marked to her attention and addressed to Box 8, Commissioner of Patents and Trademarks, Washington, DC

SUPPLEMENTARY INFORMATION: Attorneys and agents must be admitted to practice before the Patent and Trademark Office (PTO) in patent cases. 35 U.S.C. 31; 37 CFR 10.10. The purpose of the proposed rule change is to allow federal employees who fulfill the requirements for registration set forth at 37 CFR 10.7 to have their names placed on the PTO register of attorneys and agents.

The rules, as presently written, provide that an officer or employee of the Government whose official duties include preparation and prosecution of patent applications may be registered. 37 CFR 10.6(d). Under the rule, all other Government employees will not be registered. If a registered practitioner becomes an employee, the rule requires that the practitioner's name be endorsed as "inactive."

In a recent decision by the U.S. District Court for the District of Columbia, portions of 37 CFR 10.6(d) were held to be invalid. In that case, an attorney presently employed by a federal agency petitioned the Commissioner, requesting that his name be placed (with an inactive designation) on the register of attorneys and agents entitled to practice before the PTO in patent cases. His petition was denied in view of 37 CFR 10.6(d). *In re Athridge*, 230 USPQ 470 (Comm'r Pat. 1986). Following the Commissioner's decision, the attorney sought judicial review in the U.S. District Court for the Dsitrict of Columbia. The court determined that 37 CFR 10.6(d) was invalid to the extent that it precluded registration of an otherwise qualified individual solely on the basis of his status as a Government employee. Based on its determination, the court held that the employee could be registered and designated as "inactive." *Athridge v. Quigg*, 655 F.Supp. 779, 3 USPQ 2d 1391 (D.D.C. 1987).

The rule changes proposed herein would eliminate 37 CFR 10.6(d). The effect of removing § 10.6(d) will permit otherwise qualified Government employees to be registered to practice before the PTO in patent cases. Registration, however, will not relieve any Government employee from otherwise complying with conflict of interest requirements, e.g., 18 U.S.C. 203, 205, 207, applicable agency regulations and personnel practices, and applicable codes of professional responsibility.

Other Considerations

The proposed rule change will not have a significant impact on the quality of the human environment or the conservation of energy resources.

The proposed rule change is in conformity with the requirements of the Regulatory Flexibility Act (Pub. L. 96–354), Executive Orders 12291 and 12612, and the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*

The General Counsel of the Department of Commerce has certified to the Small Business Administration that the proposed rule change will not have a significant adverse economic impact on a substantial number of small entities (Regulatory Flexibility Act, Pub. L. 96–354). The proposed rule change allowing Government employees who meet the requirements set forth at 37 CFR 10.7 to have their names placed on the Patent and Trademark Office register of attorneys and agents would not be expected to result in an increase of fees charged by attorneys and agents to entities, including small entities.

The Patent and Trademark Office has determined that this rule change is not a major rule under Executive Order 12291. The annual effect to the economy will be less than $100 million. There will be no major increase in costs or prices for consumers, individual industries, federal, state or local government agencies, or geographic regions. There will be no significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-

based enterprises in domestic or export markets.

The PTO has also determined that this notice has no federalism implications affecting the relationship between the national government and the states as outlined in Executive Order 12612.

The rule change will not impose any additional burden under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.* Office of Management and Budget approval of the registration information reporting requirements contained in the proposed rules was extended until July 31, 1990, OMB Control No. 0651–0012.

List of Subjects in 37 CFR Part 10

Administrative practice and procedure, Conflicts of interest, Courts, Inventions and patents, lawyers.

Notice is hereby given that, pursuant to the authority granted to the Commissioner of Patents and Trademarks by 35 U.S.C. 6 and 31, the Patent and Trademark Office proposes to amend Title 37 of the Code of the Federal Regulations as set forth below:

It is proposed to amend 37 CFR Part 10, as follows wherein removals are indicated by brackets and additions by arrows:

PART 10—REPRESENTATION OF OTHERS BEFORE THE PATENT AND TRADEMARK OFFICE

1. The authority citation for 37 CFR Part 10 would continue to read as follows:

Authority: 5 U.S.C. 500; 15 U.S.C. 1123; 35 U.S.C. 6, 31, 32, 41.

§ 10.6 [Amended]

2. Section 10.6 is proposed to be amended by removing paragraph (d) and redesignating paragraph (e) as § 10.10(b).

3. Section 10.10 is proposed to be amended by revising the title, redesignating the text as paragraph (a), revising newly redesignated paragraph (b) and adding new paragraphs (c) and (d) to read as follows:

§ 10.10 ►Restrictions on◄ [Individuals not registerd recognized to] practice in patent cases.

►(a)◄ * * *

(b) [No individual who has served in the Office will be registered after termination of his or her services, nor if registered before such service, be reinstated, unless he or she signs a written statement indicating that he or she has read 18 U.S.C. 207.] No individual who has served in the patent examining corps of the Office ►may practice before the Office◄ [will be registered] after termination of his or her service, [nor if registered before such service, be reinstated,] unless he or she signs a written undertaking (1) not to prosecute or aid in any manner in the prosecution of any patent application pending in any patent examining group during his or her period of service therein and (2) not to prepare or prosecute or to assist in any manner in the preparation or prosecution of any patent application of another (i) assigned to such group for examination and (ii) filed within two years after the date he or she left such group, without written authorization of the Director. Associated and related classes in other patent examining groups may be required to be included in the undertaking or designated classes may be excluded from the undertaking. When an application for registration [or reinstatement] is made after resignation from the Office, the applicant will not be registered [or reinstated] if he or she has prepared or prosecuted or assisted in the preparation or prosecution of any patent application as indicated in the paragraph.

►Preparation or prosecution or providing assistance in the preparation or prosecution of any patent application contrary to the provisions of this paragraph shall constitute misconduct under § 10.23(c)(13) of this part.◄

(Approved by the Office of Management and Budget under control number 0651–0012)

►(c) A practitioner who is an employee of the Office cannot prosecute or aid in any manner in the prosecution of any patent application before the Office.

(d) Practice before the Office by Government employees is subject to any applicable conflict of interest laws, regulations or codes of professional responsibility.◄

4. Section 10.23 is proposed to be amended by revising paragraph (c)(13) and by adding new paragraphs (c)(19) and (c)(20) to read as follows:

§ 10.23 Misconduct.

* * * * *

(c) * * *

(13) Knowingly preparing or prosecuting a patent application in violation of an undertaking signed under ►§ 10.10(b)◄ [§ 10.6].

* * * * *

►(19) Action by an employee of the Office contrary to the provisions set forth in § 10.10(c).

(20 Knowing practice by a Government employee contrary to applicable federal conflict of interest laws, or regulations of the Department, agency or commission employing said individual.◄

* * * * *

Date: May 3, 1988.

Donald J. Quigg,

Assistant Secretary and Commissioner of Patents and Trademarks.

[FR Doc. 88–12786 Filed 6–6–88; 8:45 am]

BILLING CODE 3510–16–M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 180

[PP OF2389/P452; FRL–3392–7]

Pesticide Tolerance for Permethrin

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: This document proposes that tolerances be established for the combined residues of the insecticide permethrin and its metabolites in or on the raw agricultural commodities alfalfa (fresh) and alfalfa hay; meat, fat, and meat byproducts of cattle, goats, hogs, horses, and sheep; milk; poultry; and eggs. This proposal to establish maximum permissible levels for the combined residues of permethrin was requested pursuant to petitions by FMC Corp.

DATE: Comments, identified by the document control number [PP OF2389/P452], must be received on or before June 22, 1988.

ADDRESS: By mail, submit written comments to: Information Service Section, Program Management and Support Division (TS–757C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St. SW., Washington, DC 20460.

Information submitted as comment concerning this document may be claimed confidential by marking any part or all of that information as "Confidential Business Information" (CBI). Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR Part 2. A copy of the comment that does not contain CBI must be submitted for inclusion in the public record. Information not marked confidential may be disclosed publicly by EPA without prior notice. All written comments will be available for public inspection in Rm. 246 at the address given above, from 8 a.m. to 4 p.m., Monday through Friday, except legal holidays.

FOR FURTHER INFORMATION CONTACT: By mail: George LaRocca, Product Manager (PM) 15, Registration Division (TS–767C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St. SW., Washington, DC 20460.

Office location and telephone number: Rm. 204,CM #2, 1921 Jefferson Davis Highway, Arlington, VA 22202, (703)–557–2400.

SUPPLEMENTARY INFORMATION: EPA issued a notice, published in the Federal Register of October 8, 1980 (45 FR 66863), which announced that FMC Corp., Agricultural Chemical Group, 2000 Market St., Philadelphia, PA 19103, had submitted pesticide petition OF2389 to the Agency proposing to establish new tolerances and amend existing tolerances for the combined residues of the insecticide permethrin [(3-phenoxypheny!)methyl 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate] and its metabolites *cis* and *trans* 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropoanecarboxylic acid, 3-phenoxybenzyl alcohol, and 3-phenoxybenzoic acid in or on the following raw agricultural commodites: alfalfa, fresh at 20.0 parts per million; alfalfa, hay at 65 ppm; meat and meat byproducts of cattle, goats, hogs, horses, and sheep to 2.0 ppm; milk to 0.5 ppm; poultry to 0.1 ppm; eggs to 1.0 ppm; and potatoes at 0.05 ppm. The tolerance expression was later revised to include the metabolite 3-phenoxybenzoic acid for animal commodities.

On March 30, 1988 (53 FR 10286), EPA announced the filing of an amended petition by FMC Corp. increasing the tolerances on alfalfa, fresh from 20 ppm to 25ppm; fat of cattle, hogs, and horses to 2.5 ppm; fat of goats and sheep at 3.0 ppm; meat of cattle, hogs, horses, sheep, and goats at 0.25 ppm; meat byproducts of cattle, goats, hogs, horses, and sheep at 2.0 ppm; and milk fat at 6.25 ppm, reflecting 0.25 ppm in whole milk. The proposed tolerance in or on potatoes at 0.25 was withdrawn in October 1982. The proposed tolerance for residues of permethrin in or on alfalfa, hay was also decreased from 65 ppm to 55 ppm.

There no comments or requests for referral to an advisory committee received in response to the notice of filing. The petitioner has subsequently amended the petition by increasing the tolerance levels for cattle, fat; hogs, fat; and horses, fat to 3.0 ppm; poultry, fat to 0.15 ppm; and poultry mbyp to 0.25 ppm.

The toxicity data submitted and other relevant material have been previsouly evaluated and discussed in detail in a final rule document on permethrin published in the Federal Register of October 13, 1982 (47 FR 45008).

The acceptable daily intake (ADI) based on a NOEL of 5 mg/kg/day from a 2-year rat feeding study and a safety factor of 100 is 0.05 mg/kg body weight/day. The theoretical maximum residue contribution from all food uses (including the proposed use on alfalfa and other pending tolerances) is 0.017131 mg/kg body weight/day; this is equivalent to about 36 percent of the ADI.

The metabolism of permethrin is adequately understood, and an adequate analytical method, gas-liquid chromatography with an electron capture detector or a mass spectrometer detector, is available for enforcement purposes. No actions are pending against continued registration of permethrin, nor are any other considerations involved in establishing the tolerances.

The tolerance established by amending 40 CFR 180.378 will be adequate to cover residues in alfalfa (fresh); alfalfa, hay; meat fat and meat byproducts of cattle, goats, hogs, horses, and sheep; milk; poultry; and eggs.

The pesticide is considered useful for the purpose for which the tolerances are sought. It is concluded that the tolerances will protect the public health, and they are established as set forth below.

Interested persons are invited to submit written comments on the proposed regulation. As provided for in the Administrative Procedure Act (5 U.S.C. 553(d)(3)), the time for comments is being limited to 15 days in order that the permanent tolerance may be established in the second week of June 1988. Comments must bear a notation indicating the document control number, [PP OF2389/P452]. Written comments filed in response to this proposed rule will be available in the Information Service Section at the address given above, from 8 a.m. to 4 p.m., Monday through Friday, except legal holidays.

Pursuant to the requirements of the Regulatory Flexibility Act (Pub. L. 96–354, 94 Stat. 1164, 5 U.S.C. 601–612), the Administrator has determined that regulations establishing new tolerances or raising tolerance levels or establishing exemptions from tolerance requirements do not have a significant economic impact on a substantial number of small entities. A certification statement to this effect was published in the Federal Register of May 4, 1981 (46 FR 24950).

The Office of Management and Budget has exempted this rule from the requirements of section 3 of Executive Order 12291.

(Sec. 408(d)(2), 68 Stat. 512 (21 U.S.C. 346a(d)(2)).)

List of Subjects in 40 CFR Part 180

Administrative practice and procedure, Agriculture commodities, Pesticides and pests.

Dated: May 27, 1988.

Douglas D. Campt,

Director, Office of Pesticide Programs.

Therefore, 40 CFR Part 180 is amended as follows:

PART 180—[AMENDED]

1. The authority citation continues to read as follows:

Authority: 21 U.S.C. 346a.

2. Section 180.378 is amended in paragraph (b) by adding and alphabetically inserting the commodities alfalfa, fresh and alfalfa, hay and in paragraph (c) by revising the entries for eggs; fat, meat, and meat byproducts (mbyp) of cattle, goats, hogs, horses, poultry and sheep; milk; and eggs, to read as follows:

§ 180.378 Permethrin; tolerances for residues.

* * * * *

(b) * * *

Commodity	Parts per million
Alfalfa, fresh	25.0
Alfalfa, hay	55.0

* * * * *

(c) * * *

Commodities	Parts per million
Cattle, fat	2.5
Cattle, meat	0.25
Cattle, mbyp	2.0
Eggs	1.0
Goats, fat	3.0
Goats, meat	0.25
Goats, mbyp	2.0
Hogs, fat	2.5
Hogs, meat	0.25
Hogs, mbyp	2.0
Horses, fat	2.5
Horses, meat	0.25
Horses, mbyp	2.0
Milk fat (reflecting 0.25ppm in whole milk)	6.25
Poultry, fat	1.0
Sheep, fat	3.0
Sheep, meat	0.25
Sheep, mbyp	2.0

[FR Doc. 88–12767 Filed 6–6–88; 8:45 am]

BILLING CODE 6560–50–M

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 20

Migratory Bird Hunting; Supplemental Proposals for Migratory Game Bird Hunting Regulations

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Supplemental proposed rule.

SUMMARY: In the March 9, 1988, **Federal Register**2 (53 FR 7702) the public was notified that the U.S. Fish and Wildlife Services (hereinafter the Service) proposes to establish hunting regulations for certain migratory game birds during 1988–89, and provided information on certain proposed regulations. This proposed rulemaking provides supplemental proposals for the early- and late-season migratory bird hunting regulations frameworks.

The early hunting seasons open prior to October 1 and include seasons on mourning, white-winged and white-tipped doves, band-tailed pigeons, woodcock, common snipe, rails, moorhens and gallinules, teal and sea ducks; experimental September duck seasons in Florida, Iowa, Kentucky, and Tennessee; experimental September Canada goose seasons in portions of Michigan, Minnesota and Illinois; a special sandhill crane-Canada goose season in southwestern Wyoming; sandhill cranes in the Central and Pacific Flyways; migratory bird hunting seasons in Alaska, Hawaii, Puerto Rico and the Virgin Islands; and extended falconry seasons. Late seasons open about October 1 or later and include those for most waterfowl, and seasons not previously selected for other species. The Service annually prescribes hunting regulations frameworks within which the States select specific seasons. The effect of this rulemaking is to facilitate establishment of early- and late-season migratory bird hunting regulations for the 1988–89 season.

DATES: The comment period for proposed migratory bird hunting season frameworks for Alaska, Hawaii, Puerto Rico and the Virgin Islands will end on June 22, 1988; that for other early-season frameworks proposals will end on July 18, 1988; and that for late-season frameworks proposals on August 29, 1988. Public hearings on proposed early- and late-seasons frameworks will be held on June 22 and August 3, 1988, respectively (53 FR 7702).

ADDRESSES: Send comments to: Director (FWS/MBMO), U.S. Fish and Wildlife Service, Department of the Interior, Matomic Building-Room 536, Washington, DC 20240. The public hearings will be held in the Auditorium of the Department of the Interior Building on C Street, between 18th and 19th Street NW., Washington DC. Notice of intention to participate in either hearing should be sent in writing to the Director at the address above.

Comments received on this supplemental proposed rulemaking will be available for public inspection during normal business hours in Room 536, Matomic Building, 1717 H Street NW., Washington, DC.

FOR FURTHER INFORMATION CONTACT: Rollin D. Sparrowe, Chief, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, Matomic Building—Room 536, Washington, DC 20240 (202–254–3207).

SUPPLEMENTARY INFORMATION: The annual process for developing migratory game bird hunting regulations deals with regulations for early and late seasons. Early seasons include those which open before October 1, while late seasons open about October 1 or later. Regulations are developed independently for early and late seasons. The early-seasons regulations cover mourning, white-winged and white-tipped doves, band-tailed pigeons, rails, moorhens and gallinules, woodcock, and common snipe; sea ducks in the Atlantic Flyway; teal in September in the Central and Mississippi Flyways; experimental September duck seasons in Florida, Iowa, Kentucky, and Tennessee; experimental September Canada goose seasons in portions of Michigan, Minnesota and Illinois; sandhill cranes in the Central and Pacific Flyways; a special sandhill crane-Canada goose season in southwestern Wyoming; doves in Hawaii; migratory game birds in Alaska, Puero Rico, and the Virgin Islands; and some extended falconry seasons. Late seasons include the general waterfowl seasons; special seasons for scaup and goldeneyes; extra scaup and teal during regular duck seasons; coots, moorhens and gallinules, and snipe in the Pacific Flyway; and other extended falconry seasons.

Certain general procedures are followed in developing regulations for the early and late seasons. Initial regulatory proposals are announced in a **Federal Register** document published in March and opened to public comment. These proposals are supplemented, as necessary, with additional **Federal Register** documents. Following review of comments received and after public hearings, the Service further develops and publishes proposed frameworks for times of seasons, season lengths, shooting hours, daily bag and possession limits, and other regulatory elements. After consideration of additional public comments, the Service publishes final frameworks in the **Federal Register**. Using these frameworks, State conservation agencies then select hunting season dates and options. Upon receipt of State selections, the Service publishes a final rule in the **Federal Register**, amending Subpart K of 50 CFR Part 20, to establish specific seasons, bag limits, and other regulations. The regulations become effective upon publication. States may prescribe more restrictive seasons than those provided in the final frameworks.

The regulations schedule for this year is as follows: On March 9, 1988, the Service published in the **Federal Register** (53 FR 7702) a proposal to amend 50 CFR Part 20, with public comment periods ending as noted above. The proposal dealt with establishment of seasons, limits and other regulations for migratory game birds under §§ 20.101 through 20.107, 20.109 and 20.110 of Subpart K. This document is the second in a series of proposed, supplemental, and final rules for migratory game bird hunting regulations. All comments on the March 9 proposal received through May 9, 1988, have been considered in developing this document. Comment periods on this second document are specified above under **DATES**. Final regulatory frameworks for migratory game bird hunting seasons for Alaska, Puerto Rico, and the Virgin Islands are targeted for **Federal Register** publication on or about July 27, 1988, and those for early seasons in other areas of the United States on August 10, 1988; and those for late seasons on September 16, 1988.

On June 22, 1988, a public hearing will be held in Washington, DC, as announced in the **Federal Register** of March 9, 1988, to review the status of mourning doves, woodcock, band-tailed pigeons, white-winged and white-tipped doves, rails, moorhens and gallinules, common snipe, and sandhill cranes. Recommended hunting regulations will be discussed for these species and for migratory game birds in Alaska, Puerto Rico and the Virgin Islands; September teal seasons in the Mississippi and Central Flyways; experimental September waterfowl seasons in designated States; sea duck seasons in the Altantic Flyway; and extended falconry seasons. Statements or comments are invited.

On August 3, 1988, a public hearing will be held in Washington, DC, as announced in the **Federal Register** of

March 9, 1988, to review the status and recommended hunting regulations for waterfowl not previously discussed at the June 22 public hearing.

This supplemental proposed rulemaking describes a number of changes which have been proposed by commenters on the original framework proposals published on March 9, 1988, in the **Federal Register**.

Review of Public Comments and the Service's Response

Written Comments Received

As of May 9, 1988, the Service had received comments on proposals published in the March 9, 1988, **Federal Register** (53 FR 7702) from 48 correspondents, including 7 State agencies, all four waterfowl flyway councils and 37 individuals. In some instances, the communications did not specifically mention the open comment period or the regulatory proposals; however, because they were received during the comment period and generally relate to migratory game bird hunting regulations, they are treated as comments. The comments are discussed below with particular attention to new proposals and modifications or clarifications to previously described proposals. Wherever possible, they are discussed under headings corresponding to the numbered items in the March 9, 1988, **Federal Register**. Comments received subsequent to May 9, 1987, as well as those received at the June 22, 1988, public hearing will be addressed in the next supplemental proposal targeted for publication in the **Federal Register** in early July.

In the March 9, 1988, **Federal Register** (at 53 FR 7705), the data used in regulatory decisions were outlined. At this time the Service does not have complete data from the spring breeding ground surveys but a preliminary assessment of breeding habitat was released in mid-May. The habitat conditions are not good and duck production may suffer. Restrictive duck regulations were enacted in 1985 in response to reduced duck breeding populations and fall flights, and were continued in 1986 and 1987 in response to low duck breeding populations and poor production. The Service notes that if populations need additional protection, further framework restrictions, to include outside dates, season lengths and bag limits, will be considered in the development of regulations for the 1988–89 hunting season. In addition, all aspects of past regulations which may have a bearing on possible harvest, including various special seasons and options, will be reviewed. Depending on full information from the May surveys, some actions will have to be decided for early season regulations. The public hearing for early seasons is scheduled for June 22, 1988.

General Comments

The Central Flyway Council has recommended adoption of the proposed basic regulations frameworks for 1988–89 hunting seasons on webless and waterfowl species pertinent to the Central Flyway except for specific recommendations given in the numbered headings that follow.

1. *Shooting hours.* a. An Illinois sportsman has recommended that shooting hours for 1988–89 waterfowl hunting, including hunting programs on State and Federal management areas, be standardized at 7:00 a.m. to 3:30 p.m. The individual feels the recommended shooting hours would eliminate waterfowl identification problems that may occur during poor light conditions early and late in the day, and would decrease the amount of time each day that ducks are disturbed by hunters.

Response. The Service has previously addressed the issue of shooting hours in an Environmental Assessment (EA), *Proposed Shooting Hours Regulations*, dated August 1, 1977. Based on information in this EA and findings from a subsequent study, *Shooting Activities of Waterfowl Hunters in Relation to Time of Day, and Abundance and Availability of Protected and Non-Protected Species of Birds*, it was concluded that early morning and late afternoon shooting of protected species was inconsequential. There has been no new information developed that indicates present shooting hours are harmful to the resource. Shooting hours of one-half hour before sunrise have been in effect during most years since 1918, when Federal establishment of migratory bird regulations began. The Service intends to continue the present shooting hours framework.

2. *Framework for ducks in the conterminous United States—outside dates, season length and bag limits.* a. An Illinois sportsman has recommended that the 1988–89 regulatory frameworks for duck hunting permit a 50-day split season and that the point values in the point-system be revised to give more protection to the hens of most species and eliminate the accidental taking of protected species.

Response. The Service will consider these recommendations when the late-season frameworks are developed in early August.

b. A Minnesota and a Louisiana sportsman have each recommended that the point-system bag-limit option be eliminated, and an individual from Vermont urges the Service to shorten the duck hunting season and reduce the daily bag limit.

Response. These recommendations will be considered by the Service in early August when the late-season frameworks are developed.

3. *American black ducks.* a. The Massachusetts Division of Fisheries and Wildlife submitted comments on the four regulatory options for harvest management of black ducks that were noted in the March 9, 1988, **Federal Register** (at 53 FR 7708). Massachusetts indicated that although they believed further harvest restrictions will be necessary to increase black duck population levels, the 1987–88 regulatory frameworks should be continued in 1988–89 while Canada completes its 5-year harvest reduction program, and then both countries can develop a joint harvest reduction plan.

b. New Jersey, in commenting on the four regulatory options for black duck harvest management, expressed support for continuation of current restrictive frameworks.

Response. These recommendations will be considered in early August when the late-season frameworks are developed.

4. *Wood ducks.* a. In the March 9, 1988, **Federal Register** (53 FR 7708), the Service outlined the regulations of recent years that permit southeastern States the option of selecting an early October duck season with no special wood duck bag limit restrictions. In that document the Service noted such seasons and bag limits were under review because the effect of such seasons on wood ducks is not well known. At a February 1988 symposium addressing wood duck status and management the Service indicated that preseason banding programs are not presently meeting required sample sizes to evaluate proposed or existing special seasons on a State by State basis. In the absence of an adequate data base, the Service feels wood duck harvest management should exist on a broader basis. The Service reaffirms its interest in wood duck management and will propose a program to gather information needed to address questions of harvest, recruitment and survival of wood ducks. The Service asks the Atlantic and Mississippi Flyway Councils to review existing harvest strategies and give consideration to their proper evaluation.

8. *Experimental September duck season.* a. At its March meeting the Lower Region Regulations Committee of the Mississippi Flyway Council endorsed a recommendation for the

continuation of the experimental September duck seasons in Kentucky and Tennessee for 1988. The Committee indicated that continuation of these seasons would permit further evaluation of the reduction in the wood duck bag limits prescribed in 1986 and 1987, and added that Kentucky recently initiated a research project that should provide additional insight on the effects of the early season on local wood ducks.

Response. As noted earlier in this document, preliminary results of the waterfowl breeding ground surveys and the depressed status of waterfowl populations may require review of harvest management strategies such as September duck seasons. The Service will consider this recommendation when the early-season frameworks are developed in late June.

12. *Canvasback and redhead ducks.* a. At its March meeting the Atlantic Flyway Council endorsed a recommendation requesting the Service to complete its review of the final report on the Flyway's experimental canvasback seasons (1983–1985) in order that the harvest strategy can be considered when the canvasback population increases and is able to support a hunting season.

Response. The Service will complete its review of the final report on the Atlantic Flyway's experimental canvasback seasons (1983–85).

Recommendations to develop a North American canvasback management plan have recently been made. The Service believes this may be the proper approach to developing an international harvest strategy for canvasbacks. Ways to accomplish this task are being explored.

13. *Duck zones.* The question of the proper flyway alignment of the State of Louisiana with respect to waterfowl management has been pending for several years. The Service believes this issue should be resolved prior to the opening of the 1988 waterfowl hunting season. Louisiana has been considered a Mississippi Flyway State since the flyway-management system was established in 1948. However, results of cooperative studies conducted by the Service and the Louisiana Department of Wildlife and Fisheries during 1975–81 indicated that a substantial proportion of ducks wintering in western Louisiana migrates through the Central Flyway, but there are marked differences among species in the proportions received from each flyway. Further, a wide variety of species are important in the Louisiana duck harvest, most of which are lightly harvested in comparison with the mallard. Two basic issues exit—the question of proper flyway affinity of ducks that winter or migrate through Louisiana, and whether the varied bag of formerly lightly gunned and abundant species warranted special regulations in western Louisiana. One confounding problem, however, is that the source of the mallards throughout Louisiana is the heavily gunned Mississippi Flyway birds.

These studies led to the establishment of two experimental zones in Louisiana—a western zone and an eastern zone. Since 1975 the season length in the experimental western zone has been 5 days longer than that provided for the rest of the Mississippi Flyway, while the entire State has been governed by Mississippi Flyway bag limits. In 1984 (49 FR 22420) the Service proposed to establish, beginning in 1985, a permanent west zone in Louisiana with Central Flyway season length while retaining Mississippi Flyway bag limits statewide. Most responses opposed such a change on the grounds that it would increase an already large duck harvest in Louisiana.

Subsequent to the initiation of the study, populations of many duck species, particularly mallards, pintails and blue-winged teal, have declined to very low levels and do not appear likely to recover quickly. The duck harvest in Louisiana has grown markedly since the cooperative studies began, to a point where sustained additional harvest may be detrimental to the long-term welfare of breeding stocks. Some of this additional harvest has resulted from regulatory changes made by the Service to provide additional recreational opportunity directed at lightly-harvested species such as pintails and blue-winged teal. These and other species have declined, and the Service believes that continuation of such management strategies is no longer appropriate, and will review a number of such strategies over time. Since 1985, the Service's efforts have focused on reducing harest and it appears that such an objective may be a necessary part of waterfowl management until populations recover.

The depressed population of many duck species and a full review of migratory bird harvest management practices have changed the Service's position on the west zone of Louisiana. The issue has been evaluated in the Draft Supplemental Environmental Impact Statement on the Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (SEIS) which should be available in final form by July 1988. The SEIS reaffirms that the administrative flyways, while not biologically precise, are appropriate and disirable units for effective management of waterfowl, and that not all the complexities of differences in affinities of migratory birds can be accommodated by regulations.

In summary, because of the depressed status of several duck species, reduced reproductive capacity of their breeding habitats, and an increase in the overall impact of Louisiana's duck harvest on Mississippi and Central Flyway duck populations, the Service will henceforth consider Louisiana as part of the Mississippi Flyway for the purpose of waterfowl management.

14. *Frameworks for geese and brant in the conterminous United States—outside dates, season length and bag limits.* a. The Atlantic Flyway Council endorsed the following recommendations at its March meeting:

i. That 1988–89 regulatory frameworks for Atlantic brant be established to provide for a 50-day season and a 2-bird daily bag limit pending an evaluation of the 1988 brant production. The Council noted that the 1987–88 season frameworks allowed a 30-day season and 2 brant daily, but indicated that the 1988 winter count of brant increased and the birds should arrive on the breeding grounds in excellent shape because sea lettuce, the species' major food, was very abundant this past winter. Unless there is extremely poor brant production in 1988 the Council believes the recommended frameworks are justified.

Response. The Service defers action on the recommendation until the late-season frameworks are developed in early August, at which time more information about the status of Atlantic brant will be available.

ii. That the regulatory frameworks for snow geese in the Atlantic Flyway be stabilized at the current level of 90 days and 4 snow geese daily until such time that the status of the population or biological investigation warrants a review.

Response. The Service notes the regulatory frameworks for Atlantic Flyway snow geese have been unchanged for many years, but believes action on the request to stabilize the frameworks should be deferred until a harvest management plan for Atlantic Flyway snow geese is developed and approved.

b. The Upper Region Regulations Committee of the Mississippi Flyway Council endorsed a recommendation at its March meeting that Indiana be permitted to eliminate two mandatory check-stations in its Posey County harvest zone for Mississippi Valley Population Canada geese. The State has indicated that of the total Posey County harvest during the past 3 seasons,

Hovey Lake has averaged 94 percent and therefore the total kill for the harvest zone can be extrapolated solely from the known harvest at the Hovey Lake check-station.

Response. The Service supports the request to use only the Hovey Lake check-station to estimate the Posey County harvest of Canada geese but will consider all comments received.

c. The Lower Region Regulations Committee of the Mississippi Flyway Council endorsed the following recommendations at its March meeting:

1. That the 1987–88 snow goose season regulatory frameworks for Arkansas, including a January 31 framework closing date, be continued in 1988–89, and the 1988–89 regulatory frameworks for white-fronted geese in Arkansas permit the State's season to run concurrent with its snow goose season pending evaluation of the status and production information for mid-continent white-fronted geese.

Response. The Service defers action on the recommendations until the late-season frameworks are developed in early August, at which time more information about the status of snow geese and white-fronted geese will be available. With respect to the recommendation regarding whitefronts, the Service notes that the mid-continent white-fronted goose population is shared by the Mississippi and Central Flyways and that mid-winter and spring surveys indicate this population may be declining in part of its range; therefore, this recommendation should be discussed by both Flyway Councils.

ii. That the 1987–88 regulatory frameworks that included Arkansas in the harvest allocation procedures for Mississippi Valley Population of Canada geese and prescribed a January 31 framework closing date be continued in 1988–89.

Response. Service action on this recommendation is deferred until the late-season frameworks are developed in early August, at which time more information about the status of Canada geese will be available.

d. An Illinois sportsman has recommended that the 1988–89 regulatory frameworks for hunting Canada geese permit a split season concurrent with the duck season and extending through early January.

Response. This recommendation will be considered by the Service when late-season frameworks are developed in early August.

e. A group of landowners and sportsmen from the mid-Willamette Valley of Oregon has requested a change in the regulatory frameworks for hunting geese in western Oregon that would allow hunting from December 1 through February 15. This late season is requested to help reduce late-winter goose depredations.

Response. The Service defers action on this request pending receipt of additional comments. Regulatory frameworks for hunting geese in Oregon will be developed in early August.

f. In a **Federal Register** document dated July 2, 1987 (at 52 FR 25174) the Service mentioned criteria were being developed for special resident Canada goose seasons but focused only on those criteria for early Canada goose seasons. In the intervening period additional discussions of criteria for the special seasons have occurred at flyway council and technical section meetings. Special experimental early Canada goose seasons have been established in Minnesota, Michigan and Illinois. A Memorandum of Agreement between the Service and each State was established for each of these seasons. These Memoranda of Agreement contain criteria that the Service intends to use to evaluate future special early seasons. These criteria are:

1. A State may hold a Canada goose season of up to 10 consecutive days between September 1 and September 10—this is in addition to its regular season.

2. During the September season the daily bag and possession limits may be no more than 5 and 10 Canada geese, respectively.

3. The area(s) open to hunting will be described in State regulations.

4. Provisions for discontinuing, extending or modifying the season will be included in the Memorandum of Agreement.

5. The evaluation required of the State will be incorporated in the Memorandum of Agreement and will include at the least the following:

i. Neck-collar observations and population surveys beginning a year prior to the requested season and continuing during the experiment.

ii. Determine derivation of neck-collar codes from observations and harvested geese.

iii. Collect morphological information from harvested geese to ascertain probable source population(s) of harvest.

iv. Analyze band recovery data.

v. Analyze hunter activity and estimate harvest.

vi. Prepare annual and final reports of the study.

Efforts are still underway to develop criteria for special late Canada goose seasons.

g. The Pacific Flyway Council recommended a change in the regulatory frameworks for brant seasons in Alaska. This recommendation is responded to in item 25.

15. *Tundra swans.* a. The Atlantic Flyway Council has endorsed the hunt plan for Eastern Population tundra swans and in accordance with that plan has recommended that North Carolina, Virginia and New Jersey be allowed to participate in special-permit swan hunts. Permit quotas would be 6,000, 600 and 200, respectively, for North Carolina, Virginia and New Jersey. In addition, New Jersey and Virginia have submitted copies of their proposals for an experimental swan season. New Jersey indicated the season would be limited to Salem, Cumberland and Burlington Counties, and only 200 permits would be issued with an anticipated harvest of less than 60 swans. Virginia proposes a 90-day season concurrent with its snow goose season; 600 permits would be issued with an expected harvest of 300 swans.

Response. The Service also is reviewing recommendations from the Pacific, Central and Mississippi Flyway Councils regarding the hunt plan for Eastern Population tundra swans. Action on the Atlantic Flyway Council's recommendation regarding swan hunting seasons in North Carolina, Virginia and New Jersey, and on the proposals from New Jersey and Virginia is deferred until early August at which time regulatory frameworks for tundra swan hunting seasons will be developed.

b. At its March meeting, the Pacific Flyway Council endorsed Montana's proposal to add four counties to the two counties in the Pacific Flyway area of the State in which tundra swans are hunted. Hill, Liberty, Toole and Pondera Counties are recommended to be added to Teton and Cascade Counties, but the number of permits authorized (500) would not increase.

Response. The Service will consider this recommendation when the regulatory frameworks for tundra swan seasons are developed in early August.

c. Twenty-five individuals have submitted comments urging the Service not to permit sport hunting of swans.

Response. The Service will consider these comments when the frameworks for tundra swan hunting are developed in early August.

d. The Pacific Flyway Council endorsed a proposed experimental tundra swan hunting season on Alaska's Seward Peninsula. This recommendation is responded to in item 25.

16. *Sandhill cranes.* a. The Pacific and Central Flyway Councils recommended

that the experimental sandhill crane hunting season in New Mexico's Middle Rio Grande Valley be continued in 1988–89.

Response. The Service notes both Councils' recommendations. Regulatory frameworks for 1988–89 sandhill crane hunting seasons will be developed in late June.

b. The Central Flyway Council has recommended that the sandhill crane hunting season in the Hatch-Deming area of New Mexico (portions of Sierra, Luna and Dona Ana Counties) be granted operational status (up to 350 permits; 3 cranes daily and 9 per season; not to exceed 30 days between September 1 and January 31).

In a separate but related action the Central Flyway Council has recommended that an exception to the outside framework dates of September 1 and November 30, as called for in the Pacific and Central Flyway Management Plan for Rocky Mountain Population Sandhill Cranes, be made for Sierra, Luna and Dona Ana Counties of New Mexico. The outside frameworks for these three counties would be September 1 and January 31. The exception is requested in order to accommodate the Hatch-Deming area sandhill crane hunt in southwest New Mexico noted above.

The Pacific Flyway Council has recommended that New Mexico be permitted to conduct a sandhill crane hunting season in the Hatch-Deming area with the following stipulations:

i. Both New Mexico hunts combined (Middle Rio Grande Valley and Hatch-Deming) be designed to harvest no more than 749 Rocky Mountain Population sandhill cranes.

ii. The harvest rate of greater sandhill cranes should be assumed to be 35 percent until data prove otherwise.

iii. Data relative to racial composition of the harvest will be collected.

iv. If needed, the season length will be adjusted by New Mexico to comply with the 30-day season framework in the joint management plan for Rocky Mountain Population sandhill cranes.

Response. Service action on this requested season is deferred until the proposed frameworks for hunting sandhill cranes are developed in early June.

c. The Pacific Flyway Council recommends Wyoming's proposal to eliminate hunting Canada geese in the Bear River area and to reduce the number of permits in its Salt River sandhill crane-Canada goose hunt area from 60 to 40.

Response. The Service notes the Pacific Flyway Council's recommendation.

d. In 1987 the Service approved frameworks recommendations from the Central and Pacific Flyway Councils for operational seasons for hunting sandhill cranes within the range of the Rocky Mountain Population in Arizona, Colorado, Idaho, Montana, New Mexico, Utah and Wyoming (See August 6, 1987, 52 FR 29194). The Pacific Flyway Council has give notice that Utah, in accordance with those frameworks, will initiate experimental sandhill crane seasons in Rich and Cache Counties, September 3–5, and September 10–12, 1988. Fifty permits, allowing the take of 1 sandhill crane per season, will be issued for each county. The Central Flyway Council endorses the Utah season.

Response. The Service notes Utah's intent to initiate an experimental sandhill crane season in 1988–89.

e. Montana has alerted the Service that it is considering requesting a change in its sandhill crane hunting season that would allow crane hunting in the area south of Interstate Highway 90 and west of the Bighorn River.

Response. The Service notes Montana's request is tentative pending approval by the Central and Pacific Flyway Councils and the State's Fish and Game Commission.

17. *Coots.* a. At its March meeting the Mississippi Flyway Council's Upper Region Regulations Committee adopted a recommendation that the regulatory frameworks for coot hunting be concurrent with the regulatory frameworks for the regular duck season only. The Committee indicated that permitting hunters to take coots during special duck hunting seasons would only provide hunters increased opportunity to accidentally or willfully harvest other species illegally.

Response. The Service notes the Committee's recommendation.

b. The Central Flyway Council has recommended the regulatory frameworks for coot hunting coincide with all duck hunting seasons, including September teal seasons and other special duck seasons.

Response. A similar recommendation from the Central Flyway Council was addressed by the Service in the March 9, 1988, Federal Register (at 53 FR 7710). The Service reiterates its intent to continue to limit the taking of coots in the regular duck seasons only.

21. *Woodcock.* a. Pennsylvania has submitted comments recommending that the Service continue the 1987–88 frameworks for hunting woodcock in the Eastern Region (Atlantic Flyway States) in 1988–89. The State also recommends that the framework closing date for hunting woodwock throughout the U.S. be no later than January 31.

Response. The Service will consider these recommendations when the proposed frameworks for woodcock hunting are developed in late June.

22. *Band-tailed pigeons.* a. The Pacific Flyway Council has recommended the following:

i. The framework opening date for hunting Pacific Coast Population band-tailed pigeons be delayed from September 7 to September 14 during the remaining 2 years of the scheduled 3-year harvest reduction program.

Response. The Service will consider this recommendation when the early-season frameworks are developed in late June.

ii. The regulatory frameworks for 1988–89 hunting seasons for Four-Corners Population band-tailed pigeons be the same as those of 1987–88.

Response. The Service notes the Council's recommendation.

23. *Mourning doves.* Western Management Unit (WNU).

a. The Pacific Flyway Council recommends that all WMU States, except Arizona and California be offered only 30-consecutive day hunting seasons, between September 1 and 30, 1988, and that Arizona and California be offered only 60-day seasons to be split between two periods, September 1–15, 1988, and November 1, 1988–January 15, 1989.

Response. The Service recognizes these recommended changes would effect a change in the experimental 3-year season established last year. The proposed regulations would in effect create submanagement units in the WMU. The recommendation will be further examined when the early-season frameworks are considered in late June.

24. *White-winged and white-tipped doves.* a. The Pacific Flyway Council recommends that the framework for white-winged doves in Arizona provide a season not to exceed 30 days, to be concurrent with the mourning dove season; and that frameworks for whitewings in Nevada and California provide for a season concurrent in length and timing with the mourning dove season.

Response. The Council's recommendation will be considered by the Service in late June when the early-season frameworks are developed.

b. In the March 9, 1988, Federal Register (53 FR 7712) the Service gave notice of Texas' request that the 1988–89 regulatory frameworks permit an aggregate daily bag limit of 12 white-winged, mourning and white-tipped doves to include no more than 2 white-

tipped doves during the Sepcial 4-day white-winged dove season in Texas. At its March meeting, the Central Flyway Council adopted a recommendation supporting Texas' requests.

Response. The Service notes that the early September season in south Texas was developed as a white-winged dove season. It is also noted that white-winged doves in south Texas experienced a serious population decline following a freeze of citrus nesting habitat during the winter of 1983–84. Populations have not yet fully recovered and regulations relaxation is not thought to be warranted at present. The regular mourning dove season in south Texas begins on September 20 and continues for 66 days. Although concurrent hunting of mourning doves has been permitted during the special whitewing season in the past, a large harvest of mourning doves has resulted during a period (early September) when many individuals of this species are still nesting in south Texas. The current limitation of 2 mourning doves in an aggregate bag of 10 doves has significantly reduced the mourning dove harvest during early September in 1984–87. Previous experience predicts that a large mourning dove harvest will result during the special whitewing hunt under the Texas proposal. The Service believes that a large mourning dove harvest in early September is not in the best interest of the species.

25. *Migratory bird hunting seasons in Alaska* a. The Pacific Flyway Council has forwarded its endorsement of the following to the Service:

i. Alaska's request for reinstatement of a 107-day season length framework for brant hunting seasons. The framework was reduced to 50 days in 1987 and the State has indicated the action did little to reduce harvest while adding complexity to the regulations. The Service has also received a formal request from Alaska for the framework change.

Response. The Service notes that brant populations have declined in the Pacific Flyway over the long-term and special efforts have been made to limit subsistence harvest of these birds in western Alaska. Despite the fact the shortened season may have done little to reduce the harvest, the Service questions whether a 57 day increase in season length in Alaska would be understood by Alaskan subsistence hunters, U.S. sport hunters or wildlife management officials in Mexico. The Service proposes to continue the current season length of 50 days for brant in Alaska.

ii. Alaska's proposal for a tundra swan season in its Game Management Unit 22 (Seward Peninsula). The State would issue 300 permits allowing each permittee 1 swan per season. The Service has also received a formal request from the State for the experimental season.

Response. This proposal will be further examined by the Service in late June when the frameworks for migratory bird hunting in Alaska are developed.

27. *Migratory game birds seasons for falconers* a. In the March 9, 1988, **Federal Register** (53 FR 7713) the Service gave notice of and solicited comments on a request that the outside framework dates for special falconry seasons be expanded. At its March meeting, the Pacific Flyway Council adopted a recommendation endorsing the request. In addition, eight individuals (MD–1, NC–1, IL–1, NM–1, ME–1, OR–1, NV–2) and one State (WA) submitted comments expressing support for the frameworks change. One of the individuals also supported zoning for falconry seasons and the use of falcons during September teal seasons.

Response. The Service continues to seek additional information or comments on this request. All comments will be considered in late June when the early-season frameworks are developed.

Public Comment Invited

Based on the results of migratory game bird studies now in progress and with due consideration for any data or views submitted by interested parties, the possible amendments resulting from this supplemental rulemaking will specify open seasons, shooting hours, and bag and possession limits for designated migratory game birds in the United States, including Alaska, Hawaii, Puerto Rico, and the Virgin Islands.

The Director intends that finally adopted rules be as responsive as possible to all concerned interests. He therefore desires to obtain the comments and suggestions of the public, other concerned governmental agencies, and private interests on these proposals and will take into consideration the comments received. Such comments, and any additional information received, may lead the Director to adopt final regulations that differ from these proposals. The addresses where comments should be sent and where received comments are available for public inspection were given earlier in this document under the caption **ADDRESSES**.

Special circumstances are involved in the establishment of these regulations which limit the amount of time that the Service can allow for public comment. Specifically, two considerations compress the time in which the rulemaking process must operate: the need, on the one hand, to establish final rules at a point early enough in the summer to allow affected State agencies to appropriately adjust their licensing and regulatory mechanisms, and, on the other hand, the unavailability before mid-June of specific, reliable data on this year's status of some migratory shore and upland game bird populations. Therefore, the Service believes that to allow comment periods past the dates specified earlier is contrary to the public interest.

Flyway Council Meetings

Department of the Interior representatives will be present at the following meetings of Flyway Councils:

Atlantic Flyway—Toronto, Ontario, Canada (Sutton Place Hotel) July 28–29

Mississippi Flyway—Baton Rouge, Louisiana (Hilton) July 29–30

Central Flyway—Calgary, Alberta, Canada (Marlboro Inn) July 28–29

Pacific Flyway—Reno, Nevada (Sundowner Hotel) July 28

Although agendas are not yet available, these meetings usually commence at 8:30 or 9 a.m. on the days indicated.

NEPA Consideration

The "Final Environmental Statement for the Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FES 75–54)" was filed with the Council on Environmental Quality on June 6, 1975, and notice of availability was published in the **Federal Register** on June 13, 1975 (40 FR 25241). In addition, several environmental assessments have been prepared on specific matters which serve to supplement the material in the Final Environmental Statement. Copies of these documents are available from the Service at the address indicated under the caption **ADDRESS**. As noted in the March 9, 1988, **Federal Register** (at 53 FR 7707), the Service released a draft supplemental environmental impact statement (SEIS) on the FES in September 1987. The Service has reviewed the comments received on the draft SEIS and anticipates the final SEIS will be available by July 1988.

Endangered Species Act Consideration

Section 7 of the Endangered Species Act provides that "The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act," [and shall] "insure that any action authorized, funded, or carried out . . . is not likely to jeopardize the continued

existence of such endangered or threatened species or result in the destruction or modification of [critical] habitat . . ."

Section 7 consultations are presently underway regarding both the early- and late-season regulatory proposals. It is possible that the findings from the consultation, which will be included in a biological opinion, may cause modification of some of the regulatory measures proposed in this document. Any modifications that may be desirable will be reflected in the final frameworks for Alaska, Puerto Rico, and the Virgin Islands; those for other early seasons; and those for late seasons.

Hunting regulations are designed, among other things, to remove or alleviate chances of conflict between seasons for migatory game birds and the protection and conservation of endangered and threatened species and their habitats.

The Service's biological opinions resulting from its consultation under Section 7 are considered public documents and are available for public inspection in the Division of Endangered Species and Habitat Conservation, and the Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, Washington, DC 20240.

Regulatory Flexibility Act, Executive Order 12291, and the Paperwork Reduction Act

In the **Federal Register** dated March 9, 1988, (53 FR 7707), the Service reported measures it had undertaken to comply with requirements of the Regulatory Flexibility Act and the Executive Order. These included preparing a Determination of Effects and an updated Final Regulatory Impact Analysis, and publication of a summary of the latter. This information is included in the present document by reference. As noted in the above **Federal Register** publication, the Service plans to issue its Memorandum of Law for the migratory bird hunting regulations at the same time the first of the annual hunting rules is finalized. This rule does not contain any information collecting requiring approval by OMB under 44 U.S.C. 3504.

Authorship

The primary author of this supplemental proposed rulemaking is Morton M. Smith, Office of Migratory Bird Management, working under the direction of Rollin D. Sparrowe, Chief.

List of Subjects in 50 CFR Part 20

Exports, Hunting, Imports, Transportation, Wildlife.

Dated: May 27, 1988.

Susan Recce,

Acting Assistant Secretary for Fish and Wildlife and Parks.

[FR Doc. 88-12714 Filed 6-6-88; 8:45 am]

BILLING CODE 4310-55-M

Notices

Federal Register
Vol. 53, No. 109
Tuesday, June 7, 1988

This section of the FEDERAL REGISTER contains documents other than rules or proposed rules that are applicable to the public. Notices of hearings and investigations, committee meetings, agency decisions and rulings, delegations of authority, filing of petitions and applications and agency statements of organization and functions are examples of documents appearing in this section.

COMMISSION ON CIVIL RIGHTS

Civil Rights of Native Americans; Hearing

Notice is hereby given pursuant to the provisions of the United States Commission on Civil Rights Act of 1983, Pub. L. 98–183, 97 Stat. 1304, that a public hearing before a Subcommittee of the U.S. Commission on Civil Rights will be held on July 7, 1988, beginning at 9:00 a.m. and continuing on such succeedings days as may be deemed appropriate at the discretion of the Chairman, at the Days Inn, 2320 East Lucky Lane, Flagstaff, Arizona.

The purpose of the hearing is to receive evidence about enforcement of the Indian Civil Rights Act and about the civil rights of Native Americans.

The Commission is an independent, bipartisan factfinding agency authorized to study, collect, and disseminate information and to appraise the laws and policies of the Federal Government, and to study and collect information concerning legal developments, with respect to discrimination or denials of equal protection of the laws under the Constitution because of race, color, religion, sex, handicap, or national origin, or in the administration of justice.

Dated at Washington, DC, June 2, 1988.

Clarence M. Pendleton, Jr.,

Chairman.

[FR Doc. 88–12739 Filed 6–6–88; 8:45 am]

BILLING CODE 6335–01–M

DEPARTMENT OF COMMERCE

Agency Information Collection Packages Under Review by the Office of Management and Budget

DOC has submitted to OMB for clearance five clearance requests for the collection of information under the provisions of the Paperwork Reduction Act (44 U.S.C. Chapter 35).

Agency: National Oceanic and Atmospheric Administration, Commerce.

Title: Federal Fisheries Permits.

Form Numbers: NOAA—N/A; OMB—five new numbers to be assigned.

Type of Request: Revision of a currently approved collection (formerly cleared under (0648–0097).

Burden: 12,952 respondents; 6,353 reporting hours (total estimate for all packages).

Needs and Uses: Under the authority of the Magnuson Fishery Conservation and Management Act, the Regional Fishery Management Councils have developed plans to conserve and manage marine resources. One of the steps taken to manage regulated fisheries is to issue permits to users of the resources. A separate clearance package has been submitted to OMB for each Region—Northeast, Southeast, Northwest, Southwest, and Alaska. While there are variations between Regions, the regular permit applications require essentially the same information on owners and operators of vessels, gear type used, tonnage, and fish hold capacity of vessels. Permits serve three main purposes: (1) To determine fishing effort, (2) to allow revocation of a permit as an enforcement tool, and (3) to acquire data on the economic structure of the fishing fleet. Some Regions also have special permit requirements which are used for fishery management purposes.

Affected Public: Businesses or other for-profit institutions; small businesses or organizations; non-profit institutions.

Frequency: On occasion; annually.

Respondent's Obligation: Required to obtain or retain a benefit.

OMB Desk Officer: John Griffen, 395–7340.

Copies of the information collection packages for each Region can be obtained by calling or wirting DOC Clearance Officer, Edward Michals, (202) 377–3271, Department of Commerce, Room 6622, 14th and Constitution Avenue, NW., Washington, DC 20230.

Written comments and recommendations for the proposed information collection requirements should be sent to John Griffen, OMB Desk Officer, Room 3208, New Executive Office Building, Washington, DC 20503.

Dated: June 2, 1988.

Edward Michals,

Departmental Clearance Officer, Office of Management and Organization.

[FR Doc. 88–12803 Filed 6–6–88; 8:45 am]

BILLING CODE 3510–CW–M

Bureau of Export Administration

Establishment of the Bureau of Export Administration; Department Organization Order 10–16

AGENCY: Bureau of Export Administration; Commerce.

ACTION: Notice of Department Organization Order.

SUMMARY: On October 1, 1987, the Bureau of Export Administration was established within the Department of Commerce. Attached to this notice is a copy of Department Organization Order 10–16 of March 10, 1988, which sets forth the scope of authority and the functions of the Under Secretary for Export Administration.

Dated: May 19, 1988.

Paul Freedenberg,

Under Secretary for Export Administration.

[Department Organization Order 10–16]

Department Organization Order Series

Date of Issuance: March 10, 1988.
Effective Date: March 10, 1988.
Subject: Under Secretary for Export Administration.

Section 1. Purpose

This Order prescribes the scope of authority and the functions of the Under Secretary for Export Administration. The organizational structure and the assignment of functions are prescribed in Department Organization Order 50–1, the "Bureau of Export Administration."

Section 2. Administrative Designation

.01 The Under Secretary for Export Administration, established by Section 15 of the Export Administration Act of 1979, as amended (50 U.S.C. app. 2401–2420 (1982 and Supp. III 1985)), shall be head of the Bureau of Export Administration. The Under Secretary is appointed by the President by and with the advice and consent of the Senate.

.02 The positions of Assistant Secretary, established by Section 15 of the Export Administration Act of 1979,

as amended (50 U.S.C. app. 2401–2420 (1982 and Supp. III 1985)) are designated the Assistant Secretary for Export Administration and the Assistant Secretary for Export Enforcement.

Section 3. Structure and Scope of Authority

.01 The Under Secretary for Export Administration shall be assisted in carrying out his/her responsibilities by:

a. The Deputy Under Secretary for Export Administration;

b. The Assistant Secretary for Export Administration; and

c. The Assistant Secretary for Export Enforcement.

.02 The Assistant Secretary for Export Administration shall be assisted in carrying out his/her responsibilities by:

a. The Deputy Assistant Secretary for Export Administration;

b. The Director of the Office of Export Licensing;

c. The Director of the Office of Technology and Policy Analysis; and

d. The Director of the Office of Foreign Availability.

0.3 The Assistant Secretary for Export Enforcement shall be assisted in carrying out his/her responsibilities by:

a. The Deputy Assistant Secretary for Export Enforcement;

b. The Director of the Office of Export Enforcement;

c. The Director of the Office of Export Intelligence; and

d. The Director of the Office of Antiboycott Compliance.

Section 4. Delegation of Authority

.01 Pursuant to the authority vested in the Secretary of Commerce, the Under Secretary for Export Administration is hereby delegated the following authorities of the Secretary of Commerce; provided, however, that the Secretary reserves authority to provide policy guidance and direction to the Under Secretary (and delegates) and, at the Secretary's initiative or at the request of the Under Secretary, to consult with the Under Secretary (and delegates) to the extent permitted by law regarding the exercise of the authorities delegated by this section:

a. The Export Administration Act of 1979, as amended (50 U.S.C. app. 2401–2420), and the authority under the Act conferred on the Secretary under Executive Order 12525 of July 12, 1985, Executive Order 12214 of May 12, 1980, and Executive Order 12002 of July 17, 1977, except that:

1. the submission of reports to the Congress required by Section 14 of the Act shall be reserved to the Secretary; and

2. the power, authority, and discretion to make the determination required by Section 12(c):

(a) may not be delegated below the Assistant Secretary level;

(b) determinations regarding the publication or disclosure of confidential information obtained under the Act pursuant to a request under the Freedom of Information Act (5 U.S.C. 552) shall be reserved to the Under Secretary for Export Administration; and

(c) any determination under Section 12(c) shall require the prior concurrence of the Office of the General Counsel.

b. Executive Order 11958 of January 18, 1977, as it pertains to carrying out, on behalf of the Department of State, functions under Section 38(e) of the Arms Export Control Act (22 U.S.C. 2751 *et seq.*) as agreed to by the Departments of Commerce and State;

c. Executive Order 11322 of January 5, 1967, and Executive Order 11419 of July 29, 1968, regarding the Rhodesian sanctions with respect to transactions occurring prior to December 16, 1979 (Executive Order 12183 of December 6, 1979 revoked provisions of Executive Orders 11322 and 11419 regarding transactions occurring after December 6, 1979);

d. the Nuclear Non-Proliferation Act of 1978 (22 U.S.C. 3201 *et seq.*) and the authority under that Act conferred on the Secretary under Executive Order 12058 of May 11, 1978, pertaining to nuclear exports and other matters;

e. Sections 103 and 251 of the Energy Policy and Conservation Act (42 U.S.C. 6201 *et seq.*) conferred on the Secretary under Executive Order 11912 of April 13, 1976, regarding:

1. export restrictions of coal, petroleum products, natural gas, or petrochemical feedstocks, and supplies of material or equipment necessary to maintain for further exploration, production, refining, or transportation of energy supplies or for the construction or maintenance of energy facilities within the United States; and

2. rules to authorize the export of petroleum and petroleum products as may be necessary for implementation of the obligations of the United States under the International Energy Program.

f. The delegation of authority, dated June 25, 1962, for the United States Information Agency under Section 5(e) of Executive Order 11034 of June 25, 1962, as amended by Executive Order 11380 of November 8, 1967, regarding the promotion of international trade and collection of contributions under the Mutual Educational and Cultural Exchange Act of 1961, as amended (22 U.S.C. 2451 *et seq.*).

.02 The Under Secretary may exercise other authorities of the Secretary as applicable to perform the functions assigned in this Order.

.03 Except as otherwise provided in this Order, the Under Secretary may redelegate his/her authority, subject to such conditions in the exercise of such authority as he/she may prescribe.

Section 5. Functions

The Under Secretary for Export Administration, acting as such and as head of the Bureau of Export Administration, shall be the principal officer of the Department for carrying out the policies and programs necessary to administer the Export Administration Act and other laws regarding the control of U.S. exports.

S. William Verity,

Secretary of Commerce.

[FR Doc. 88–12789 Filed 6–6–88; 8:45 am]

BILLING CODE 3510-DT-M

International Trade Administration

[A–588–703]

Antidumping Duty Order and Amendment to Final Determination of Sales at Less Than Fair Value; Certain Internal-Combustion, Industrial Forklift Trucks From Japan

AGENCY: Import Administration, International Trade Administration, Commerce.

ACTION: Notice.

SUMMARY: In separate investigations concerning certain internal-combustion, industrial forklift trucks (forklifts) from Japan, the U.S. Department of Commerce (the Department) and the U.S. International Trade Commission (the ITC) determined that forklifts are being sold at less than fair value and that imports of forklifts from Japan are materially injuring a U.S. industry. On April 7, 1988, the Department determined that critical circumstances exist with respect to imports of forklifts from Nissan Motor Co., Ltd. (Nissan) and Toyo Umpanki Co. (TCM). However, on May 31, 1988, the ITC notified the Department that critical circumstances do not exist with respect to imports of forklifts from Nissan and TCM. Therefore, based on these findings, all unliquidated entries of forklifts from Japan entered or withdrawn from warehouse, for consumption, on or after November 24, 1987, the date on which the Department published its preliminary determination notice in the **Federal Register**, will be liable for the possible assessment of

antidumping duties. As a result of the ITC's negative critical circumstances determination, U.S. Customs will refund all cash deposits and release all bonds collected on forklifts entered or withdrawn from warehouse, for consumption, on or after August 26, 1988 and before November 24, 1987. Further, a cash deposit of estimated antidumping duties must be made on all entries of forklifts from Japan entered or withdrawn from warehouse, for consumption, on or after the date of publication of this antidumping duty order in the **Federal Register**.

EFFECTIVE DATE: June 7, 1988.

FOR FURTHER INFORMATION CONTACT: Gary Taverman, Office of Investigations, International Trade Administration, U.S. Department of Commerce, 14th Street and Constitution Ave, NW., Washington, DC 20230; telephone: (202) 377–0161.

SUPPLEMENTARY INFORMATION: The products covered by this investigation are certain internal-combustion, industrial forklift trucks, with lifting capacity of 2,000 to 15,000 lbs., currently provided for under *Tariff Schedules of the United States Annotated* (TSUSA) items 692.4025, 692.4030, and 692.4070, and currently classifiable under Harmonized System (HS) item numbers 8427.20.00–0, 8427.90.00–0, and 8431.20.00–0. The products covered by this investigation are further described as follows: Assembled, not assembled, and less than complete, finished and not finished, operator-riding forklift trucks powered by gasoline, propane, or diesel fuel internal-combustion engines of off-the-highway types used in factories, warehouses, or transportation terminals for short-distance transport, towing, or handling of articles. Less than complete forklift trucks are defined as imports which include a frame by itself or a frame assembled with one or more component parts. Component parts of the subject forklift trucks which are not assembled with a frame are not covered by this order.

Products not covered by this investigation are genuinely used forklifts. For the purposes of this antidumping duty order and amendment to the final determination, we consider any forklift to be used if, at the time of entry into the United States, the importer can demonstrate to the satisfaction of the U.S. Customs Service that the forklift was manufactured in a calendar year at least three years prior to the year of entry into the United States. The importer must show documentation from industrial publications that reconcile the serial number and year of manufacture of the forklift. If the calendar year of manufacture is at least three years prior to its year of entry into the United States, it will not be subject to the suspension of liquidation or any assessment of antidumping duties.

For example, if a forklift is entered or withdrawn from warehouse, for consumption in June 1988 and if the importer demonstrates through industrial publications that the forklift was manufactured in or before calendar year 1985, that forklift will not be covered by this order.

In accordance with section 735(a) of the Tariff Act of 1930, as amended (19 U.S.C. 1673d(a)) (the Act), on April 7, 1988, the Department made its final determination that forklifts from Japan are being sold at less than fair value (53 FR 12552, April 15, 1988) and that critical circumstances exist with respect to Nissan and TCM. On May 31, 1988, in accordance with section 735(d) of the Act, the ITC notified the Department that such imports are materially injuring a U.S. industry and that critical circumstances do not exist with respect to Nissan and TCM.

Subsequent to the publication of the Department's final determination, Komatsu Forklift Co., Ltd. (Komatsu) made allegations that certain clerical errors had been made in the concordance. The Department conducted a review based on these comments and amended its final determination to correct these errors. These corrections changed Komatsu's weighted-average dumping margin from 47.73% to 47.50% and the "all others" rate from 39.50% to 39.45%.

Therefore, in accordance with sections 736 and 751 of the Act (19 U.S.C. 1673e and 1675), the Department directs U.S. Customs officers to assess, upon further advice by the administering authority pursuant to section 736(a)(1) of the Act (19 U.S.C. 1673e(a)(1)), antidumping duties equal to the amount by which the foreign market value of the merchandise exceeds the United States price for all entries of forklifts from Japan, with the exception of genuinely used forklifts as described above. These antidumping duties will be assessed on all unliquidated entries of forklifts from Japan entered or withdrawn from warehouse, for consumption, on or after November 24, 1987, the date on which the Department published its preliminary determination notice in the **Federal Register** (52 FR 45003).

On and after the date of publication of this notice, U.S. Customs officers must require, at the same time as importers would normally deposit estimated duties on forklifts from Japan, a cash deposit equal to the estimated weighted-average dumping duty margins noted below:

Manufacturers/Producers/Exporters	*Weighted-average margin (percent)*
Toyota Motor Corp	17.29
Nissan Motor Co., Ltd	51.33
Komatsu Forklift Co., Ltd	47.50
Sumitomo-Yale Co., Ltd	51.33
Toyo Umpanki Co., Ltd	51.33
Sanki Industrial Co., Ltd	13.65
Kasagi Forklift, Inc	56.81
All Others	39.45

This determination constitutes an amendment to the final determination and an antidumping duty order with respect to forklifts from Japan, pursuant to sections 735(d) and 736(a) of the Act (19 U.S.C. 1673d(d) and 1673e(a)) and § 353.48 of the Commerce Regulations (19 CFR 353.48). We have deleted from the Commerce Regulations, Annex I of 19 CFR Part 353, which listed antidumping duty findings and orders currently in effect. Instead, interested parties may contact the Central Records Unit, Room B–099, Import Administration, for copies of the updated list of orders currently in effect.

This notice is published in accordance with sections 735(d) and 736(a) of the Act (19 U.S.C. 1673d(d) and 1673e) and 19 CFR 353.48.

Joseph A. Spetrini,

Acting Assistant Secretary for Import Administration.

June 3, 1988.

[FR Doc. 88–12918 Filed 6–6–88; 8:45 am]

BILLING CODE 3510–DS–M

COMMITTEE FOR THE IMPLEMENTATION OF TEXTILE AGREEMENTS

Increasing Guaranteed Access Levels for Certain Cotton and Man-Made Fiber Textile Products Produced or Manufactured in Jamaica

June 2, 1988.

AGENCY: Committee for the Implementation of Textile Agreements (CITA).

ACTION: Issuing a directive to the Commissioner of Customs increasing guaranteed access levels.

EFFECTIVE DATE: June 9, 1988.

Authority: Executive Order 11651 of March 3, 1972, as amended; section 204 of the Agricultural Act of 1956, as amended (7 U.S.C. 1854); President's February 20, 1986 announcement of a Special Access Program.

FOR FURTHER INFORMATION CONTACT: Naomi Freeman, International Trade

Specialist, Office of Textiles and Apparel, U.S. Department of Commerce, (202) 377–4212.

SUPPLEMENTARY INFORMATION: During recent consultations between the Governments of the United States and Jamaica, agreement was reached to increase the guaranteed access levels for certain properly certified cotton and man-made fiber textile products which are assembled in Jamaica from fabric formed and cut in the United States and exported during 1988.

A description of the textile categories in terms of T.S.U.S.A. numbers is available in the CORRELATION: Textile and Apparel Categories with Tariff Schedules of the United States Annotated (see **Federal Register** notice 52 FR 47745, dated December 11, 1987). Also see 51 FR 21208, published on June 11, 1986; 52 FR 26057, published on July 10, 1987; and 52 FR 49185, published on December 30, 1987.

The letter to the Commissioner of Customs and the actions taken pursuant to it are not designed to implement all of the provisions of the bilateral agreement, but are designed to assist only in the implementation of certain of its provisions.

Ferenc Molnar,

Acting Chairman, Committee for the Implementation of Textile Agreements.

Committee for the Implementation of Textile Agreements

June 2, 1988.

Commissioner of Customs,
Department of the Treasury,
Washington, D.C. 20229.

Dear Mr. Commissioner: This directive amends, but does not cancel, the directive of December 24, 1987, concerning, among other things, guaranteed access levels for certain cotton and man-made fiber textile products, assembled in Jamaica from fabric formed and cut in the United States and exported from Jamaica during the twelve-month period which began on January 1, 1988 and extends through December 31, 1988.

Effective on June 9, 1988, the directive of December 24, 1987 is amended to increase the guaranteed access levels for cotton and man-made fiber textile products in the following categories, under the terms of the current bilateral agreement between the Governments of the United States and Jamaica:

Category	Guaranteed access level (dozen)
338/339/638/639	1,500,000
340/640	300,000
341/641	375,000
347/348/647/648	2,000,000
352/652	1,550,000
632	3,000,000

The Committee for the Implementation of Textile Agreements has determined that these actions fall within the foreign affairs exception to the rulemaking provisions of 5 U.S.C. 553(a)(1).

Sincerely,

Ferenc Molnar,

Acting Chairman, Committee for the Implementation of Textile Agreements.

[FR Doc. 88–12801 Filed 6–6–88; 8:45 am]

BILLING CODE 3510-DR -M

DEPARTMENT OF DEFENSE

Office of the Secretary

Defense Science Board Task Force on Strategic Arms Reduction Treaty (START) Verification Procedures; Meeting

ACTION: Cancellation of meeting.

SUMMARY: The meeting notice for the Defense Science Board Task Force on Strategic Arms Reduction Treaty (START) Verification Procedures scheduled for May 10–11, 1988 as published in the **Federal Register** (Vol. 53, No. 88, Page 16315, Friday, May 6, 1988, FR Doc. 88–10105) has been cancelled.

Linda M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

June 1, 1988.

[FR Doc. 88–12815 Filed 6–6–88; 8:45 am]

BILLING CODE 3810-01-M

Defense Science Board Task Force on Use of Commercial Components in Military Equipment, Revisit; Meeting

ACTION: Cancellation of meeting.

SUMMARY: The meeting notice for the Defense Science Board Task Force on Use of Commercial Components in Military Equipment—Revisit scheduled for June 17, 1988 as published in the **Federal Register** (Vol. 53, No. 14, Page 1815, Friday, January 22, 1988, FR Doc. 88–1315) has been cancelled.

Linda M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

June 1, 1988.

[FR Doc. 88–12816 Filed 6–6–88; 8:45 am]

BILLING CODE 3810-01-M

Defense Science Board Task Force on Defense Industrial Cooperation With Pacific Rim Nations; Meeting

ACTION: Notice of Advisory Committee Meetings.

SUMMARY: The Defense Science Board Task Force on Defense Industrial Cooperation With Pacific Rim Nations will meet in closed session on June 23–24, 1988 at the Institute for Defense Analyses, Alexandria, Virginia.

The mission of the Defense Science Board is to advise the Secretary of Defense and the Under Secretary of Defense for Acquisition on scientific and technical matters as they affect the perceived needs of the Department of Defense. At this meeting the Task Force will examine the potential for achieving U.S. security objectives in the Pacific Rim area through defense industrial cooperation with the nations of that area.

In accordance with section 10(d) of the Federal Advisory Committee Act, Pub. L. 92–463, as amended (5 U.S.C. App. II (1982)), it has been determined that this DSB Task Force meeting concerns matters listed in 5 U.S.C. 552b(c)(1) (1982), and that accordingly this meeting will be closed to the public.

Linda M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

June 1, 1988.

[FR Doc. 88–12817 Filed 6–6–88; 8:45 am]

BILLING CODE 3810-01-M

DEPARTMENT OF EDUCATION

Proposed Information Collection Requests

AGENCY: Department of Education.

ACTION: Notice of Proposed Information Collection Requests.

SUMMARY: The Director, Information Technology Services, invites comments on the proposed information collection requests as required by the Paperwork Reduction Act of 1980.

DATES: Interested persons are invited to submit comments on or before July 7, 1988.

ADDRESSES: Written comments should be addressed to the Office of Information and Regulatory Affairs, Attention: Jim Houser, Desk Officer, Department of Education, Officer of Management and Budget, 726 Jackson Place, NW., Room 3208, New Executive Office Building, Washington, DC 20503. Requests for copies of the proposed information collection requests should be addressed to Margaret B. Webster, Department of Education, 400 Maryland Avenue, SW., Room 5624, Regional Office Building 3, Washington, DC 20202.

FOR FURTHER INFORMATION CONTACT: Margaret B. Webster (202) 732-3915.

SUPPLEMENTARY INFORMATION: Section 3517 of the Paperwork Reduction Act of 1980 (44 U.S.C. Chapter 35) requires that the Office of Management and Budget (OMB) provide interested Federal agencies and the public an early opportunity to comment on information collection requests. OMB may amend or waive the requirement for public consultation to the extent that public participation in the approval process would defeat the purpose of the information collection, violate State or Federal law, or substantially interfere with any agency's ability to perform its statutory obligations.

The Director, Information Technology Services, publishes this notice containing proposed information collection requests prior to submission of these requests to OMB. Each proposed information collection, grouped by office, contains the following: (1) Type of review requested, e.g., new, revision, extension, existing or reinstatement; (2) Title; (3) Frequency of collection; (4) The affected public; (5) Reporting burden; and/or (6) Recordkeeping burden; and (7) Abstract. OMB invites public comment at the address specified above. Copies of the requests are available from Margaret Webster at the address specified above.

Dated: June 2, 1988.

Carlos U. Rice,

Director for Information Technology Services.

Office of Postsecondary Education

Type of Review: Extension
Title: Lender's Request for Interest and Special Allowance for Loans Made from Tax-Exempt Funds
Frequency: Quarterly
Affected Public: Businesses or other for-profit
Reporting Burden:
Responses: 300
Burden Hours: 352
Recordkeeping:
Recordkeepers: 75
Burden Hours: 113
Abstract: This form will be used by lenders participating in the Guaranteed Student Loan (GSL) and PLUS programs. The Department will use the information to pay interest and special allowance payments to tax-exempt lenders.

Office of Postsecondary Education

Type of Review: Extension
Title: Lender's Request for Interest and Special Allowance
Frequency: Quarterly
Affected Public: Business or other for-profit
Reporting Burden:
Responses: 48,000
Burden Hours: 79,200
Recordkeeping:
Recordkeepers: 12,000
Burden Hours: 18,000
Abstract: This form will be used by lenders participating in the Guaranteed Student Loan (GSL) and PLUS programs. The Department will use the information to pay interest and special allowance payments to lenders.

Office of Postsecondary Education

Type of Review: Reinstatement
Title: Tape Dump Procedures for the Guaranteed Student Loan (GSL) and PLUS/SLS Programs
Frequency: Annually
Affected Public: State or local governments; non-profit institutions
Reporting Burden:
Responses: 108
Burden Hours: 4,752
Recordkeeping:
Recordkeepers: 0
Burden Hours: 0
Abstract: State and private, nonprofit guarantee agencies provide specific data on the GSL and PLUS/SLS Programs, via magnetic tape, to the Department. The Department uses the data to describe the characteristics of borrowers; to assess the impact of various legislative, regulatory and budgetary proposals; and to monitor borrower fraud and abuse.

Office of Postsecondary Education

Type of Review: Reinstatement
Title: New and Continuation Application for Grants under the Upward Bound Program
Frequency: Annually
Affected Public: State or local governments; non-profit institutions; small businesses or organizations
Reporting Burden:
Responses: 700
Burden Hours: 23,800
Recordkeeping:
Recordkeepers: 0
Burden Hours: 0
Abstract: This form will be used by institutions of higher education, public and private agencies or organizations, and in exceptional cases, secondary schools, to apply for funding under the Upward Bound Program. The Department will use the information to make grant awards.

[FR Doc. 88-12814 Filed 6-6-88; 8:45 am]

BILLING CODE 4000-01-M

Notice Inviting Applications for New State Grant Awards for Fiscal Year 1988

Title of Program: Training Personnel for the Education of the Handicapped.

CFDA No: 84.029H4.

Purpose: To increase the quantity and improve the quality of personnel to educate children and youth with handicaps. Applications for State grants may be submitted by State educational agencies (SEAs).

Subsequent to the initial publication of application announcements for fiscal year (FY) 1988, the Conference report accompanying the FY 1988 appropriations bill expressed an expectation that 10 percent of the funds available for awards under Part D of the Education of the Handicapped Act (EHA-D) would be awarded under section 632. The Secretary has decided to supplement the FY 1988 awards under section 632 of the EHA-D by inviting SEAs to submit applications—including SEAs that have received new or continuation grants under the State Grant Program (84.029H) for FY 1988—for additional funds. Each SEA that submits an application will receive a grant.

Deadline for Transmittal of Applications: July 20, 1988.

Applications Available: June 10, 1988.

Estimated Range of Awards: $10,000 to $40,000.

Estimated Average Size of Awards: $25,000.

Estimated Number of Awards: 24.

Project Period: 12 months.

Applicable Regulations: (a) The Training Personnel for the Education of the Handicapped Program, 34 CFR Part 319, 52 FR 25830 *et seq.*; and (b) the Education Department General Administration Regulations, 34 CFR Parts 75, 77, 78, and 80.

For Applications or Information Contact: Norman D. Howe, U.S. Department of Education, Office of Special Education Programs, Division of Personnel Preparation, 400 Maryland Avenue, S.W. (Switzer Building, Room 3094—M/S 2313), Washington, DC 20202. Telephone: (202) 732-1070.

Program Authority: 20 U.S.C. 1432.

Dated: June 2, 1988.

(Catalog of Federal Domestic Assistance No. 84.029: Training Personnel for the Education of the Handicapped)

Madeleine Will,

Assistant Secretary, Office of Special Education and Rehabilitative Services.

[FR Doc. 88-12813 Filed 6-6-88; 8:45 am]

BILLING CODE 4000-01-M

[CFDA NO.: 84.073E]

National Diffusion Network Program; Application for New Dissemination Process Awards for Fiscal Year 1988

ACTION: Extension of deadline date for transmittal of applications.

The Secretary extends the deadline date for transmittal of applications from June 1, 1988 to August 1, 1988.

On January 28, 1988 the Secretary published in the Federal Register (53 FR 2532) a notice inviting applications for new Dissemination Process awards. Detailed information is included in that notice. On March 31, 1988 the Secretary published in the Federal Register (53 FR 10418) a notice extending the closing date for transmittal of applications to June 1, 1988.

The purpose of this notice is to further extend the closing date for transmittal or applications so that potential applicants may have additional time to complete their applications.

For Applications or Information Contact: Mrs. Linda Jones, U.S. Department of Education, 555 New Jersey Avenue NW, Room 510, Washington, DC 20208. Telephone: (202) 357-6153.

Program Authority: 20 U.S.C. 3851.

Dated: June 2, 1988.

Chester E. Finn, Jr.,

Assistant Secretary and Counselor to the Secretary.

[FR Doc. 88-12812 Filed 6-6-88; 8:45 am]

BILLING CODE 4000-01-M

DEPARTMENT OF ENERGY

Assistant Secretary for International Affairs and Energy Emergencies

Proposed Subsequent Arrangement; Australia

Pursuant to section 131 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2160) notice is hereby given of a proposed "subsequent arrangement" under the Agreement for Cooperation between the Government of the United States of America and the Government of Australia concerning Peaceful Uses of Nuclear Energy.

The subsequent arrangement to be carried out under the above-mentioned agreement involves approval of the following sale: Contract Number S-AU-132, for the sale of 5 milligrams of plutonium-239 to the Australian Radiation Laboratory, Yallambie, Victoria, Australia, for use in emission rate studies.

In accordance with section 131 of the Atomic Energy Act of 1954, as amended, it has been determined that this subsequent arrangement will not be inimical to the common defense and security.

This subsequent arrangement will take effect no sooner than fifteen days after the date of publication of this notice.

For the Department of Energy.

Dated: June 2, 1988.

George J. Bradley, Jr.,

Principal Deputy Assistant Secretary for International Affairs and Energy Emergencies.

[FR Doc. 88-12799 Filed 6-6-88; 8:45 am]

BILLING CODE 6450-01-M

Proposed Subsequent Arrangement; Japan

Pursuant to section 131 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2160) notice is hereby given of a proposed "subsequent arrangement" under the Additional Agreement for Cooperation between the Government of the United States of America and the European Atomic Energy Community (EURATOM) concerning Peaceful Uses of Atomic Energy, as amended, and the Agreement for Cooperation between the Government of the United States of America and the Government of Japan concerning Civil Uses of Atomic Energy, as amended.

The subsequent arrangement to be carried out under the above-mentioned agreements involves approval of the following retransfer: RTD/JA(EU)-42, for the transfer of fuel elements containing 4.992 kilograms of uranium, enriched to 93.17 percent in the isotope uranium-235, from France to Japan for use as fuel in the KYOTO University reactor.

In accordance with section 131 of the Atomic Energy Act of 1954, as amended, it has been determined that this subsequent arrangement will not be inimical to the common defense and security.

This subsequent arrangement will take effect no sooner than fifteen days after the date of publication of this notice.

For the Department of Energy.

Dated: June 2, 1988.

George J. Bradley, Jr.,

Principal Deputy Assistant Secretary for International Affairs and Energy Emergencies.

[FR Doc. 88-12800 Filed 6-6-88; 8:45 am]

BILLING CODE 6450-01-M

Economic Regulatory Administration

[Docket No. ERA C&E 88-12; Certification Notice—17]

Filing of Certification of Compliance; Coal Capability of New Electric Powerplants; Panda Energy Corp.

AGENCY: Economic Regulatory Administration, DOE.

ACTION: Notice of filing.

SUMMARY: Title II of the Powerplant and Industrial Fuel Use Act of 1978, as amended ("FUA" or "the Act") (42 U.S.C. 8301 *et seq.*) provides that no new electric powerplant may be constructed or operated as a base load powerplant without the capability to use coal or another alternate fuel as a primary energy source (section 201(a)). In order to meet the requirement of coal capability, the owner or operator of any new electric powerplant to be operated as a base load powerplant proposing to use natural gas or petroleum as its primary energy source may certify, pursuant to section 201(d), to the Secretary of Energy prior to construction, or prior to operation as a base load powerplant, that such powerplant has capability to use coal or another alternate fuel. Such certification establishes compliance with section 201(a) as of the date it is filed with the Secretary. The Secretary is required to publish in the Federal Register a notice reciting that the certification has been filed. One owner and operator of a proposed new electric base load powerplant has filed a self certification in accordance with section 201(d). Further information is provided in the **SUPPLEMENTARY INFORMATION** section below.

SUPPLEMENTARY INFORMATION: The following company filed a self certification:

Name	Date received	Type facility	Megawatt capacity	Location
Panda Energy Corp., Dallas, TX	5-17-88	Cogeneration Combined Cycle	11.4	Dallas, TX

Amendments to FUA on May 22, 1987 (Pub. L. 100–42) altered the general prohibitions to include only new electric baseload powerplants and to provide for the self certification procedure.

Issued in Washington, DC on May 25, 1988.

Constance L Buckley,

Acting Director, Office of Fuels Programs, Economic Regulatory Administration.

[FR Doc. 88–12757 Filed 6–6–88; 8:45 am]

BILLING CODE 6450–01–M

Federal Energy Regulatory Commission

[Docket Nos. ES88–38–000, et al.]

PacifiCorp doing business as Pacific Power & Light Co. et al.; Electric Rate, Small Power Production, and Interlocking Directorate Filings

Take notice that the following filings have been made with the Commission:

1. Pacific Power & Light Co.

[Docket No. ES88–38–000]

May 31, 1988.

Take notice that on May 19, 1988, PacifiCorp dba Pacific Power & Light Company (Pacific) filed its application with the Federal Energy Regulatory Commission, pursuant to Section 204 of the Federal Power Act, seeking an order authorizing it to (1) guaranty up to $15,000,000 principal amount of debt, together with interest thereon, on behalf of its PacifiCorp K Plus Employee Savings and Stock Ownership Plan and Trust and (2) enter into such agreements or arrangements with financial institutions necessary to effect the guaranty.

Comment date: June 14, 1988, in accordance with Standard Paragraph E at the end of this notice.

2. Vermont Electric Power Company, Inc.

[Docket No. ER88–411–000]

June 1, 1988.

Take notice that on May 24, 1988, Vermont Electric Power Company, Inc. (VELCO) tendered for filing substantially identical Agreements for Transmission Services by which VELCO agrees to provide transmission services (a) for the transmission of 50 megawatts of power and associated energy to be taken by VELCO at the New York/Vermont border near Whitehall, New York, and to be delivered to Public Service Company of New Hampshire at the Vermont/ New Hampshire border near Ascutney, Vermont, and (b) for the transmission of 75 megawatts of power and associated energy to be taken by VELCO at the New York/Vermont border near Hoosick, New York, and to be delivered for Boston Edison Company to New England Electric System at the Vermont/Massachusetts border near North Adams, Massachusetts, each for a period of six months commencing on May 1, 1988, and each at a rate of $1.50 per kilowatt month.

VELCO proposes that the Agreements for Transmission Services become effective on May 1, 1988. VELCO requests waiver of the Commission's regulations to allow the Agreements to become effective as of that date. If waiver is granted, VELCO states that there will be no adverse effect upon customers under VELCO's other rate schedules.

VELCO states that it has served the filing upon the Vermont Public Service Board, the Vermont Department of Public Service, Boston Edison Company, Public Service Company of New Hampshire, Niagara Mohawk Power Corporation, Northeast Utilities Service Corporation, and New England Electric System.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this notice.

3. Ohio Power Co. and Kentucky Power Co.

[Docket No. ER88–408–000]

June 1, 1988.

Take notice that on May 23, 1988, American Electric Power Service Corporation (AEP) on behalf of its affiliates, Ohio Power Company and Kentucky Power Company, tendered for filing the following:

1. The Facilities Agreement among Kentucky Power Company, Ohio Power Company, and City of Vanceburg, dated September 1, 1980.

2. The Agreement among City of Hamilton, Ohio, American Municipal Power-Ohio, Inc. and Ohio Power Company, dated September 1, 1980.

3. The Agreement between City of Vancebury and Kentucky Power Company, dated September 1, 1980.

4. Agreement among City of Hamilton, American Municipal Power-Ohio, Kentucky Power Company, and Ohio Power Company, dated May 1, 1988.

5. Agreement between Kentucky Power and City of Vanceburg, Kentucky, dated May 1, 1988.

Items 1, 2, and 3 above are being terminated and Items 4 and 5 are effectively replacing them. These changes in contractual arrangements are necessitated by the City of Hamilton's acquisition from the City of Vanceburg of the Greenup hydroelectric facility.

Copies of the filing were served upon American Municipal Power-Ohio, City of Hamilton, City of Vanceburg, Public Utilities Commission of Ohio, and Kentucky Public Service Commission.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this notice.

4. Northern States Power Co.

[Docket No. ER88–410–000]

June 1, 1988.

Take notice that on May 23, 1988, Northern States Power Company (Minnesota) tendered for filing the Municipal Transmission Service Agreement Between Northern States Power Company (NSP) and the City of Truman.

The Municipal Transmission Service Agreement is an initial rate schedule filing. The Municipal Transmission Service Agreement essentially provides that NSP will wheel power and energy delivered to it by the Western Area Power Administration to the Interstate Power Company for ultimate delivery to Truman. The power in question has been sold by the Missouri Basin Municipal Power Agency to Truman. The rate and charges provided for this service are on file with the Commission for similar agreements with other cities.

NSP requests the Municipal Transmission Service Agreement become effective on May 1, 1988 and therefore, requests waiver of the Commission's notice requirements.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this document.

5. Indiana Michigan Power Co.

[Docket No. ER88–409–000]

June 1, 1988.

Take notice that on May 23, 1988, American Electic Power Service Corporation (AEP) tendered for filing on behalf of its affiliate Indiana Michigan Power Company (I&M), which is an AEP affiliated operating subsidiary, Modification No. 14 dated May 1, 1988 to the Agreement dated January 1, 1977 between I&M and the Indiana Municipal Power Agency (IMPA), assignee of the City of Richmond, Indiana. The Commission has previously designated the 1977 Agreement as I&M's Rate Schedule FERC No. 70.

This Modification updates the Emergency Service and Interchange Power Service Schedules to make them similar to those I&M currently has on file with the Commission.

Copies of this filing were served upon IMPA, RP&L, the Public Service Commission of Indiana and the Michigan Public Service Commission.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this notice.

6. Union Electric Co.

[Docket No. ER84-560-004]

June 1, 1988.

Take notice that on May 20, 1988, Union Electric Company tendered for filing an amendment to its filing of January 14, 1988. That original filing included tariff sheets in compliance with the Commission's Opinion No. 279-A in Docket Nos. ER84-560-002 and 003 issued December 21, 1987, and the Opinion and Order Establishing Just and Reasonable Rates (Opinion 279) issued July 20, 1987, in docket No. ER84-560-000, as well as various schedules and workpapers as directed by the Commission's Orders. This Amendment is filing pursuant to the instructions of the Division of Electric Power Application Review by letter dated April 25, 1988.

Copies of the filing were served upon the public's utility's jurisdictional customers, intervenors and the Missouri Public Service Commission.

Comment Date: June 15, 1988, in accordance with Standard Paragraph E at the end of this notice.

7. Upper Peninsula Power Co.

[Docket No. ER88-402-00]

June 1, 1988.

Take notice that on May 19, 1988, Upper Peninsula Power Company tendered for filing, pursuant to Part 35 of the regulation under the Federal Power Act, an Interconnection Agreement between Upper Peninsula Power Company and the City of Escanaba dated December 12, 1986.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this document.

8. Public Service Electric and Gas Co.

[Docket No. ER88-412-000]

June 1, 1988.

Take notice that on May 24, 1988, Public Service Electric and Gas Company (PSE&G) tendered for filing to Part 131.53 of the Commission's Regulations a Notice of Cancellation of Sale of Power Agreement for a sale of system power from PSE&G to Connecticut Light and Power Company for the period January 1, 1988 through January 31, 1988.

PSE&G requests that the cancellation be made effective as of February 1, 1988. Consequently, PSE&G requests waiver of the notice requirements to the extent necessary to accomplish the foregoing.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this notice.

9. Central Power & Light Co.

[Docket No. EL79-8-002]

June 1, 1988.

Take notice that on May 20, 1988, Texas Utilities Electric Company tendered for filing in the above-referenced proceeding a compliance Tariff for Transmission Service To, From and Over Certain HVDC Interconnections, pursuant to the Commission's Order Approving Settlement issued July 23, 1987 in the above-referenced docket. The compliance tariff replaces references to the South HVDC Interconnection with references to an East HVDC Interconnection, as ordered by the Commission in its Order Approving Settlement. The compliance filing also includes a provision concerning reservation of capacity by qualified utilities. The compliance filing reflects no change in the rates presently on file.

Comment date: June 15, 1988, in accordance with Standard Paragraph E at the end of this notice.

10. Freeport Geothermal Resources Company, a Delaware Corporation

[Docket No. QF87-586-002]

June 2, 1988.

On May 13, 1988, Freeport Geothermal Resources Company, a Delaware Corporation (Applicant), of 1160 N. Dutton, Suite 200, Santa Rosa, California 95401-4606, submitted for filing an application for certification of a facility as a qualifying small power production facility pursuant to § 292.207 of the Commission's regulations. No determination has been made that the submittal constitutes a complete filing.

The application for recertification requests that approximately 1.3 miles of 230 kV transmission line, to be constructed by Applicant, be determined to be part of the qualifying small power production facility. The proposed transmission line will interconnect the facility with the transmission system of Pacific Gas and Electric Company (PG&E). The transmission line will be utilized to transmit the qualifying facility's electric power output to PG&E, and to transmit standby, maintenance and back up power from PG&E to the facility. The facility was previously certified as a qualifying small power production facility on February 23, 1988, Freeport Geothermal Resources Company, a Delaware Corporation, Docket No. QF87-586-001, 42 FERC ¶62,145. All other facility's characteristics remain unchanged.

Comment date: Thirty days from publication in the Federal Register, in accordance with Standard Paragraph E at the end of this notice.

11. Freeport-McMoRan Resource Partners Limited Partnership, a Delaware limited partnership

[Docket No. QF87-587-002]

June 2, 1988.

On May 13, 1988, Freeport-McMoRan Resource Partners Limited Partnership, a Delaware limited partnership (Applicant), of 1160 N. Dutton, Suite 200, Santa Rosa, California 95401-4606, submitted for filing an application for certification of a facility as a qualifying small power production facility pursuant to § 292.207 of the Commission's regulations. No determination has been made that the submittal constitutes a complete filing.

The application for recertification requests that approximately 1.8 miles of 230 kV transmission line, to be constructed by Applicant, be determined to be part of the qualifying small power production facility. The proposed transmission line will interconnect the facility with the transmission system of Pacific Gas and Electric Company (PG&E). The transmission line will be utilized to transmit the qualifying facility's electric power output to PG&E, and to transmit standby, maintenance and back up power from PG&E to the facility. The facility was previously certified as a qualifying small power production facility on February 24, 1988, Freeport-McMoRan Resource Partners Limited Partnership, a Delaware limited partnership, Docket No. QF87-587-001, 42 FERC ¶62,147. All other facility's characteristics remain unchanged.

Comment date: Thirty days from publication in the Federal Register, in accordance with Standard Paragraph E at the end of this notice.

Standard Paragraphs

E. Any person desiring to be heard or to protest said filing should file a motion to intervene or protest with the Federal Energy Regulatory Commission, 825 North Capitol Street, NE., Washington, DC 20426, in accordance with Rules 211 and 214 of the Commission's Rules of Practice and Procedure (18 CFR 385.211 and 385.214). All such motions or protests should be filed on or before the comment date. Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Any person wishing to become a party must file a motion to intervene. Copies of this filing are on file with the

Commission and are available for public inspection.

Lois D. Cashell,

Acting Secretary.

[FR Doc. 88-12807 Filed 6-6-88; 8:45 am]

BILLING CODE 6717-01-M

[Docket Nos. CP88-388-000, et al.]

PennEast Gas Services Co., et al.; Natural gas certificate filings

June 1, 1988.

Take notice that the following filings have been made with the Commission:

1. PennEast Gas Services Company

[Docket No. CP88-388-000]

Take notice that on May 11, 1988, PennEast Gas Services Company (Applicant), Post Office Box 2521, Houston, Texas 77252, filed in Docket No. CP88-388-000 an application pursuant to section 7(c) of the Natural Gas Act requesting authorization to provide long-term firm storage and firm transportation service for Valley Gas Company (Valley), all as more fully set forth in the application which is on file with the Commission and open to public inspection.

It is indicated that on April 30, 1987, Applicant filed an application in Docket No. CP87-312-000 to render a firm storage and transportation service commencing April 1, 1988 under Rate Schedule PSS and T-1. It is further indicated that Applicant, in an amended application in Docket No. CP87-92-002 filed on January 15, 1988, requested approval to implement such service commencing November of 1989. Applicant states that the PSS storage service, as requested in Docket No. CP87-312-00, is based upon 10 Bcf of storage capacity to be developed by Applicant at the North Summit Pool located in Fayette County, Pennsylvania, in combination with the purchase by Applicant of 10 Bcf of storage service from CNG Transmission Corporation, also pending authorization in Docket No. CP87-312-000. Applicant further states that the storage service specifies a maximum daily withdrawal quantity of up to 199,104 dt equivalent per day under Applicant's Rate Schedule PSS.

Applicant submits that Valley has requested storage service from Applicant under Applicant's proposed Rate Schedule PSS and has entered into a precedent agreement dated September 23, 1987 with Applicant for a maximum daily withdrawal quantity of 1,000 dt equivalent. Applicant further submits that a position of the storage capacity proposed in Docket No. CP87-312-000 was undesignated and would be utilized to render the proposed service for Valley.

Applicant proposes on behalf of Valley, pursuant to Rate Schedule PSS, to receive gas from Valley at the receipt point specified in the service agreement and to inject such gas into Applicant's storage capacity, and to withdraw gas from Applicant's storage capacity and deliver such gas for the account of Valley at the delivery point specified in the service agreement. Also, Applicant proposes, when capacity is available on Applicant'system for receipt of gas from or for the account of Valley, to receive from or for the account of Valley quantities of gas and inject into storage for Valley's account such quantities of gas. Applicant proposes to withdraw from storage for Valley, at Valley's request, quantities of gas from the Valley's storage inventory up to the Valley's maximum daily withdrawal quantity (and such additional quantity as Applicant in its judgement is able to withdraw) and deliver to or for the account of Valley such quantities less company use gas, all subject to the provisions of Rate Schedule PSS.

In addition to the firm storage service contracted for by Valley, Applicant proposes to render to Valley a long-term firm transportation service pursuant to Applicant's firm transportation Rate Schedule T-1. Applicants proposes to transport for Valley on a daily basis natural gas up to contract demand quantity of 969 dt equivalent commencing November 15, 1988.

Applicant states that a copy of the precedent agreement and proforma storage service and transportation agreements between Applicant and Valley are attached in Exhibit I to the application.

It is indicated that Applicant would charge Valley, pursuant to Rate Schedules PSS and T-1, such rates to be derived and charged as proposed in Docket No. CP87-312-000.

Comment date: June 22, 1988, in accordance with Standard Paragraph F at the end of this notice.

2. Southern Natural Gas Company

[Docket No. CP88-367-000]

Take notice that on April 29, 1988, Southern Natural Gas Company (Southern), P.O. Box 2563, Birmingham, Alabama 35202-2563, filed in Docket No. CP88-367-000 an application, as amended May 19, 1988, pursuant to section 7(b) of the Natural Gas Act for permission and approval to abandon its interest in certain pipeline and regulating facilities, all as more fully set forth in the request on file with the Commission and open to public inspection.

Southern proposes to abandon by assignment to Huffco Petroleum Corporation (Huffco) its interest in approximately 6.5 miles of 10-inch pipeline and related measurement and appurtenant facilities extending from a production platform in Eugne Island Area, Block 260, offshore Louisiana, to an interconnection with Sea Robin Pipeline Company's 24-inch pipeline in Eugene Island Area, Block 273, offshore Louisiana. Southern states that it has agreed to assign the Facilities to Huffco pursuant to an agreement between Southern and Huffco dated April 1, 1988.

Southern states further that the abandonment of the facilities would not result in termination of any service to its customers, and that the purpose of such abandonment is to provide partial consideration for the reformation of a Gas Purchase Contract between Huffco and Southern, the terms of which are subject to an understanding of confidentiality between the parties.

Comment date: June 22, 1988, in accordance with Standard Paragraph F at the end of this notice.

3. Tennessee Gas Pipeline Company

[Docket No. CP88-400-000]

Take notice that on May 19, 1988, Tennessee Gas Pipeline Company (Tennessee), P.O. Box 2511, Houston, Texas 77252, filed in Docket No. CP88-400-000 an application pursuant to section 7(b) of the Natural Gas Act, for permission and approval to abandon certain facilities in offshore Louisiana, all as more fully set forth in the application on file with the Commission and open to public inspection.

Tennessee requests authority to abandon natural gas pipeline, compression and metering facilities located in West Delta Blocks 68, 69, 70, 71, 94, 95, and 96 and Grand Isle Block 43, which facilities are designated by Tennessee as the Grand Isle Gathering System. It is stated that these facilities consist of 25 segments of pipeline ranging in length from 0.07 mile to 6.64 miles and ranging in size from 4 inches to 16 inches, a total of 6,000 horsepower of compression located on four offshore platforms, seven measuring facilities installed on various offshore platforms and other appurtenant facilities.

Tennessee states that the facilities of the Grand Isle Gathering System have been and presently are utilized for the production, transportation and delivery of natural gas produced from various wells located in the West Delta and Grand Isle offshore areas to metering facilities located on the platform

designated the Grand Isle 43AA platform on OCS Block 0175, offshore Louisiana. It is further stated that all of the gas delivered to Tennessee through these metering facilities is purchased for Tennessee's system supply under various gas purchase agreements between Tennessee and Conoco, Inc., Atlantic Richfield Company, Texaco Producing Inc., and Cities Service Oil and Gas Corporation (referred to collectively as CATC). Upon receipt of the CATC gas on the Grand Isle 43AA platform, Tennessee transports the gas through its existing facilities to its onshore pipeline system.

Tennessee proposes to effect the abandonment by transferring all title and interest in the Grand Isle Gathering System to CATC. Tennessee notes, however, that this arrangement is contingent on an FERC finding that, following approval of the subject abandonment, the Grand Isle Gathering System will not be subject to FERC jurisdiction under the Natural Gas Act. It is stated that such a finding by the FERC is to be requested in a companion filing with the FERC to be made by CATC.

Tennessee explains that in the past it has entered into various operating agreements with CATC for various segments of the Grand Isle Gathering System. Despite these operating agreements, Tennessee asserts that total costs of operation and maintenance of the Grand Isle System have been comparatively high, exceeding $1,500,000 per year. In addition, it is noted that considerable employee effort has been expended to evaluate and recoup from CATC appropriate reimbursement for CATC's production related usage of the Grand Isle System.

Tennessee asserts that by conveying the Grand Isle System to CATC, it will maintain the same gas supply dedication while eliminating all the expenses of maintaining and operating the system. Tennessee states that such a reduction in operating expenses would generate savings to Tennessee's customers.

Comment date: June 22, 1988, in accordance with Standard Paragraph F at the end of this notice.

4. Transcontinental Gas Pipe Line Company

[Docket No. CP88-391-000]

Take notice that on May 12, 1988, as supplemented May 20, 1988, Transcontinental Gas Pipe Line Corporation (Transco), Post Office Box 1396, Houston, Texas 77251, filed an application in Docket No. CP88-391-000, proposing to restructure the sales, transportation and storage services offered to its customers, for abandonment authorization and for approval of tariff changes pursuant to a stipulation and agreement and in accordance with the provisions of sections 4 and 7 of the Natural Gas Act and the applicable provisions of the Commission's regulations, all as more fully set forth in the application which is on file with the Commission and open to public inspection.

Applicant requests authorization among other things, (1) to comprehensively restructure the basic services offered by the pipeline to include flexible sales and transportation options; (2) to provide an opportunity for customers to submit new or revised entitlement nominations for such service; and (3) to implement a gas inventory charge (Option Service Charge) in conformance with the fundamental principles and policies underlying Order No. 500. Transco states that the service restructuring proposal involves the updating of Volume 1 of Applicant's FERC Gas Tariff to eliminate or suspend outdated rate schedules or provisions, and to offer a basket of new and existing services.

Applicant states that the instant filing represents an offer of settlement because it is the result of negotiations involving Transco, its customers and other interested participants. Applicant accordingly requests that this filing be processed under the provision of the Rules of Practice and Procedure dealing with offers of settlement, Rule 602 *et seq.*

Transco summarizes the major elements of the settlement agreement as follows:

(1) Transco states that it is offering a new MDQ Rate Schedule as a voluntary alternative to its CD Rate Schedule. It is indicated that the MDQ Rate Schedule offers greater flexibility for firm transportation and sales service while ensuring that Transco remains revenue neutral. Transco states that customers would be able to freely nominate for MDQ service as well as for firm transportation service, provided that any increase in firm capacity entitlements should only be available within the constraints of Transco's existing pipeline capacity. It is also indicated that in order to manage the gas supply and price risks inherent in the MDQ service, a threshold aggregate level of MDQ nominations must be achieved on a daily and annual basis. Transco states that it reserves the right to withdraw the MDQ Rate Schedule from the available service options if the aggregate initial customer nominations under the MDQ Rate Schedule do not equal or exceed 1,900,000 dt equivalent of gas per day and 438,000,000 dt equivalent of gas per year.

(2) Transco states that its customers would be given the opportunity at the outset to choose from among a wide variety of service options: (a) *Switch* to the new MDQ merchant service; (b) *remain* on the existing sales rate schedules; (c) *convert* all or a portion of their firm sales entitlement to FT service; (d) *reduce* or relinquish firm sales entitlements; or (e) *structure* a combination of sales service and transportation service.

(3) It is indicated that the gas commodity pricing of Transco's sales services—both under the MDQ Rate Schedule and under existing rate schedules—would be based on a markets—oriented structure employing an initial price formula keyed to spot prices and that the pricing regime would provide mutual rights to periodic price redeterminations which would encompass the right to invoke binding arbitration designed to yield market-sensitive gas commodity prices over the term of the agreements.

(4) Transco states that its gas inventory charge, the Option Service Charge, is modeled on one of the Order No. 500 prototypes. In addition to the spot-based gas commodity rate outlined above, it is indicated that customers would pay a Daily Option Service Charge based on daily entitlements plus a Monthly Option Service Charge based on the customer's nominated annual entitlement to sales service and the customer's nominated load factor. If such OSC provision or its function equivalent is limited or discontinued as a result of future regulatory action, Transco indicates it shall have the right to make a concomitant limitation or termination with respect to the quantity and/or term provisions of the service agreements under the Rate Schedule MDQ.

(5) Transco states that it would provide its firm transportation customers (under "converted" FT service, regular FT service, and transportation under the MDQ Rate Schedule) with specific capacity rights in the production area as well as to mainline facilities. It is indicated that the intent and effect of the tariff provisions is to put customer-arranged supplies on a par with system supply insofar as concerns access to Transco's production area pipeline capacity.

(6) Transco also states it would (1) remove the existing restrictions in its major storage rate schedules which preclude the injection of third-party supplies into such storage, (2) offer a

new open access firm storage rate schedule if and to the extent that storage capacity is available in excess of that which is dedicated to specific storage services and to system operations, and (3) offer a new IS rate schedule for interruptible service to on and off-system customers. Transco requests blanket authority to use that rate schedule. Transco indicates that the rates for this service would be negotiated within a range of prices set forth in the rate schedule.

(7) Transco also states that it would update Volume 1 of Applicant's FERC Gas Tariff to eliminate outdated Rate Schedules OG, E, T-1, T-11 and TSS, to suspend both the existing purchased gas adjustment (PGA) mechanism and the gas supply deficiency curtailment provisions and to conditionally eliminate the minimum commodity bills from sales rate schedules.

With respect to (2) above, Transco states that any customer electing to remain on the existing CD, G, ACQ and PS Rate Schedules shall be entitled to do so for the remaining term of such customer's service agreement and thereafter until abandonment of service is approved. Transco indicates that the gas costs for those rate schedules would be based on the market-based formulae used for the MDQ service. Transco indicates that customers electing to remain on the existing firm sales rate schedules for annual service should only have the contract conversion rights as specified in Order No. 436/500 but no reduction rights. Transco states that customers shall have the option to convert all or any portion of existing CD, G and OG Rate Schedule entitlements to firm transportation under the FT Rate Schedule. Transco also states that its sole direct sale customer, Owens-Corning Fiberglas Corporation shall have the option to convert its contract sales service to FT service and/or an MDQ-type service. Transco indicates it would file under section 7(c) for such converted FT service for any customer which has elected to so convert and whose conversion has already taken place. Transco also states that with respect to future conversions to FT service under the MDQ Rate Schedule in the future, approval of the stipulation and agreement would constitute certificate authority to perform any such service under section 7 of the Natural Gas Act.

With respect to reductions in firm daily capacity, Transco indicates that during the first three years of the availability of MDQ Rate Schedule service, customers under such rate schedules shall have a one-time conditional right to reduce their firm entitlement capacity by up to 10 percent of the customer's then-effective firm daily entitlement.

Transco also proposes to permit its MDQ customers upon one year's notice to convert to firm transportation under the FT Rate Schedule up to fifteen percent per year of its original nominated MDQ daily quantity. Transco indicates the reduction rights would be non-cumulative.

Transco requests waiver of any sections of the Commission's regulations which may be necessary to permit the filing to be approved and made effective on a prospective basis. Transco also advises that approval of an application filed in Docket No. CI88-455-000 by Transco on behalf of its producer suppliers for blanket abandonment and sales authority to implement the marketing of all released gas supplies subject to the Commission's Natural Gas Act jurisdiction is a necessary and integral part of the stipulation and agreement and is a condition to the effectiveness hereof. Transco further alleges that Commission approval of the stipulation and agreement constitutes all approvals under sections 4 and 7 of the Natural Gas Act to effectuate the implementation, restructuring and abandonments of the various services proposed in the application, and to establish the gas pricing provisions including price changes pursuant to price formulae discussed in the application.

Comment date: June 22, 1988, in accordance with Standard Paragraph F at the end of this notice.

Standard Paragraphs

F. Any person desiring to be heard or make any protest with reference to said filing should on or before the comment date file with the Federal Energy Regulatory Commission, 825 North Capitol Street, NE., Washington, DC 20426, a motion to intervene or a protest in accordance with the requirements of the Commission's Rules of Practice and Procedure (18 CFR 385.211 and 385.214) and the Regulations under the Natural Gas Act (18 CFR 157.10). All protests filed with the Commission will be considered by it in determining the appropriate action to be taken but will not serve to make the protestants parties to the proceeding. Any person wishing to become a party to a proceeding or to participate as a party in any hearing therein must file a motion to intervene in accordance with the Commission's Rules.

Take further notice that, pursuant to the authority contained in and subject to jurisdiction conferred upon the Federal Energy Regulatory Commission by sections 7 and 15 of the Natural Gas Act and the Commission's Rules of Practice and Procedure, a hearing will be held without further nitice before the Commission or its designee on this filing if no motion to intervene is filed within the time required herein, if the Commission on its own review of the matter finds that a grant of the certificate is required by the public convenience and necessity. If a motion for leave to intervene is timely filed, or if the Commission on its own motion believes that a formal hearing is required, further notice of such hearing will be duly given.

Under the procedure herein provided for, unless otherwise advised, it will be unnecessary for the applicant to appear or be represented at the hearing.

Lois D. Cashell,

Acting Secretary.

[FR Doc. 88-12808 Filed 6-6-88; 8:45 am]
BILLING CODE 6717-01-M

[Docket No. G-2748-001, et al.]

Total Minatome Corp.; Application

June 2, 1988.

Take notice that on May 20, 1988, Total Minatome Corporation (TMC) of P.O. Box 4326, Houston, Texas 77210-4326, filed an application pursuant to sections 4 and 7 of the Natural Gas Act (NGA) and the Commission's regulations thereunder requesting that the Commission reflect TMC's status as successor-in-interest to CSX Oil & Gas Corporation (CSX) by amending the orders issuing certificates of public convenience and necessity to CSX in the dockets listed on the attached Appendix, redesignating CSX's related FERC Gas Rate Schedules listed on the attached Appendix and related blanket affidavits filed under §§ 154.94(h) and (k) of the Commission's regulations, and substituting TMC for CSX in pending proceedings before the Commission in which CSX was a party.

Effective April 27, 1988, CSX was merged into TMC after TMC purchased all shares of CSX capital stock. TMC thereby assumed all of the assets, liabilities, rights and powers formerly held by CSX.

Any person desiring to be heard or to make any protest with reference to said application should on or before June 15, 1988, file with the Federal Energy Regulatory Commission, Washington, DC 20426, a petition to intervene or a protest in accordance with the

requirements of the Commission's Rules of Practice and Procedure (18 CFR 385.211, 385.214). All protests filed with the Commission will be considered by it in determining the appropriate action to be taken but will not serve to make the protestants parties to the proceeding. Any person wishing to become a party in any proceeding herein must file a petition to intervene in accordance with the Commission's rules.

Under the procedure herein provided for, unless otherwise advised, it will be unnecessary for Applicant to appear or to be represented at the hearing.

Lois D. Cashell,

Acting Secretary.

APPENDIX.—TOTAL MINATOME CORPORATION

[Successor-in-Interest to CSX Oil & Gas Corporation]

Docket No.	Rate Schedule No.	Purchaser name
G-2748 [1]	1	Texas Gas Transmission Corp.
CI61-1427 [1]	7	Texas Gas Transmission Corp.
CI62-204 [1]	8	Texas Gas Transmission Corp.
CI68-1438	22	Natural Gas Pipeline Company of America.
CI69-782 [1]	27	Texas Gas Transmission Corp.
CI70-322	28	Consolidated Gas Supply Corp.
CI72-419 [1]	29	Texas Gas Transmission Corp.
CI72-674	30	United Gas Pipe Line Company.
CI72-664 [1]	31	Texas Gas Transmission Corp.
CI72-680	32	Columbia Gas Transmission Corp.
CI73-259 [1]	33	Texas Gas Transmission Corp.
CI73-260 [1]	34	Texas Gas Transmission Corp.
CI75-35	35	Consolidated Gas Supply Corp.
CI76-176 [1]	41	Texas Gas Transmission Corp.
CI76-180 [1]	42	Texas Gas Transmission Corp.
CI77-161 [1]	43	Texas Gas Transmission Corp.
CI77-159 [1]	44	Texas Gas Transmission Corp.
CI77-287 [1]	45	Texas Gas Transmission Corp.
CI78-385 [1]	46	Texas Gas Transmission Corp.
CI78-386 [1]	47	Texas Gas Transmission Corp.
CI78-489 [1]	48	Texas Gas Transmission Corp.
CI77-101 [1]	49	Texas Gas Transmission Corp.
CI78-576	50	Consolidated Gas Supply Corp.
CI78-562	51	Consolidated Gas Supply Corp.
CI78-1221	52	Northwest Pipeline Corporation.
CI79-88 [1]	53	Texas Gas Transmission Corp.

APPENDIX.—TOTAL MINATOME CORPORATION—Continued

[Successor-in-Interest to CSX Oil & Gas Corporation]

Docket No.	Rate Schedule No.	Purchaser name
CI79-91 [2]	54	Texas Gas Transmission Corp.
CI79-336 [1]	55	Texas Gas Transmission Corp.
CI79-354 [1]	56	Texas Gas Transmission Corp.
CI79-624	57	Consolidated Gas Supply Corp.
CI79-640 [1]	58	Texas Gas Transmission Corp.
CI80-148	59	Columbia Gas Transmission Corp.
CI81-45	60	Columbia Gas Transmission Corp.
CI81-69 [2]	61	Texas Gas Transmission Corp.
CI81-91 [1]	62	Texas Gas Transmission Corp.
CI81-92 [2]	63	Texas Gas Transmission Corp.
CI81-176	64	Consolidated Gas Supply Corp.
CI82-2-001	65	Columbia Gas Transmission Corp.
CI83-306 [2]	66	Texas Gas Transmission Corp.
CI83-402 [1]	67	Texas Gas Transmission Corp.
CI85-233	68	Columbia Gas Transmission Corp.
CI85-2334	69	Columbia Gas Transmission Corp.

[1] The certificates issued in these dockets are presently inactive because gas sales service was abandoned pursuant to the good faith negotiation procedures of § 270.201 of the Commission's regulations and Orders Nos. 451 and 451-A, effective September 30, 1987.

[2] The certificates issued in these dockets are presently inactive because service was abandoned by order issued pursuant to sectoin 7(b) of the Natural Gas Act, effective September 30, 1987. *CSX Oil & Gas Corporation,* 40 FERC (CCH) ¶ 61,373 (1987).

[FR Doc. 88-12809 Filed 6-6-88; 8:45 am]

BILLING CODE 6717-01-M

ENVIRONMENTAL PROTECTION AGENCY

[ER-FRL-3387-3]

Intent To Prepare an Environmental Impact Statement Supplement; North Jefferson County, KY, Metropolitan Sewer District (MSD)

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of intent to prepare a supplement to "The North County Area Environmental Impact Statement, Jefferson County, Kentucky" (July 1983) to evaluate a new proposed wastewater management alternative and its impacts.

Purpose: Pursuant to 40 CFR 1507.7 and in accordance with section 511(c) of the Clean Water Act (CWA) and section 102(c) of the National Environmental Policy Act (NEPA), EPA has identified a need to prepare an EIS supplement and therefore issues this notice of intent.

For Further Information and to be Placed on the Project Mailing List Contact: Robert B. Howard, Chief, NEPA Compliance Section, Environmental Assessment Branch, EAB-4, US EPA Region IV, 345 Courtland Street NE., Atlanta, Georgia 30365. Telephone: (404) 347-3776 or (FTS) 257-3776.

Need for Action: MSD has developed a wastewater management plan (North County Action Plan) for the North County Area of Jefferson County which proposes a different alternative than the preferred alternative of the original EIS. The North County Action Plan proposes eliminating all small "package plant" treatment facilities, constructing force mains, and using the existing Ohio River Interceptor and Morris Forman Wastewater Treatment Plant to handle all sewage of North Jefferson County. The original preferred alternative proposed the elimination of all small "package plant" treatment facilities and the construction of a regional treatment facility with gravity flow sewers. The EPA and MSD have determined the need to reevaluate the alternatives presented in the original EIS in light of changes that have occurred in North Jefferson County and determine a new preferred alternative. Issues to be addressed include land use impacts, impacts on the overflows of the Ohio River Interceptor, and primary impacts of operational changes on residential communities.

Alternatives: The EIS supplement will examine the long term alternatives for wastewater management in the study area.

Scoping: Participation in the EIS process is invited from individuals, organizations, and government agencies. Preliminary project scoping is underway. The EPA will hold a public scoping meeting on or about June 28, 1988 in North Jefferson County, Kentucky. A brief history of the project and a general description of the project goals will be presented. Comments and questions are encouraged and will be addressed and recorded. A Public Notice will be issued stating the exact time and location of the scoping meeting.

Estimated Date of DEIS Release: November 30, 1988.

Responsible Official: Greer C. Tidwell, Regional Administrator.

Richard E. Sanderson,

Director, Office of Federal Activities.

[FR Doc. 88-12753 Filed 6-6-88; 8:45 am]

BILLING CODE 6560-50-M

[OPTS-59259A; FRL-3393-1]

Certain Chemical; Approval of Test Marketing Exemption

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: This notice announces EPA's approval of an application for a test marketing exemption (TME) under section 5(h)(1) of the Toxic Substances Control Act (TSCA) and 40 CFR 720.38. EPA has designated this application as TME-88-10. The test marketing conditions are described below:

EFFECTIVE DATE: May 26, 1988.

FOR FURTHER INFORMATION CONTACT: Roy Seidenstein, Premanufacture Notice Management Branch, Chemical Control Division (TS-794), Environmental Protection Agency, Rm. E-611, 401 M St., SW., Washington, DC 20460, (202-382-3395).

SUPPLEMENTARY INFORMATION: Section 5(h)(1) of TSCA authorizes EPA to exempt persons from premanufacture notification (PMN) requirements and permit them to manufacture or import new chemical substances for test marketing purposes if the Agency finds that the manufacture, processing, distribution in commerce, use, and disposal of the substance for test marketing purposes will not present an unreasonable risk of injury to health or the environment. EPA may impose restrictions on test marketing activities and may modify or revoke a test marketing exemption upon receipt of new information which casts significant doubt on its finding that the test marketing activity will not present any unreasonable risk or injury.

EPA hereby approves TME-88-10. EPA has determined that test marketing of the new chemical substance described below, under the conditions set out in the TME application and for the time period and restrictions specified below, will not present any unreasonable risk of injury to health or the environment. Production volume, use, and the number of customers must not exceed those specified in the application. All other conditions and restrictions described in the application and in this notice must be met.

The following additional restrictions apply to TME-88-10. A bill of lading accompanying each shipment must state that the use of the substance is restricted to that approved in the TME. In addition, the Company shall maintain the following records until five years after the dates they are created, and shall make them available for inspection or copying in accordance with section 11 of TSCA:

1. The applicant must maintain records of the quantities of the TME substance produced and the dates of manufacture.

2. The applicant must maintain records of the quantities shipped to customers and the date of each shipment.

3. The applicant must maintain copies of the bill of lading that accompanies each shipment of the TME substance.

T-88-10.

Date of Receipt: April 12, 1988.

Notice of Receipt: April 28, 1988; 53 FR 15284.

Close of Review Period: May 26, 1988.

Applicant: Confidential.

Chemical: (G) Modified polyacrylamide.

Use: Cement additive.

Production Volume: Confidential.

Number of Customers: Nine.

Worker Exposure: At each of the 9 processing or use sites, approximately 4 to 20 workers will be exposed dermally to up to 3,900 mg/day and by inhalation to up to 150 mg/day, 250 days/year. For activities involving significant exposure, the Material Safety Data Sheet recommends the following protective equipment: respirators, gloves, goggles and protective clothing.

Test Marketing Period: 18 months.

Commencing on: Date of first manufacture.

Risk assessment: EPA identified no significant environmental concerns. EPA identified a potential concern for irritation to skin and mucous membranes. However, EPA believes that any potential health hazard will be mitigated by the protective equipment specified in the Material Safety Data Sheet. Therefore, the test market substance will not present any unreasonable risk of injury to health or the environment.

The Agency reserves the right to rescind approval or modify the conditions and restrictions of an exemption should any new information come to its attention which casts significant doubt on its findings that the test market activities will not present any unreasonable risk of injury to health or the environment.

Dated: May 26, 1988.

Charles L. Elkins,

Director, Office of Toxic Substances.

[FR Doc. 88-12773 Filed 6-6-88; 8:45 am]

BILLING CODE 6560-50-M

[FRL-3392-4]

Chicot Aquifer System of Southwest Louisiana; Sole Source Aquifer; Final Determination

AGENCY: Environmental Protection Agency.

ACTION: Notice.

SUMMARY: Notice is hereby given that pursuant to section 1424(e) of the Safe Drinking Water Act, the Regional Administrator, Region VI of the U.S. Environmental Protection Agency (EPA), has determined that the Chicot aquifer system is the sole or principal source of drinking water for an area comprising all or parts of 18 parishes in southwest Louisiana, and that this aquifer, if contaminated would create a significant hazard to public health. As a result of this action, Federal financially assisted projects constructed in the designated area will be subject to EPA review to ensure that these projects are designed and constructed so that they do not create a significant hazard to public health.

DATE: This determination shall be promulgated for purposes of judicial review at 1:00 p.m. eastern time, two weeks after the date of **Federal Register** publication.

ADDRESS: The data on which these findings are based are available to the public and may be inspected during normal business hours at the library of the U.S. Environmental Protection Agency, Region VI, 1445 Ross Avenue, Dallas, Texas 75202.

FOR FURTHER INFORMATION CONTACT: Ken Williams, Office of Groundwater, Environmental Protection Agency, Region VI at (214) 655-6446.

SUPPLEMENTARY INFORMATION:

I. Background

Section 1424(e) of the Safe Drinking Water Act (42 U.S.C., U.S.C., 300f, 300h-3(e), Pub. L. 83-523) states:

(e) If the Regional Administrator determines on his own initiative or upon petition that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the **Federal Register**. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Regional Administrator determines may contaminate such aquifer through a

recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

On December 5, 1986, "Save Acadia's Water" of Egan, Louisiana; petitioned the Environmental Protection Agency, Region VI, to designate the aquifer system in southwest Louisiana as a sole or principal source of drinking water. On May 8, 1987, EPA published a public notice announcing the receipt of the petition and requesting public comment. A public hearing was held in Lafayette, Louisiana, on June 9, 1987. The public was invited to submit comments and information on the petition until June 22, 1987. After review of all available information EPA determined that the aquifer system and its recharge zone occupies an eighteen parish area in Louisiana (consisting of all of Acadia, Allen, Beauregard, Calcasieu, Cameron, Evangeline, Jefferson Davis, Lafayette, St. Landry, and Vermilion parishes and portions of Avoyelles, Iberia, Natchitoches, Rapides, Sabine, St. Martin, St. Mary and Vernon parishes).

II. Basis for Determination

Among the factors to be considered by the Region VI Administrator in connection with the designation of an area under section 1424(e) are: (1) Whether the Chicot aquifer system is the area's sole or principal source of drinking water and (2) whether contamination of the aquifer would create a significant hazard to public health. On the basis of technical information available to this Agency, the Region VI Administrator has made the following findings, which are the bases for the determination noted above:

1. The Chicot aquifer system supplies approximately 87% of the public and domestic water consumed in the aquifer area.

2. There is no existing alternative drinking water source or combination of sources which provides 50% or more of the drinking water to the designated area, nor is there any available cost effective future source capable of supplying the drinking water demands for the designated area.

3. The Chicot aquifer system consists predominantly of a series of sands interbedded with discontinous clay layers. Where these sands are exposed at the surface in the recharge area, they are vulnerable to contamination from a number of sources including, but not limited to, chemical spills, highway and urban runoff, septic systems, leaking storage tanks and landfill leachate. Public and domestic wells which withdraw water from shallow aquifers under water table conditions in the recharge area are most susceptible to contamination. Since groundwater contamination can be difficult or sometimes impossible to reverse and since most of the drinking water in the designated area is provided by the Chicot aquifer system, contamination of the aquifer system would pose a significant public health hazard.

III. Description of the Chicot Aquifer System and its Recharge Zone

The designated area of the Chicot aquifer system occupies a portion of southwest Louisiana consisting of all or parts of eighteen parishes. The area is bounded on the west by the Sabine River, on the south by the Gulf of Mexico, on the east by the Atchafalaya River and on the north by the Red River and northernmost contiguous outcrop of the Carnahan Bayou member of the Fleming formation. The recharge zone covers all of this area. From its northern boundary, the aquifer system thickens progressively toward the south where near the edge of the designated area, a natural increase in the salinity of the groundwater renders it non-potable for local use.

The aquifer system may contain a dozen or more fresh water bearing sands at a single locality, but many of these sands are not contiguous and may not be reliably traced in the subsurface over long distances. The sands are recharged by downward percolating rainwater where they crop out in the recharge zone, by the Atchafalaya Basin to the east and by the vertical movement of fresh water from aquifers below the sands and overlying alluvial aquifers.

The area in which Federal financially assisted projects will be subject to review is the designated area described above. The streamflow source zone is not included in the project review area; only a small part of the northern portion of the recharge zone is traversed by a stream (Kisatchie Bayou) which originates outside the designated area, and under the existing climatic conditions flow of groundwater into streams strongly predominates over flow from streams into the groundwater.

IV. Information Utilized in Determination

The information utilized in this determination includes the petition, written and verbal comments submitted by the public, and various technical publications. The above data are available to the public and may be inspected during normal business hours at the library of the U.S. Environmental Protection Agency, Region VI, 1445 Ross Avenue, Dallas, Texas 75202.

V. Project Review

EPA Region VI will work with Federal agencies that in the future may provide financial assistance to the projects in the area of concern. Interagency procedures will be developed in which EPA will be notified of proposed commitments by Federal agencies for projects which could contaminate the aquifer. EPA will evaluate such projects and where necessary, conduct an in-depth review, including solicitation of public comments where appropriate. Should the Regional Administrator determine that a project may contaminate the aquifer through its recharge zone so as to create a significant hazard to public health, no commitment for Federal financial assistance may be entered into. However, a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer. Although the project review process cannot be delegated, the U.S. Environmental Protection Agency will rely to the maximum extent possible, on any existing or future state and local control mechanisms in protecting the groundwater quality of the aquifer.

Included in the review of any Federal financially assisted project, will be coordination, as needed, with the State and local agencies. Their comments will be given full consideration, and the Federal review process will attempt to complement and support State and local groundwater protection mechanisms.

VI. Summary of Public Comments

All comments at the public hearing were unanimously in favor of designation. Written comments received also strongly supported designation. EPA has prepared a Responsiveness Summary which addresses the comments received at the public hearing and during the comment periods.

Robert E. Layton Jr.,

Regional Administrator, Region VI.

Date: May 27, 1988.

[FR Doc. 88-12769 Filed 6-6-88; 8:45 am]

BILLING CODE 6560-50-M

[FRL-3392-1]

Sole Source Aquifer Determination for Missoula Valley Aquifer, Missoula, Montana

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of final determination.

SUMMARY: Pursuant to section 1424(e) of the Safe Drinking Water Act, the Regional Administrator in Region VIII of the U.S. Environmental Protection Agency (EPA) has determined that the Missoula Valley Aquifer and surrounding and immediately adjacent recharge area is the sole or principal source of drinking water for a valley in western Montana extending from the city of Missoula on the eastern end to the town of Huson approximately 20 miles to the northwest. No viable drinking water alternative sources of sufficient supply exist. If this aquifer is contaminated, a signficant hazard to public health could occur.

The boundaries of the designated area and project review area have been reviewed and approved by EPA. As a result of this action, Federal financially-assisted projects constructed in the approximately 100 square mile area mentioned above will be subject to EPA review to ensure that these projects are designed and constructed in a manner which does not create a significant hazard to public health.

EFFECTIVE DATE: This determination shall be promulgated for purposes of judicial review at 1:00 p.m. Eastern time on June 7, 1988.

ADDRESSES: The data upon which these findings are based are available to the public and may be inspected during normal business hours at the U.S. Environmental Protection Agency, Region VIII, 999 18th Street, Suite 500, Denver, CO 80202–2405.

FOR FURTHER INFORMATION CONTACT: James F. Dunn, Ground-Water Branch, EPA Region VIII, Denver Place, 999 18th Street, Suite 500, Denver, CO 80202–2405, telephone (303) 293–1703.

SUPPLEMENTARY INFORMATION: Notice is hereby given that, pursuant to section 1424(e) of the Safe Drinking Water Act, 42 U.S.C. 300f, 300h–3(e), Pub. L. 93–523 as amended, the Regional Administrator of the U.S. Environmental Protection Agency (EPA) has determined that the Missoula Valley Aquifer is the sole or principal source of drinking water for the Missoula-Huson area of western Montana described above. Pursuant to section 1424(e), Missoula-Huson area described above will be subject to EPA review.

I. Background

Section 1423(e) of the Safe Drinking Water Act states:

> If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the **Federal Register**. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of the law, be entered into to plan or design the project to assure that will not so contaminate the aquifer.

Effective March 9, 1987, authority to make a Sole Source Aquifer Designation Determination was delegated to the U.S. EPA Regional Administrators.

On November 23, 1987, a petition was received from the Missoula City-County Health Department (MCCHD), 301 West Adler, Missoula, Montana 59802, requesting EPA to designate ground-water resources of the Missoula-Huson area as a principal source of drinking water. In response to this petition, EPA published a notice in newspapers of Statewide distribution on January 31, 1988. EPA also sent copies of the notice to potentially-interested parties in the Missoula Valley area. This notice announced receipt of the petition and requested public comment. EPA prepared a draft document verifying technical information and proposing a sole or principal source aquifer designation. Due to a totally positive public response to the designation and lack of presentation of any new information during the public comment period, the public hearing scheduled for March 17, 1988 was cancelled. The public was allowed to submit comments until March 31, 1988. In all eight (8) comments were received by EPA. The comments unilaterally supported the designation of the Missoula Valley Aquifer as proposed.

II. Basis for Determination

Among the factors to be considered by the Regional Administrator in connection with the designation of an area under section 1424(e) are: (1) Whether the aquifer is the area's sole or principal source of drinking water and (2) whether contamination of the aquifer would create a significant hazard to public health.

On the basis of information available to this Agency, the Regional Administrator has made the following findings, which are the basis for the determination noted above:

1. The Missoula Valley Aquifer serves as the "principal source" of drinking water for approximately 60,000 permanent residents within the Missoula Valley area.

2. There is no existing alternative drinking water source or combination of sources which provides fifty percent or more of the drinking water to the designated area, nor is there any demonstrated available alternative future source capable of supplying the area's drinking water needs at an economical cost.

3. Although the water quality over most of the study area is satisfactory for domestic use, widespread potential exists for degradation. Potential sources of direct contamination include: septic systems, industrial waste ponds, several historical and one active municipal waste landfill(s), underground fuel and chemical storage tanks, and high pressure petroleum pipelines. Two major transportation routes, the Burlington Northern Railroad and Interstate 90, run parallel to each other bisecting the northern boundary of the aquifer. Hazardous materials and waste are routinely transported through Missoula over these routes. Accidental spills and releases of these materials could result in catastrophic damage to the aquifer. A number of incidents that have occurred and threatened or contaminated the Missoula Valley Aquifer are described below.

Yellowstone Pipeline

On June 26, 1982, a rupture occurred in a high pressure gasoline pipeline which spewed an undetermined amount of gasoline into La Valle Creek located in the north central portion of the aquifer. This spill caused contamination of wells in the aquifer adjacent to the creek. This was the second such rupture of this pipeline that the MCCHD is aware of. There was a leak in the mid 1970s that caused contamination of wells in the Grant Creek area just east of the La Valle Creek drainage.

Milltown Contamination

Just east and upstream of the proposed designation area is the Milltown Superfund site. The aquifer in this area is contaminated with arsenic and other heavy metals. The source of this contamination is the sediments trapped behind the Milltown Dam located on the Clark Fork River. This river flows through the Missoula Valley and is a major source of recharge to the Missoula Valley Aquifer.

Missoula County Weed Control Contamination

In December of 1984 low levels of pesticides were noted in a community water supply serving a KOA campground and mobile home court. Chemical analysis showed that a number of wells had elevated levels of the herbicide Picloram. Further investigation revealed that the source of the Picloram was the County Weed Control Department which was disposing of unused spray into a sump at their shop located upgradient of the wells. This practice was immediately ceased.

Browning Ferris Landfill Leachate

The Browning-Ferris Landfill, Missoula's only municipal waste landfill, is located near the northeastern boundary of the Missoula Aquifer between the Grant Creek and Rattlesnake Creek drainages.

In the spring of 1986 routine ground-water samples began showing elevated levels for almost every parameter sampled. Follow-up samples in the summer of 1986 taken from the base of the landfill showed continuing contamination of the ground-water system just down-gradient from the landfill.

Monitoring wells were drilled in the Missoula Valley Aquifer down-gradient from the landfill monitoring wells in late 1986. Sampling during 1987 has shown the continued presence of leachate at the landfill, but wells finished in the Missoula Aquifer have not yet shown any contamination. It is hypothesized that the Missoula Aquifer provides a tremendous dilution factor for the landfill leachate and therefore water quality has not changed noticeably in the aquifer. Monitoring and assessment are ongoing.

Burlington Northern Diesel Contamination

In the fall of 1986 the Montana Water Quality Bureau (WQB) informed MCCHD that diesel fuel had been detected at the Burlington Northern (BN) Railroad refueling site, located in the northern part of the city of Missoula and entirely within the aquifer boundaries.

The amount of fuel that had leaked into the aquifer was unknown at that time and remains unknown today, but several monitoring wells showed free product on the water table. At least one well had a lens of diesel fuel seven feet thick floating on top of the water table.

Since fall of 1986, BN has attempted to identify the source of the product and has begun recovery operations. As of October, 1987 the source of the problem has not been identified and full scale recovery has not been implemented. BN is continuing to work on the problem under the guidance of the WQB.

High Nitrate Levels in the Linda Vista Area

In a subdivision located on the southeast boundary of the proposed designation area at the mouth of Miller Creek, MCCHD discovered that a number of individual wells had elevated nitrate levels. Nine wells in this subdivision had nitrate levels above 19 mg/liter. These levels have been associated with the high use of dry wells (seepage pits) for sewage disposal in this area. These systems are being upgraded upon replacement.

Bacterial Contamination in the Frenchtown Area

In September of 1986, MCCHD became aware that 25 of 36 individual wells, located in a two square mile area near the west end of the designated area, were contaminated with coliform bacteria. Although a definite cause has not been determined, it appears that the bacterial contamination is related to high ground water during the summer and fall created by recharge from a large irrigation canal. Contamination of the supplies also seems to be correlated with improper well construction.

California Street Gasoline Contamination

Ground water beneath the California Street area of Missoula was contaminated by gasoline that leaked from a tank buried at the Champion Missoula Sawmill (CMS). Gasoline was detected in domestic wells near the CMS in May of 1985. CMS excavated a 1,000 gallon gasoline tank and discovered many holes in the tank. A loss of 600 gallons of fuel was recorded over a three day period after the tank was pressure tested. The total amount of fuel lost is unknown but it is assumed the tank had been leaking for several years. Champion initiated a ground-water monitoring program in May of 1985 to comply with a request from the Montana Department of Health and Environmental Sciences to determine the extent of pollution. Drinking water and in-line carbon filters for 24 individual wells were provided to the affected neighbors. In January, 1986, when gasoline constituents were verified in samples of the area wells, Champion began a well replacement program for the users. In the process of review for other possible contributors to contamination in the area, an abandoned oil refinery was discovered. This site was tested by an EPA FIT Team and is currently listed as a potential Superfund site.

Storm Water

Urban storm runoff is a matter of interest as a source of ground-water and surface water recharge, but most importantly as a potential source of contamination. According to a recent study by the University of Montana (Woessner/Wogsland, 1987), there are 2669 dry wells in the municipal area that meet the EPA Class 5 description of an injection well. It is estimated that annually, 119 million gallons of contaminant-laden storm water are injected eight to twenty feet deep into highly permeable soils via these sumps. Although the contribution to ground-water recharge is relatively small compared to other sources, the potential for contamination is disproportionately higher. Runoff quality is variable, with annual total dissolved solids levels estimated at more than 4400 tons.

Although it appears most of the chemicals are attenuated within the vadose zone, higher levels of calcium, magnesium, sodium, chloride, and iron have been found in ground water associated with runoff recharge.

The above examples of real and potential contamination clearly illustrate the vulnerability of the Missoula Aquifer.

III. Description of the Petitioned Aquifer

Located in western Montana, the Missoula Valley Aquifer consists of alluvial sediments of Early Miocene to Recent age deposited within a wide alluvial mountain basin (Missoula Valley). The valley extends from the city of Missoula on the eastern end to the town of Huson approximately twenty (20) miles to the northwest. From an aerial view, the valley is eight (8) miles wide at its widest extent and tapers to about one (1) mile in width near its western end at Huson. The boundary of the aquifer closely follows the limit of the valley floor and is defined by the topographic break of the surrounding terraces and mountain slopes.

The bedrock under the Valley consists of the Precambrian Belt Supergroup Metasediments (marine sedimentary rocks). These rocks are relatively impermeable and yield water from fracture systems only. The Renova Formation is a Tertiary deposit of clays, silts, sand, gravel and volcanic ash which unconformably overlies the marine sediments in the area beneath the Missoula Valley Aquifer. These strata range in thickness from 2,000 to 2,500 feet in the Missoula Valley.

The Missoula Valley Aquifer overlies the Renova Formation and forms the valley floor. This aquifer consists of a complex arrangement of fluvial, lacustrine and colluvial sediments, but it can generally be subdivided into three hydrostratigraphic units. The upper unit is a fluvially-deposited strata which consists of boulders, coarse cobbles, sand and silt. This unit ranges in thickness from 10 to 30 feet. The water content in this unit ranges from fully saturated to unsaturated, with the percentage of saturation dependent on location in the valley and time of year. The middle unit is a silty sandy clay with lenses of sand and gravel. Finer materials found in this unit are believed to have been deposited in a Pleistocene glacial lake which formed in the valley. This unit is approximately 40 feet thick and is less transmissive than the upper unit. The lower unit is composed primarily of coarse-grained sediments interlayered with thin layers of fine-grained sediments, with a total unit thickness ranging from 50 to 150 feet. This unit is hydraulically connected to the upper two units and behaves as an unconfined aquifer. This unit is quite transmissive (transmissivities range from approximately 100,000 to 1,700,000 gpd/ft) and is the unit of choice when most water supply wells are drilled in the valley.

IV. Information Utilized in Determination

The information utilized in this determination includes the petition from the Missoula City-County Health Department, research of available literature, the results of investigative efforts conducted to date on the ground-water resources of the area, and written and verbal comments submitted by the public. This data is available to the public and may be inspected during normal business hours at EPA Region VIII, 999 18th Street, Suite 500, Denver, CO 80202-2405, Attn: James F. Dunn (8WM-GW), telephone (303) 293-1703.

V. Project Review

EPA Region VIII will work with the Federal agencies that may in the future provide financial assistance to projects in the area of concern. Interagency procedures will be developed in which EPA will be notified of proposed commitments by Federal agencies for projects which could contaminate the aquifer. EPA will evaluate such projects and, where necessary, conduct an in-depth review, including soliciting public comments where appropriate. Should the Regional Administrator determine that a project may contaminate the aquifer through its recharge zone so as to create a significant hazard to public health, no commitment for Federal assistance may be entered into. However, a commitment for Federal assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not contaminate the aquifer.

Although the project review process cannot be delegated to state or local agencies, the EPA will rely upon any existing or future state and local control mechanisms to the maximum extent possible in protecting the ground-water quality of the aquifer. Included in the review of any Federal financially-assisted project will be coordination with the state and local agencies. Their comments will be given full consideration, and the Federal review process will attempt to complement and support state and local ground-water quality protection mechanisms.

VI. Summary and Discussion of Public Comments

In response to the Public Notice dated January 31, 1988, eight (8) written comments were received. These comments unanimously supported the designation of the area as a sole or principal source of drinking water. In addition, resolutions were adopted by the Missoula City Council and the Missoula County Commission supporting the petition and urging designation. No new information was presented during the public comment period regarding aquifer characteristics or reasons not to delegate.

Dated: May 9, 1988.

James J. Scherer,

Regional Administrator.

[FR Doc. 88-12771 Filed 6-6-88; 8:45 am]

BILLING CODE 6560-50-M

[FRL-3392-5]

A Portion of the Austin-Area Edwards Aquifer in Parts of Hays and Travis Counties, Texas; Sole Source Aquifer; Final Determination

AGENCY: Environmental Protection Agency.

ACTION: Notice.

SUMMARY: Notice is hereby given that pursuant to section 1424(e) of the Safe Drinking Water Act, the Regional Administrator, Region VI of the U.S. Environmental Protection Agency (EPA), has determined that a portion of the Austin-area Edwards aquifer is the sole or principal source of drinking water for an area of approximately 115 square miles in central Texas which includes parts of northern Hays and southern Travis counties, and that this aquifer, if contaminated would create a significant hazard to public health. As a result of this action, Federally financially assisted projects constructed in the designated area or in the stream flow source areas which contribute recharge to the aquifer will be subject to EPA review to ensure that these projects are designed and constructed so that they do not create a significant hazard to public health.

DATE: This determination shall be promulgated for purposes of judical review at 1:00 p.m. eastern time, two weeks after the date of Federal Register publication.

ADDRESS: The data on which these findings are based are available to the public and may be inspected during normal business hours at the library of the U.S. Environmental Protection Agency, Region VI, 1445 Ross Ave., Dallas, Texas 75202.

FOR FURTHER INFORMATION CONTACT: Richard A. Wooster, Officer of Groundwater, Environmental Protection Agency, Region VI at 214/655-6446.

SUPPLEMENTARY INFORMATION:

I. Background

Section 1424(e) of the Safe Drinking Water Act states:

> If the Administrator determines on his own initiative or upon petition that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

On August 29, 1986, the Hays County Soil and Water Conservation District #351 petitioned EPA for sole source designation of a portion of the Austin-area Edwards aquifer in parts of Hays and Travis Counties. The petition was substantially complete according to the proposed regulations for sole source designation which were applicable at the time. A public hearing was held on March 3, 1987, in Austin, Texas, to solicit public comments. The public comment period closed on March 11, 1987. At the public hearing a representative of the newly created

Barton Springs Edwards Aquifer Conservation (BSEACD) District declared the intention of the District to join in petitioning EPA for designation. On March 5, 1987, notice was published in the **Federal Register** of the availability of new guidance for evaluating SSA petitions. The notice also indicated that the guidance would apply to all petitions received after June 19, 1986. Thus, the new guidance is applicable to the Austin-area Edwards aquifer petition. Subsequently, the Region notified the petitioners that the petition was incomplete according to the new guidance and outlined the specific areas where additional information was needed. On December 11, 1987, EPA Regional representatives met with representatives of the BSEACD, the City of Austin and the Texas Water Commission to discuss additional information needed in the petition. Information to complete the petition was received by EPA in March of 1988.

II. Basis for Determination

Among the factors to be considered by the Region VI Administrator in connection with the designation of an area under section 1424(e) are: (1) Whether the particular aquifer is the sole or principal source of drinking water within the area in which it serves as a drinking water supply; and (2) whether contamination of the aquifer would create a significant hazard to public health. On the basis of technical information available to this Agency, the Region VI Administrator has made the following findings, which constitute the basis for the determination noted above:

1. A portion of the Austin-area Edwards aquifer system supplies approximately 74% of the public and domestic water consumed in the aquifer service area, as identified by the petitioner.

2. There is no existing alternative drinking water source or combination of sources which currently provides fifty percent or more of the drinking water to the aquifer service area, nor are there any reasonably available alternative sources which are capable of supplying the drinking water demands of the aquifer service area, should the aquifer become contaminated.

3. The Austin-area Edwards aquifer consists of the Georgetown limestone and the underlying Edwards limestone, both of which are of Cretaceous age. The Georgetown limestone ranges in thickness from 40 to 100 feet in the subsurface, and consists of interbeds of fossiliferous limestone and marly limestone. The Edwards limestone ranges in thickness from about 300 to 350 feet in the subsurface, and is composed of thick to thin-bedded limestone and dolomitic limestone containing solution collapse zones that create cavernous and vugular porosity. Since infiltration of precipitation and streamflow to the aquifer occurs readily in the recharge area, due to the extensive fractures, faults, and other secondary porosity features (e.g., caves, sinkholes, etc.) which characterize both the Edwards and Georgetown formations, the aquifer is vulnerable to contamination. Public and domestic wells which withdraw water from the Austin-area Edwards aquifer under water table conditions in the recharge area are most susceptible to contamination. Since groundwater contamination can be difficult or sometimes impossible to remediate and since most of the drinking water in the aquifer service area is provided by the aquifer, contamination of the Austin-area Edwards aquifer would pose a significant public health hazard.

III. Description of the Austin-area Edwards Aquifer

The Austin-area Edwards aquifer extends northeastwardly in a narrow band from a "groundwater divide," which separates it from the San Antonio-area Edwards aquifer near Kyle, Texas, in Hays County, to the Colorado River in southern Travis County. Laterally, the location of the Austin-area Edwards aquifer is defined to the west by a line delineating the geologic contact between the Edwards Limestone, which forms the base of the aquifer, and underlying Walnut or Glen Rose formations. To the east, the lateral boundary of the Austin-area Edwards aquifer is a line which delineates a marked decrease in groundwater quality, known locally as the "bad water line."

The designated area covers approximately the southern two-thirds of the area in which the Austin-area Edwards aquifer occurs, includes about 115 square miles and has boundaries at its west, south, and east which coincide with those which define the extent of the aquifer. The northern boundary of the designated area, as proposed by the petitioners, is the surface watershed divide (i.e., a topographic high) between Slaughter Creek and Williamson Creek and between Slaughter Creek and Boggy Creek.

The Austin-area Edwards aquifer recharge area makes up about the western one-half of the designated area described above, and occurs where the Edwards or Georgetown limestones (which together comprise the Edwards aquifer) crop out at the surface. The major creeks that cross the recharge area within the designated area and which contribute most of the recharge to the Austin-area Edwards aquifer are: Slaughter, Bear, Little Bear and Onion. Since recharge from these creeks provides the major portion of drinking water for approximately 22,800 people, the project review area includes the entire designated area and the streamflow source areas which contribute recharge to the aquifer through its recharge area.

IV. Information Utilized in Determination

The information utilized in making this determination includes the petition, written and verbal comments submitted by the public, and various technical publications. The above data are available to the public and may be inspected during normal business hours at the library of the U.S. Environmental Protection Agency, Region VI, 1445 Ross Avenue, Dallas, Texas 75202.

V. Project Review

EPA Region VI will work with Federal agencies that in the future may provide financial assistance to projects in the project review area of concern. Interagency coordination will be established to ensure EPA will be notified of proposed commitments by Federal agencies for projects which could contaminate the aquifer. EPA will then evaluate such projects and, where necessary, conduct an in-depth review, including solicitation of public comments where appropriate. Should the Regional Administrator determine that a project may contaminate the aquifer through its recharge zone so as to create a significant hazard to public health, no commitment may be entered into for Federal financial assistance. However, a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer. Although the project review process cannot be delegated, the U.S. Environmental Protection Agency will rely to the maximum extent possible, on any existing or future State and local control mechanisms in protecting the groundwater quality of the aquifer.

The EPA's review of any Federally financially assisted project will include coordination, as needed, with all appropriate State and local agencies. The EPA will give those agencies' comments given full consideration, and the Federal review process will attempt to complement and support State and

local groundwater protection mechanisms.

VI. Summary of Public Comments

Of the comments received at the public hearing and during the comment period, ten were in favor of designation, seven were opposed and three were undecided. Major issues rasied by these comments are discussed below:

Federal, State and Local Responsibilities

Several commenters expressed concern that the sole source aquifer program is a major duplication of existing Federal, state and local regulations and restrictions regarding groundwater protection and also represents another layer of bureaucratic red tape. EPA does not believe that this is the case. The sole source aquifer program only affects Federally financially assisted projects and, therefore, does not duplicate efforts to control the siting and operation of non-Federally funded projects. EPA recognizes the right of the states and municipalities to initiate their own groundwater protection programs, but the Sole Source Aquifer program, as implemented under the SDWA, deals directly with Federally assisted proejects.

Impact on Growth and Development of the Area Proposed for Designation

Many commenters were concerned that designation would restrict the growth of south Austin and would cause lengthy, expensive and unnecessary delays for projects involving Federal funds. EPA believes this will not be the case for several reasons. The great majority of the proposed area lies outside the city limits of Austin; few projects located within the current city limits would be reviewed. Also, in the eastern portion of the designated area, including San Leanna, Manchaca, Buda and other heavily developed areas, the aquifer is covered by the Del Rio clay and is said to be under artesian conditions. Because the aquifer is much less vulnerable to contamination in the artesian area, EPA anticipates that only certain types of projects (e.g. those involving excavations or wells) will require detailed review for the artesian area. Also, small isolated projects such as home loans are presumed to pose an insignificant threat to the aquifer and will not be reviewed individually although their cumulative affect may be reviewed for larger projects or housing developments. The SSA program has not been responsible for any unnecessary delays in any project completion, nor for the rejection of any project's application for Federal funding.

Location of Boundaries of the Designated Area

Some commenters questioned the placement of the northern boundary of the designated area. It was pointed out that the Edwards aquifer in this area is a hydrologic unit which is bounded on the south by the Southern boudary of the designated area but extends northward to the Colorado River. The designated area covers only the southern two-thirds of this hydrologic unit, and it was argued that excluding the northern one-third of the aquifer would not allow complete protection of the groundwater.

While EPA recognizes that the aquifer extends beyond the boundaries of the designated area it also recognizes that the local population north of Slaughter Creek is served predominantly by surface water supplied by the City of Austin. The Hays County Soil and Water Conservation District #351, is its sole source aquifer petition to EPA, identified the Edwards aquifer as the "sole or principal water source" for the people living in the southern two-thirds of the aquifer segment. The course of Slaughter Creek roughly defines the northern boundary of the area identified in the petition to be protected because of its overwhelming dependence on the Edwards as a drinking water source. In order to include the entire area which drains into Slaughter Creek that might impact the area to be protected, the northern border of the designated area is set at the northern surface watershed divide for Slaughter Creek (the topographic high separating the watershed of Slaughter Creek from the watersheds of Williamson and Boggy Creeks).

Hydrologic studies by the U.S. Geological Survey indicate that the flow of groundwater in the Edwards aquifer south of Austin is toward the northeast. Consequently, contamination of the aquifer north of Slaughter Creek would not affect the designated area. However, due to the direction of groundwater flow, the designation does provide a degree of protection to the undesignated portion of the hydrologic unit.

Availability of Alternate Water Supplies

Some commenters felt that the Edwards aquifer should not be considered the sole or principal source of water supply for the designated area because of the future or present availability of Austin city water. Commenters suggested that the present Austin water system could be easily expanded to supply surface water to the designated area and that such extension is bound to follow development of the area in the future. Under EPA guidelines for the sole source aquifer program, the feasibility of replacing the aquifer as a water supply source is considered when deciding whether to grant designation. When cost of replacement exceeds 0.6% of the mean household income, replacement by the alternate source is considered to be an economic burden.

It is estimated that the city of Austin has the ability to replace the water supply of the designated area. However, reasonable estimates of the total cost of replacement by surface water from Austin result in a cost of approximately $531 per year for each family in the designated area, or 2.2% of the mean household income. Under the circumstances, Austin city water is not considered to be a feasible replacement for the water supplied by the Edwards aquifer.

Regarding the question of expansion of Austin city services into the designated area, the designation decision can not be based on future events which are subject to unpredictable economic and political influences. The area under consideration currently meets the requirements for designation under the sole aquifer program and there is no provision in the Act or in EPA guidance for denial of a petition based on anticipated development of an area.

Date: May 27, 1988.

John S. Floex,

Acting Regional Administrator, Region VI.

[FR Doc. 88-12768 Filed 6-6-88; 8:45 am]

BILLING CODE 6560-50-M

FEDERAL EMERGENCY MANAGEMENT AGENCY

Agency Information Collection Submitted to the Office of Management and Budget for Clearance

The Federal Emergency Management Agency (FEMA) has submitted to the Office of Management and Budget the following information collection package for clearance in accordance with the Paperwork Reduction Act (44 U.S.C. Chapter 35)

Type: Revision of 3067-0106.

Title: Flooded Property Purchase Program.

Abstract: Section 1362 of the National Flood Insurance Act of 1968 (Pub. L. 90-488) as amended. (42 U.S.C. 4103) authorizes FEMA to purchase severely or repetitively damaged insured properties to reduce future Federal disaster costs. The forms

will be used to collect data which determines eligibility, funding priorities and cost effectiveness.

Type of Respondents:
Individuals or households
State or local governments
Farms
Businesses or other for-profit
Non-profit institutions
Small businesses or organizations

Number of Respondents: 150.
Burden Hours: 75.
Frequency of Recordkeeping or Reporting: Annually.

Copies of the above information collection request and supporting documentation can be obtained by calling or writing the FEMA Clearance Officer, Linda Shiley, (202) 646–2624, 500 C Street, SW., Washington, DC 20472.

Comments should be directed to Francine Picoult, (202) 395–7231, Office of Management and Budget, 3235 NEOB, Washington, DC 20503 within two weeks of this notice.

Dated: May 31, 1988.

Wesley C. Moore,

Director, Office of Administrative Support.

[FR Doc. 88–12759 Filed 6–6–88; 8:45 am]

BILLING CODE 6718–21–M

FEDERAL MARITIME COMMISSION

Agreement(s) Filed; Alabama State Docks Terminal Agreement

The Federal Maritime Commission hereby gives notice of the filing of the following agreement(s) pursuant to section 5 of the Shipping Act of 1984.

Interested parties may inspect and obtain a copy of each agreement at the Washington, DC Office of the Federal Maritime Commission, 1100 L Street, NW., Room 10325. Interested parties may submit comments on each agreement to the Secretary, Federal Maritime Commission, Washington, DC. 20573, within 10 days after the date of the **Federal Register** in which this notice appears. The requirements for comments are found in § 572.603 of Title 46 of the Code of Federal Regulations. Interested persons should consult this section before communicating with the Commission regarding a pending agreement.

Agreement No.: 224–200124.
Title: Alabama State Docks Terminal Agreement.
Parties:
Alabama State Docks Department (Department)
Bama Stevedore & Terminal Operators, Inc. (Bama)

Synopsis: The agreement authorizes Bama to perform or have performed freight handling services at the Department's facilities at the Port of Mobile.

By order of the Federal Maritime Commission.

Tony P. Kominoth,

Assistant Secretary.

Dated: June 2, 1988.

[FR Doc. 88–12788 Filed 6–6–88; 8:45 am]

BILLING CODE 6730–01–M

Agreement(s) Filed; South Europe/U.S.A. Freight Conference

The Federal Maritime Commission hereby gives notice of the filing of the following agreement(s) pursuant to section 5 of the Shipping Act of 1984.

Interested parties may inspect and obtain a copy of each agreement at the Washington, DC Office of the Federal Maritime Commission, 1100 L Street NW., Room 10325. Interested parties may submit comments on each agreement to the Secretary, Federal Maritime Commission, Washington, DC 20573, within 10 days after the date of the *Federal Register* in which this notice appears. The requirements for comments are found in § 572.603 of Title 46 of the Code of Federal Regulations. Interested persons should consult this section before communicating with the Commission regarding a pending agreement.

Agreement No.: 202–010676–029.
Title: South Europe/U.S.A. Freight Conference.
Parties:
Achille Lauro
Compania Trasatlantica Espanola, S.A.
Costa Container Lines, S.p.A.
Evergreen Marine Corporation (Taiwan) Ltd.
Farrell Lines, Inc.
Italia di Navigazione, S.p.A.
Jugolinija
Jugooceanija
Lykes Lines
A.P. Moller-Maersk Line
Nedloyd Lines
Sea-Land Services, Inc.
Trans Freight Lines
Zim Israel Navigation Company, Ltd.

Synopsis: The proposed amendment would specifically state the authority of the parties to negotiate and agree upon prices or rates to be paid by the parties to European inland carriers.

Agreement No.: 202–010790–005.
Title: Israel Eastbound Conference.
Parties:
Zim Israel Navigation Co., Ltd.
Farrell Lines, Inc.
Lykes Bros. Steamship Company, Inc.

Synopsis: The proposed amendment would conform the agreement to the Commission's requirements concerning service contract provisions and make other technical revisions necessitated by such action.

Agreement No.: 203–011075–006.
Title: Central America Discussion Agreement.
Parties:
United States/Central America Liner Association
Nordana Line, Inc.
Concorde Shipping, Inc.
Marine Bulk Carriers, Inc.
Nexos Line
Thompson Shipping Co., Ltd.
Maritima Juno, S.A.

Synopsis: The proposed amendment would delete Transportes Navieros Equatorianos as a party and would add Gran Golfo Express as a party to the agreement. The parties have requested a shortened review period

Agreement No.: 271–011196.
Title: Nedlloyd Lines/Hoegh Lines Reciprocal Space Charter Agreement.
Parties:
Nedlloyd Lines,
Hoegh Lines.

Synopsis: The proposed agreement would permit the parties to charter space aboard one another's vessels in the trade between Pacific Coast ports of North America and ports in Australia. The parties have requested a shortened review period.

By Order of the Federal Maritime Commission.

Tony P. Kominoth,

Assistant Secretary.

Dated: June 2, 1988.

[FR Doc. 88–12787 Filed 6–6–88; 8:45 am]

BILLING CODE 6730–01–M

FEDERAL RESERVE SYSTEM

Consumer Advisory Council; Solicitation of Nominations for Membership

AGENCY: Board of Governors of the Federal Reserve System.

ACTION: Solicitation of nominations for membership on the Board's Consumer Advisory Council.

SUMMARY: The Board is asking the public to nominate qualified individuals for appointment to its Consumer Advisory Council, which is comprised of representatives both of consumer and community interests and of the financial services industry. Twelve new members will be selected for three-year terms that

will begin in January 1989. It is contemplated that the Board will announce its selection of new members by year-end.

DATE: Nominations should be received by August 31, 1988.

ADDRESS: Nominations should be submitted in writing to Dolores S. Smith, Assistant Director, Division of Consumer and Community Affairs, Board of Governors of the Federal Reserve System, Washington, DC 20551. This information about nominees is available for inspection upon request, except as provided in the Board's Rules Regarding Availability of Information (12 CFR 262.6(a)).

FOR FURTHER INFORMATION CONTACT: Bedelia Calhoun, Staff Specialist, Division of Consumer and Community Affairs, (202) 452-2412; or for Telecommunications Device for the Deaf (TDD) users *only*, Earnestine Hill or Dorothea Thompson (202) 452-3544; Board of Governors of the Federal Reserve System, Washington, DC 20551.

SUPPLEMENTARY INFORMATION: The Consumer Advisory Council was established in 1976 at the direction of Congress to advise the Federal Reserve Board on the exercise of its duties under the Consumer Credit Protection Act and on other consumer related matters. The Council by law represents the interests both of consumers and of the financial community. Members serve three-year terms that are staggered to provide the Council with continuity.

Twelve new members will be selected this year for terms beginning January 1, 1989, to replace members whose terms expire this year. Nominations should include the address and telephone number of the nominee, information about past and present positions held, and a description of special knowledge, interests or experience related to consumer credit or other consumer financial services. Persons may nominate themselves as well as other candidates.

The Board is interested in candidates who are willing to express their viewpoints and who have some familiarity with consumer financial services. Candidates do not have to be experts on all levels of consumer financial services, but they should possess some basic knowledge of the area. In addition, they should be able to make the necessary time commitment to prepare for and attend meetings (usually two to three days long) three times a year and to take part in committee work.

In making the appointments, the Board will seek to complement the qualifications of continuing Council members in terms of affiliation and geographic representation, and to ensure the representation of women and minority groups. The Board expects to announce its selection of new members by year-end.

The Council meets in Washington, DC. Council members receive $100 per day for participating in meetings and for travel time. The Board also pays travel expenses.

The names and affiliations of current Council members (and the expiration date of each term of office) are listed below:

Chairman

Steven W. Hamm, Administrator, South Carolina Department of Consumer Affairs, Columbia, South Carolina, December 31, 1988

Stephen Brobeck, Executive Director, Consumer Federation of America, Washington, DC, December 31, 1990

Vice Chairman

Edward J. Williams, Senior Vice President, Consumer Banking Group, Harris Trust and Savings Bank, Chicago, Illinois, December 31, 1988

Edwin B. Brooks, Jr., President, Security Federal Savings and Loan Association, Richmond, Virginia, December 31, 1988

Members

Naomi G. Albanese, Former Professor of Home Economics, University of North Carolina, Greensboro, North Carolina, December 31, 1990

Judith N. Brown, Treasurer, American Association of Retired Persons, Edina, Minnesota, December 31, 1989

Michael S. Cassidy, Vice President, Chase Manhattan Bank, N.A., New York, New York, December 31, 1988

Betty Tom Chu, Chairman, Trust Savings Bank, Arcadia, California, December 31, 1990

Jerry D. Craft, Executive Vice President, First National Bank of Atlanta, Atlanta, Georgia, December 31, 1990

Donald C. Day, President, New England Securities Corp., Boston, Massachusetts, December 31, 1990

Richard B. Doby, Financial Services Consultant, Denver, Colorado, December 31, 1989

Richard H. Fink, President, Citizens for a Sound Economy, Washington, DC, December 31, 1989

Neil J. Fogarty, Attorney, Hudson County Legal Services, Jersey City, New Jersey, December 31, 1988

Stephen Gardner, Assistant Attorney General, Consumer Protection Division, State of Texas, Dallas, Texas, December 31, 1989

Kenneth A. Hall, President, South Division, First United Bank, Picayune, Mississippi, December 31, 1988

Elena Hanggi, Director, Institute for Social Justice, Little Rock, Arkansas, December 31, 1989

Robert A. Hess, President and General Manager, Wright Patman Congressional Federal Credit Union, Washington, DC, December 31, 1990

Robert J. Hobbs, Deputy Director, National Consumer Law Center, Boston, Massachusetts, December 31, 1988

Ramon W. Johnson, Professor of Finance, College of Business and Graduate School of Business, University of Utah, Salt Lake City, Utah, December 31, 1989

Robert W. Johnson, Professor of Management and Director, Credit Research Center, Purdue University, West Lafayette, Indiana, December 31, 1988

A.J. King, Chairman, Valley Bank of Kalispell, Kalispell, Montana, December 31, 1990

John M. Kolesar, President, Ameritrust Development Bank, Cleveland, Ohio, December 31, 1988

Alan B. Lerner, Senior Executive Vice President, Associates Corporation of North America, Dallas, Texas, December 31, 1988

Richard L.D. Morse, Professor of Family Economics, Kansas State University, Manhattan, Kansas, December 31, 1989

William E. Odom, Chairman of the Board, Ford Motor Credit Company, Dearborn, Michigan, December 31, 1990

Sandra R. Parker, Chairman, Banking Committee, Richmond United Neighborhoods, Richmond, Virginia, December 31, 1988

Sandra Phillips, Executive Director, Oakland Planning and Development Corporation, Pittsburgh, Pennsylvania, December 31, 1990

Jane Shull, Director, Institute for the Study of Civic Values, Philadelphia, Pennsylvania, December 31, 1988

Ralph E. Spurgin, President and Chief Executive Officer, Limited Credit Services, Inc., Columbus, Ohio, December 31, 1990

Lawrence Winthrop, President, Consumer Credit Counseling Service of Oregon, Inc., Portland, Oregon, December 31, 1990

Board of Governors of the Federal Reserve System, June 1, 1988.

James McAfee,

Associate Secretary of the Board.

[FR Doc. 88-12720 Filed 6-6-88; 8:45 am]

BILLING CODE 6210-01-M

FEDERAL TRADE COMMISSION

Granting of Request for Early Termination of the Waiting Period Under the Premerger Notification Rules

Section 7A of the Clayton Act, 15 U.S.C. 18a, as added by Title II of the Hart-Scott-Rodino Antitrust Improvements Act of 1976, requires persons contemplating certain mergers or acquisitions to give the Federal Trade Commission and the Assistant Attorney General advance notice and to wait designated periods before consummation of such plans. Section 7A(b)(2) of the Act permits the agencies, in individual cases, to terminate this waiting period prior to its expiration and requires that notice of this action be published in the Federal Register.

The following transactions were granted early termination of the waiting period provided by law and the premerger notification rules. The grants were made by the Federal Trade Commission and the Assistant Attorney General for the Antitrust Division of the Department of Justice. Neither agency intends to take any action with respect to these proposed acquititions during the applicable waiting period:

TRANSACTIONS GRANTED EARLY TERMINATION BETWEEN: 05/16/88 AND 05/28/88

Name of Acquiring Person, Name of Acquired Person, Name of Acquired Entity	PMN No.	Date terminated
Cox Enterprises, Inc., Metropolitan Broadasting Holding Company, Metropolitan Broadcasting Corporation of Tampa	88-1560	05/16/88
USX Corporation, K N Energy, Inc., Western Gas, Western Gas Transmission, Texas Gasmark	88-1403	05/17/88
Stewart A. Resnick, Theron Shamgochian, Monte Cristo Packing Company, Monte Cristo Intl. Sales	88-1454	05/17/88
H.B. Fuller Company, Widger Chemical Corporation, certain assets of WCC	88-1455	05/17/88
NIKE, Inc., The Bear Stearns Companies, Inc., Cole Haan Holdings Incorporated	88-1472	05/17/88
Sara Lee Corporation, Morrison Incorporated, Morrison Incorporated	88-1478	05/17/88
Grand Metropolitan Public Limited Company, Vision Express, Vision Express	88-1485	05/17/88
Alliant Computer Systems Corporation, Raster Technologies, Inc., Raster Technologies, Inc.	88-1367	05/18/88
The Prospect Group, Inc., BSN Corp., Cheerleader Supply, Inc., Team Mates, Inc., Green River	88-1512	05/18/88

TRANSACTIONS GRANTED EARLY TERMINATION BETWEEN: 05/16/88 AND 05/28/88—Continued

Name of Acquiring Person, Name of Acquired Person, Name of Acquired Entity	PMN No.	Date terminated
Koninklijke Wessanen N.V., Sheikh Abdulaziz A. Al-Sulaiman, Sheikh Abdulaziz A. Al-Sulaiman	88-1524	05/18/88
Norton Opax plc, Barlow Rand Limited, ICI Capital Corporation	88-1538	05/18/88
Inland Steel Industries, Inc., AFCO Metals, Inc., AFCO Metals, Inc.	88-1520	05/19/88
GTE Corporation, Intermountain Health Care, Inc., IHC Affiliated Services, Inc.	88-1544	05/19/88
Triax Midwest Associates, L.P., Mr. John A. Stephens, Vantage Cable, Inc.	88-1447	05/20/88
Triax Midwest Associates, L. P., Iowa Farm Bureau Federation, Vantage Cable, Inc.	88-1448	05/20/88
American General Corporation, Manufacturers Hanover Corporation, Manufacturers Hanover Consumer Services Group, Inc.	88-1466	05/20/88
Waste Management, Inc., The Henley Group, Inc., Wheelabrator Holdings Inc.	88-1468	05/20/88
The Henley Group, Inc., Waste Management, Inc., Two subs and UPE	88-1470	05/20/88
NRM Energy Company, L. P., Newmont Mining Corporation, Newmont Mining Corporation	88-1540	05/20/88
Norfolk Southern Corporation, Advanced Telecommunications Corporation, Advanced Telecommunications Corporation	88-1545	05/20/88
Occidental Petroleum Corporation, Mobil Corporation, Mobil Exploration & Producing North America, Inc.	88-1559	05/20/88
Skandia Insurance Company, Lincoln National Corporation, The Western Fire Insurance Company	88-1566	05/20/88
Businessland, Inc., ComputerCraft, Inc., ComputerCraft, Inc.	88-1580	05/20/88
TCW Special Placements Fund II, Michael W. Wilsey, Wilsey Foods, Inc.	88-1582	05/20/88
Victoria Co., Ltd., Illinois Mountain Partners, Aspen Skiing Company	88-1585	05/20/88
Victoria Co., Ltd., MKDG III Aspen Inc., Aspen Skiing Co.	88-1586	05/20/88
Victoria Co., Ltd., MKDG IV Aspen Inc., Aspen Skiing Company	88-1587	05/20/88
Heraeus Holding GmbH, Hendrik Jan Cornelis Kleijn, Electro-Nite Co.	88-1589	05/20/88
Gulf+Western Inc., Barclays PLC, Barclays PLC	88-1590	05/20/88
USF&G Corporation, Citicorp (1) Citicorp Invest. Mgmt. Inc. & (2) certain rel. assets	88-1595	05/20/88
Anchor Savings Bank FSB, Salomon Inc., Two subsidiaries of SI	88-1603	05/20/88

TRANSACTIONS GRANTED EARLY TERMINATION BETWEEN: 05/16/88 AND 05/28/88—Continued

Name of Acquiring Person, Name of Acquired Person, Name of Acquired Entity	PMN No.	Date terminated
LMG II, Inc., Roxboro (1976) Ltd., Brillion Iron Works, Inc.	88-1606	05/20/88
Sharad Tak, WGRZ Acquisition Corp., WGRZ Acquisition Corp.	88-1607	05/20/88
P. J. Carroll and Company plc, Alan M. Glazer, Bedford Fair Industries, Ltd., Bedford Fair Warehouse	88-1612	05/20/88
Shoji Kanazawa, Holiday Corporation, Holiday Corporation	88-1626	05/20/88
LIT Holdings PLC, Goldberg Securities, Inc., Goldberg Securities, Inc.	88-1611	05/23/88
Heritage Health Systems, John Hancock Mutual Life Insurance Company, John Hancock Healthplans, Inc.	88-1465	05/24/88
Banc One Corporation, General Electric Company, Geico Corporation	88-1552	05/24/88
John Buzzetta, Jean L. Scudder, The Times Herald Printing Company	88-1570	05/24/88
John Buzzetta, William Dean Singleton, The Times Herald Printing Company	88-1571	05/24/88
British Aerospace plc, Dennis D. Davis, Arkansas Modification Center, Inc.	88-1605	05/24/88
China International Trust & Investment Corporation, Phoenix Steel Corporation, Phoenix Steel Corporation	88-1630	05/24/88
Craig O. McCaw, Voting Trustee for MFC, Inc., Graphic Scanning Corp., Graphic Scanning Corp.	88-1486	05/25/88
Societe Internationale Pirelli S.A., Armtek Corporation, The Armstrong Rubber Company	88-1528	05/25/88
Pirelli S.p.A., Armtek Corporation, The Armstrong Rubber Company	88-1529	05/25/88
Prudential Corporation plc, Avalon/Applause, Inc., Avalon/Applause, Inc.	88-1553	05/25/88
Prudential Corporation plc, Harris Toibb, Applause Inc.	88-1554	05/25/88
Corning Glass Works, Revere Copper and Brass Incorporated, Revere Ware, Inc. and Revere Ware Courtesy Stores, Inc.	88-1562	05/25/88
Prudential Corporation plc, Larry Elins, Applause Inc.	88-1569	05/25/88
ALLTEL Corporation, Advanced Telecommunications Corporation, Advanced Telecommunications Corporation	88-1575	05/25/88
Golder, Thoma, Cressey Fund III Limited Partnership, Postal Instant Press, Inc., Postal Instant Press, Inc.	88-1583	05/25/88
Kamilche Company, Edward L. Scarff, Edward L. Scarff	88-1591	05/25/88
Sheldon G. Adelson, Kirk Kerkorian, MGM Sands, Inc.	88-1593	05/25/88

TRANSACTIONS GRANTED EARLY TERMINATION BETWEEN: 05/16/88 AND 05/28/88—Continued

Name of Acquiring Person, Name of Acquired Person, Name of Acquired Entity	PMN No.	Date terminated
American National Insurance Company, Primerica Corporation, Pennsylvania Life Ins. Co. et. al.	88-1620	05/25/88
First Chicago Corporation, Bentley Carpets, Inc., Bentley Carpets, Inc.	88-1635	05/25/88
First Chicago Corporation, BC Holding Corp., BC Holding, Corp.	88-1650	05/25/88
Sulzer Brothers Limited, Guy F. Atkinson Company of California, Bingham International, Inc.	88-1497	05/26/88
Thomas Robinson Group PLC, John Crowther Group plc, John Crowther Group plc	88-1558	05/26/88
Mannesmann A.G., Phillips Petroleum Company, Applied Automation, Inc.	88-1484	05/27/88
Norton Company, Roger C. Stull, Penhall Company	88-1509	05/27/88
Northern California Health Center, Homoeopathic Foundation of California, Marshal Hale Memorial Hospital	88-1530	05/27/88
Tele-Communications, Inc., United Cable Television Corporation, United Cable Television Corporation	88-1531	05/27/88
USA Mobile Communications, Inc. II, Henry Crown and Company, CQ Communications Corporation	88-1596	05/27/88
USA Mobile Communications, Inc. II, ALLTEL Corporation, ALLTEL Mobile Communications of Ohio	88-1597	05/27/88
USA Mobile Communications, Inc. II, Graphic Scanning Corp., Graphic Scanning Corp.	88-1598	05/27/88
David L. Paul, Dr. Ghaith R. Pharaon, American Southern Insurance Company	88-1600	05/27/88
Curtis L. Carlson, General Electric Company, Gelco Travel Management Services, Inc.	88-1604	05/27/88
William J. Stoecker, City Auto Stamping Co., Inc., City Auto Stamping Co., Inc.	88-1608	05/27/88
Eugene C. Cashman, Donald K. Gearheart, Quick Weight Loss Centers, Inc.	88-1617	05/27/88
Printon, Kane Government Securities, L. P., First Interstate Bancorp., First Interstate Capital Markets, Inc.	88-1618	05/27/88
Peninsular & Oriental Steam Navigation Company, LMB, Inc., LMB, Inc.	88-1622	05/27/88
Pacific Enterprises, Apache Petroleum Company, L.P., APC Operating Partnership, L.P.	88-1629	05/27/88
"Winterthur" Swiss Insurance Company, Fireman's Fund Corporation, Southern Guaranty Insurance Company	88-1640	05/27/88

TRANSACTIONS GRANTED EARLY TERMINATION BETWEEN: 05/16/88 AND 05/28/88—Continued

Name of Acquiring Person, Name of Acquired Person, Name of Acquired Entity	PMN No.	Date terminated
Richard G. Fanslow, Cargill, Incorporated, Summit National Life Insurance Company	88-1644	05/27/88
Eugene C. Cashman, Phillip R. and Joyce A. Schuman, Quick Weight Loss Centers, Inc.	88-1646	05/27/88
MLH Income Realty Partnership VI, Donald E. and Mary Katheryn Russell, Russell/Sutro, a California limited partnership	88-1655	05/27/88
ML Media Partners, L.P., Anthony S. Ocepek, Wincom Corporation	88-1662	05/27/88
International Broadcasting Corporation, Auto Club Insurance Association, Island of Bob-Lo Company	88-1666	05/27/88
ML Media Partners, L.P., Walter A. Tiburski, Wincom Broadcasting Corporation	88-1669	05/27/88
The Prospect Group, Inc., Kemper Corporation, National Automobile and Casualty Insurance Co.	88-1677	05/27/88
John W. Kluge, Orion Pictures Corporation, Orion Pictures Corporation	88-1680	05/27/88

FOR FURTHER INFORMATION CONTACT: Sandra M. Peay, Contact Representative, Premerger Notification Office, Bureau of Competition, Room 301, Federal Trade Commission, Washington, DC 20580, (202) 326-3100.

By direction of the Commission.

Emily H. Rock,

Secretary.

[FR Doc. 88-12750 Filed 6-6-88; 8:45 am]

BILLING CODE 6750-01-M

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Centers for Disease Control

National Institute for Occupational Safety and Health; Research and Demonstration Grants Relating to Occupational Safety and Health; Availability of Funds for Fiscal Year 1988

The Centers for Disease Control (CDC), National Institute for Occupational Safety and Health (NIOSH), announces the availability of funds in Fiscal Year 1988 for research and demonstration project grants relating to occupational safety and health. The objective of this program is to award funds to eligible institutions or agencies to establish, discover, elucidate, or confirm information relating to occupational safety and health, including innovative methods, techniques, and approaches for dealing with occupational safety and health problems. The Catalog of Federal Domestic Assistance number is 13.262.

Authority

This program is authorized under section 20(a)(1) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 669(a)(1)) and section 501(c) of the Federal Mine Safety and Health Act of 1977 (30 U.S.C. 951). Program regulations applicable to these grants are in Part 87, "National Institute for Occupational Safety and Health Research and Demonstration Grants," of Title 42, Code of Federal Regulations.

Eligibility Requirements

Eligible applicants include non-profit and for-profit organizations. Thus universities, colleges, research institutions and other public and private organizations including State and local governments and small, minority and/or woman-owned businesses are eligible for these research and demonstration grants.

Availability of Funds

There is $6,299,000 available in Fiscal Year 1988 to fund research project grants, demonstration grants, Special Emphasis Research Career Award (SERCA) grants, small grants, and Small Business Innovation Research (SBIR) grants.

For research project grants, it is expected that 22 continuation grants will be awarded totaling approximately $3.099 million and that about 17 new and competing renewal grants will be awarded totaling approximately $2.153 million and ranging from approximately $50,000 to $250,000 with the average award being approximately $140,000.

For SERCA grants, it is expected that approximately $222,000 will be awarded for seven continuation grants and $259,000 for eight new grants.

For small grants, it is expected that approximately $143,000 will be awarded for seven continuation grants and $248,000 for eleven new grants.

For SBIR grants, the total available funds for phase I and II awards is approximately $175,000.

Grants are usually funded for 12 months in project periods of up to 5 years for research project and demonstration grants, 3 years for SERCA grants, and 2 years for small grants. Continuation awards within the project period are made on the basis of

satisfactory progress and on the availability of funds.

Program Requirements

A. Research Project Grants

A research project grant application should be intended and designed to establish, discover, develop, elucidate, or confirm information relating to occupational safety and health, including innovative methods, techniques, and approaches for dealing with occupational safety and health problems. These studies may generate information that is readily available to solve problems or contribute to a better understanding of underlying causes and mechanisms.

B. Demonstration Grants

A demonstration grant application should address, either on a pilot or full-scale basis, the technical or economic feasibility or application of: (1) A new or improved occupational safety or health procedure, method, technique, or system, or (2) an innovative method, technique, or approach for preventing occupational safety or health problems.

C. Special Emphasis Research Career Award (SERCA) Grants

The SERCA is designed to enhance the research capability of individuals in the formative stages of their careers who have demonstrated outstanding potential for contributing as independent investigators to health-related research. Candidates must have had 2 or more years of relevant post-doctoral experience prior to the submission date. The application must document accomplishments in this period that demonstrate research potential; it must also present a plan for additional experience in a productive scientific environment at domestic institutions that will foster development of a career of independent research in the area of occupational safety and health. The SERCA is not intended for untried investigators, or for productive, independent investigators with significant numbers of publications of high quality, or for persons of senior academic rank (above associate professor or tenured). Moreover, the award is not intended to substitute one source of salary support for another for an individual who is already conducting full-time research, nor is it intended to be a mechanism for providing institutional support. The application must demonstrate that the award will make a difference in and enhance the candidate's development as an independent investigator.

Candidates must indicate a commitment of at least 60 percent time (not necessarily 60 percent salary) devoted to research under the SERCA grant, although full-time is desirable. Other work in the area of occupational safety and health will enhance the candidate's qualifications but is not a substitute for this requirement. While working closely with one or more advisers, the awardee is expected to develop capabilities in fundamental, applied, and/or clinical research in one of the areas listed under "Programmatic Interests." At the end of the award period, evidence of independent investigative capability should be present such that the individual is better able to compete in traditional NIOSH research grant activities.

The total grant award may comprise direct costs of up to $30,000 per year and up to 8 percent additional indirect costs. Direct costs may include salary plus fringe benefits, technical assistance, equipment, supplies, consultant costs, domestic travel, publication, and other costs. If the awardee already holds a small grant on the same research topic, the amount of the SERCA may be reduced up to the amount of the small grant. Awards may be up to 3 years and will not be renewable.

D. Small Grants

A small grant application is intended to provide financial support to carry out exploratory or pilot studies, to develop or test new techniques or methods, or to analyze data previously collected. This small grant program is intended for predoctoral graduate students, post-doctoral researchers (within 3 years following completion of doctoral degree or completion of residency or public health training) and junior faculty members (no higher than assistant professor). If university policy requires that a more senior person be listed as principal investigator, the application should specify that the funds are for the use of a particular student or junior-level person and should include appropriate justification for this arrangement. Though biographical sketches are required only for the person actually doing the work, the application should indicate who would be supervising the research. Small grant applications should be identified as such on the application form.

The total small grant award may comprise direct costs of up to $15,000 per year and additional indirect costs, as appropriate. The grants may be awarded for up to 2 years and are thereafter continuable by competitive renewal as a regular research grant. Salary of the principal investigator as well as that of the junior investigator, if university policy requires a senior person to be listed as the principal investigator, will not be allowed on a small grant, though salaries can be requested for necessary support staff such as laboratory technicians, interviewers, etc.

E. Program Project Grants

NIOSH will also accept applications for program project grants, but only after discussion with the individuals listed in this announcement.

Programmatic Interests

NIOSH program priorities, listed below, are applicable to all of the above types of grants. The conditions or examples listed under each category are selected examples, not comprehensive defintions of the category. Investigators may also apply in other areas related to occupational safety and health. Applications responding to this announcement will be reviewed by staff for their responsiveness and relevance to occupational safety and health. Assignment to NIOSH for funding consideration will be according to established referral guidelines. Potential applicants with questions concerning the acceptability of their proposed work should contact the individuals listed in this announcement under **"FOR FURTHER INFORMATION CONTACT."**

1. Occupational lung disease: asbestosis, byssinosis, silicosis, coal workers' pneumoconiosis, lung cancer, occupational asthma

2. Musculoskeletal injuries: disorders of the back, trunk, upper extremity, neck, lower extremity: traumatically induced Raynaud's phenomenon

3. Occupational cancers (other than lung): leukemia; Mesothelioma; cancers of the bladder, nose and liver

4. Severe occupational traumatic injuries: amputations, fractures, eye loss, and lacerations

5. Cardiovascular diseases: hepertension, coronary artery disease, acute myocardial infarction

6. Disorders of reproduction: inferitlity, spontaneous abortion, teratogenesis

7. Neurotoxic disorders: peripheral neuropathy, toxic encephalitis, psychoses, extreme personality changes (exposure-related)

8. Noise-induced loss of hearing

9. Dermatologic conditions: dermatoses, burns (scalding), chemical burns, contusions (abrasions)

10. Psychological disorders: neuroses, personality disorders, alcoholism, drug dependency

11. Engineering control systems: new technology performance evaluation, preconstruction review, equipment redesign, containment of hazards at the source, fundamental dust generation mechanisms, machine guarding/avoidance methods, explosion control, removal of emissions after generation, dispersion models, monitoring and warning techniques, technology transfer

12. Respirator research: new and innovative respiratory protective devices, techniques to predict performance, effectiveness of respirator programs, physiologic and ergonomic factors, medical surveillance strategies, psychological and motivational aspects, effectiveness of sorbents and filters, including chemical and physical properties.

Criteria for Review

Applications are not subject to review as governed by Executive Order 12372, Intergovernmental Review of Federal Programs.

Applications will be evaluated by a dual review process. The primary (peer) review is based on scientific merit and significance of the project, competence of the proposed staff in relation to the type of research involved, feasibility of the project, likelihood of its producing meaningul results, appropriateness of the proposed project period, adequacy of the applicant's resources available for the project, and appropriateness of the budget request.

Demonstration grant applications will be reviewed additionally on the basis of the following criteria:

- Degree to which project objectives are clearly established, obtainable, and for which progress toward attainment can and will be measured.
- Availability, adequancy, and competence of personnel, facilities, and other resources needed to carry out the project.
- Degree to which the project can be expected to yield or demonstrate results that will be useful and desirable on a national or regional basis.
- Extent of cooperation expected from industry, union, or other participants in the project, where applicable.

SERCA grant applications will be reviewed additionally on the basis of the following criteria:

- The review process will consider the applicant's scientific achievements, evidence of demonstrated commitment to a research career in occupational safety and health, and supportive nature of the research environment (including letter(s) of reference from adviser(s) which should accompany the application).

Small grant applications will be reviewed additionally on the basis of the following criteria:

- The review process will take into consideration the fact that the applicants do not have extensive experience with the grant process.

A secondary review will also be conducted. Factors considered in the secondary review will include:

- The results of the initial review.
- The significance of the proposed study to the research programs of NIOSH.
- National needs and program balance.
- Policy and budegtary considerations.

Application and Award

Applications should be submitted on Form PHS-398 (revised September 1986) or PHS-5161-1 for State and local government applications. Forms should be available from the institutional business offices or from: Office of Grants Inquiries, Division of Research Grants, National Institutes of Health, Westwood Building—Room 449, 5333 Westbard Avenue, Bethesda, Maryland 20892.

The original and six copies of the application must be submitted to the address below on or before the specified receipt dates in accordance with the instructions in the PHS-398 packet: Division of Research Grants, National Institutes of Health, Westwood Building—Room 240, Bethesda, Maryland 20892.

In developing the application please note that the conventional presentation for grant applications should be used and the points identified under "Criteria for Review" must be fulfilled.

An applicant organization has the option of having specific salary and fringe benefit amounts for individuals omitted from the copies of the application that are made available to outside reviewing groups. If the applicant's orginization elects to exercise this option, use asterisks on the original and six copies of the application to indicate those individuals for whom salaries and fringe benefits are being requested; the subtotals must still be shown. In addition, submit an additional copy of page 4 of Form PHS-398, completed in full with the asterisks replaced by the amount of the salary and fringe benefits requested for each individual listed. This budget page will be reserved for internal PHS staff use only.

The instructions in the Form PHS-398 packet should be followed concerning deadlines for either deliverying or mailing the applications. The application should be sent or delivered using the mailing label in the Form PHS-398 packet.

The proposed timetable for receiving applications and awarding grants is as follows:

Application deadline	Primary review group meeting	Secondary review meeting	Earliest possible beginning date
New and competing renewal applications:			
February 1 [1]	June	September	December 1.
June 1 [1]	October/November	January	April 1.
October 1 [1]	February/March	May	July 1.
Exceptions: Career Development and Small Grants:			
March 1	June	September	December 1.
July 1	October/November	January	April 1.
November 1	February/March	May	July 1.

[1] Competing renewal deadlines are 1 month later.

Awards will be made based on results of the initial and secondary reviews, balance among areas of programmatic interest, emphasis area, and availability of funds.

FOR FURTHER INFORMATION CONTACT:

For Technical Information Contact: Roy M. Fleming, Sc.D., Associate Director for Grants, National Institute for Occupational Safety and Health, Centers for Disease Control, 1600 Clifton Road, NE., Bldg. 1, Room 3053, Atlanta, Georgia 30333, Telephone: (404) 639-3343.

For Business Information Contact:
Henry Cassell, Grants Management Officer, Centers for Disease Control, 255 E. Paces Ferry Rd., NE., Room 321, Atlanta, Georgia 30305, Telephone: (404) 842-6575.

Dated: May 27, 1988.

Signed by:

Larry W. Sparks,

Acting Director, National Institute for Occupational Safety and Health.

[FR. Doc. 88-12781 Filed 6-6-88; 8:45 am]

BILLING CODE 4160-19-M

Food and Drug Administration

[Docket No. 88M-0186]

Medstone International, Inc.; Premarket Approval of the Medstone 1050 ST Lithotripter

AGENCY: Food and Drug Administration; HHS.

ACTION: Notice.

SUMMARY: The Food and Drug Administration (FDA) is announcing its approval of the application by Medstone International, Inc., Costa Mesa, CA, for premarket approval, under the Medical Device Amendments of 1976, of the Medstone 1050 ST Lithotripter. After reviewing the recommendation of the Gastroenterology/Urology Devices Panel, FDA's Center for Devices and Radiological Health (CDRH) notified the applicant by letter of April 15, 1988, of the approval of the application.

DATE: Petitions for administrative review by July 7, 1988.

ADDRESS: Written requests for copies of the summary of safety and effectiveness data and petitions for administrative review to the Dockets Management Branch (HFA-305), Food and Drug Administration, Rm. 4-62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Frank S. Casciani, Center for Devices and Radiological Health (HFZ-420), Food and Drug Administration, 8757 Georgia Ave., Silver Spring, MD 20910, 301-427-7750.

SUPPLEMENTARY INFORMATION: On September 3, 1987, Medstone International, Inc., Costa Mesa, CA 92627, submitted to CDRH an application for premarket approval of the Medstone 1050 ST Lithotripter. FDA filed the application on September 10, 1987. The device is an extracorporeal shock wave lithotripter for use in the fragmentation of upper urinary tract stones, i.e., renal calyceal stones, renal pelvic stones, and upper ureteral stones.

On November 18, 1987, the Gastroenterology-Urology Devices Panel, an FDA advisory committee, reviewed and recommended approval of the application. On April 15, 1988, CDRH approved the application by a letter to the applicant from the Director of the Office of Device Evaluation, CDRH.

A summary of the safety and effectiveness data on which CDRH based its approval is on file in the Dockets Management Branch (address above) and is available from that office upon written request. Requests should be identified with the name of the device and the docket number found in brackets in the heading of this document.

A copy of all approved labeling is available for public inspection at CDRH—contact Frank S. Casciani (HFZ-420), address above.

Opportunity for Administrative Review

Section 515(d)(3) of the Federal Food, Drug, and Cosmetic Act (the act) (21 U.S.C. 360e(d)(3)) authorizes any interested person to petition, under section 515(g) of the act (21 U.S.C. 360e)(g)), for administrative review of CDRH's decision to approve this application. A petitioner may request either a formal hearing under Part 12 (21 CFR Part 12) of FDA's administrative practices and procedures, regulations or a review of the application and CDRH's action by an independent advisory committee of experts. A petition is to be in the form of a petition for reconsideration under § 10.33(b) (21 CFR 10.33(b)). A petitioner shall identify the form of review requested (hearing or independent advisory committee) and shall submit with the petition supporting data and information showing that there is a genuine and substantial issue of material fact for resolution through administrative review. After reviewing the petition, FDA will decide whether to grant or deny the petition and will publish a notice of its decision in the **Federal Register.** If FDA grants the petition, the notice will state the issue to be reviewed, the form of review to be used, the persons who may participate in the review, the time and place where the review will occur, and other details.

Petitioners may, at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) two copies of each petition and supporting data and information, identified with the name of the device and the docket number found in brackets in the heading of this document. Received petitions may be seen in the office above between 9 a.m. and 4 p.m., Monday through Friday.

This notice is issued under the Federal Food, Drug, and Cosmetic Act (secs. 515(d), 520(h), 90 Stat. 554-555, 571 (21 U.S.C. 360e(d), 360j(h))) and under authority delegated to the Commissioner of Food and Drugs (21 CFR 5.10) and redelegated to the Director, Center for Devices and Radiological Health (21 CFR 5.53).

Dated: May 27, 1988

John C. Villforth,

Director, Center for Devices and Radiological Health.

[FR Doc. 88-12790 Filed 6-6-88; 8:45 am]

BILLING CODE 4160-01-M

[Docket No. 88M-0161]

N&N Contact Lens International, Inc.; Premarket Approval of Tresoft and Tresoft Thin (Ocufilcon A) Soft (Hydrophilic) Contact Lenses

AGENCY: Food and Drug Administration; HHS.

ACTION: Notice.

SUMMARY: The Food and Drug Administration (FDA) is announcing its approval of the application by N & N Contact Lens International, Inc., Lynnwood, WA, for premarket approval, under the Medical Device Amendments of 1976, of the Tresoft and Tresoft Thin (ocufilcon A) Soft (Hydrophilic) Contact Lenses. After reviewing the recommendation of the Ophthalmic Devices Panel, FDA's Center for Devices and Radiological Health (CDRH) notified the applicant by letter of March 31, 1988, of the approval of the application.

DATE: Petitions for administrative review by July 7, 1988.

ADDRESS: Written requests for copies of the summary of safety and effectiveness data and petitions for administrative review to the Dockets Management Branch (FHA-305), Food and Drug Administration, Rm. 4-62, 5600 Fishers Lane, Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: David M. Whipple, Center for Devices and Radiological Health (HFZ-460), Food and Drug Administration, 8757 Georgia Ave., Silver Spring, MD 20910, 301-427-7940.

SUPPLEMENTARY INFORMATION: On December 15, 1987, N & N Contact Lens International, Inc., Lynnwood, WA 98046, submitted to CDRH an application for premarket approval of the Tresoft and Tresoft Thin (ocufilcon A) Soft (Hydrophilic) Contact Lenses. The lenses are indicated for daily wear for the correction of visual acuity in aphakic and not-aphakic persons with nondiseased eyes that are myopic or hyperopic. The lenses may be worn by

persons who exhibit astigmatism of 1.50 diopters (D) or less that does not interfere with visual acuity. The Tresoft (ocufilcon A) Lens ranges in powers from −20.00 D to +20.00 D. The Tresoft Thin (ocufilcon A) Lens ranges in powers from −15.00 D to +20.00 D. The lenses are to be disinfected using a chemical (not heat) disinfection system. The application includes authorization from Ciba Vision Corp., Atlanta, GA 30340, to incorporate the information contained in its approved premarket approval applications for the Tresoft and Tresoft Thin (ocufilcon A) Soft (Hydrophilic) Contact Lenses.

On February 18, 1977, Ciba's PMA N17–855 was approved by FDA. On March 31, 1988, CDRH approved the subject application (P870079) by a letter to the applicant from the Director of the Office of Device Evaluation, CDRH.

A summary of the safety and effectiveness data on which CDRH based its approval is on file in the Dockets Management Branch (address above) and is available from that office upon written request. Requests should be identified with the name of the device and the docket number found in brackets in the heading of this document.

A copy of all approved labeling is available for public inspection at CDRH—contact David M. Whipple (HFZ–460), address above.

The labeling of the aproved contact lens states that the lens is to be used only with certain solutions for disinfection and other purposes. The restrictive labeling informs new users that they must avoid using certain products, such as solutions intended for use with hard contact lenses only. The restrictive labeling needs to be updated periodically, however, to refer to new lens solutions that CDRH approves for use with aproved contact lenses made of polymers other than polymethylmethacrylate, to comply with the Federal Food, Drug, and Cosmetic Act (the act) (21 U.S.C. 301 et seq.), and regulations thereunder, and with the Federal Trade Commission Act (15 U.S.C. 41–58), as amended. Accordingly, whenever CDRH publishes a notice in the **Federal Register** of approval of a new solution for use with an approved lens, each contact lens manufacturer or PMA holder shall correct its labeling to refer to the new solution at the next printing or at any other time CDRH prescribes by letter to the applicant.

Opportunity for Administrative Review

Section 515(d)(3) of the act (21 U.S.C. 360e(d)(3)) authorizes any interested person to petition, under section 515(g) of the act (21 U.S.C. 360e(g)), for administrative review of CDRH's decision to approve this application. A petitioner may request either a formal hearing under Part 12 (21 CFR Part 12) of FDA's administrative practices and procedures regulations or a review of the application and CDRH's action by an independent advisory committee of experts. A petition is to be in the form of a petition for reconsideration under § 10.33(b) (21 CFR 10.33(b)). A petitioner shall identify the form of review requested (hearing or independent advisory committee) and shall submit with the petition supporting data and information showing that there is a genuine and substantial issue of material fact for resolution through administrative review. After reviewing the petititon, FDA will decide whether to grant or deny the petition and will publish a notice of its decision in the **Federal Register.** If FDA grants the petition, the notice will state the issue to be reviewed, the form of review to be used, the persons who may participate in the review, the time and place where the review will occur, and other details.

Petitioners may, at any time on or before July 7, 1988, file with the Dockets Management Branch (address above) two copies of each petition and supporting data and information, identified with the name of the device and the docket number found in brackets in the heading of this document. Received petitions may be seen in the office above between 9 a.m. and 4 p.m., Monday through Friday.

This notice is issued under the Federal Food, Drug, and Cosmetic Act (secs. 515(d), 520(h), 90 Stat. 554–555, 571 (21 U.S.C. 360e(d), 360(h))) and under authority delegated to the Commissioner of Food and Drugs (21 CFR 5.10) and redelegated to the Director, Center for Devices and Radiological Health (21 CFR 5.53).

Dated: May 27, 1988.

John C. Villforth,

Director, Center for Devices and Radiological Health.

[FR Doc. 88–12791 Filed 6–6–88; 8:45 am]

BILLING CODE 4160–01–M

National Institutes of Health

National Cancer Institute; Meeting

Notice is hereby given that a public meeting will be held so that the recently formed National Research Council/National Academy of Sciences Committee on Dietary Guidelines Implementation may receive information relevant to its study. Established at the request of the National Cancer Institute and the Kaiser Family Foundation, the Committee will conduct an indepth study and propose detailed strategies and options for the implementation of dietary guidelines by government agencies at all levels; by professionals in the nutrition, medical, and allied health fields; by educational institutions; and by certain segments of the private sector, including institutions concerned with mass feeding.

The Committee is chaired by Dr. Edward N. Brandt, Chancellor of the University of Maryland at Baltimore and former Assistant Secretary for Health.

The meeting will be held on Wednesday, July 6 from 9:15 a.m. to 3:30 p.m. in the auditorium of the National Academy of Sciences, 2100 C Street, NW., Washington, DC 20418. The entire meeting will be open to the public, but attendance will be open to the public, but attendance will be limited to space available.

Written material for presentation to the Committee can be of any length and should be sent to one of the individuals listed below by Friday, June 17. Multiple copies should be provided if public distribution at the meeting is desired. Persons wishing to make oral presentations should also submit their written comments by June 17. When the final program has been determined, all oral presenters will be given a specified amount of time to summarize their views. Time will be also provided for discussion.

For further information contact Lenora Moragne, Ph.D., or Paul Thomas, Ed.D., Dietary Guidelines Implementation Committee, National Academy of Sciences, 2101 Constitution Avenue, NW., Room 340, Washington, DC 20418, (202) 334–2582.

Dated: May 31, 1988.

James B. Wyngaarden,

Director, National Institutes of Health.

[FR Doc. 88–12797 Filed 6–6–88; 8:45 am]

BILLING CODE 4140–01–M

National Heart, Lung, and Blood Institute; Meeting

Notice is hereby given of the meeting of the Interagency Technical Committee (IATC), sponsored by the National Heart, Lung, and Blood Institute on July 20, 1988, from 1 p.m. to 5 p.m., at the National Institutes of Health, Building 31, C-Wing, Conference Room 9, 9000 Rockville Pike, Bethesda, Maryland 20892, (301) 496–5031.

The entire meeting is open to the public. The IATC is meeting to give member agencies the opportunity to exchange information on the status of their respective programs that relate to

heart, blood vessel, lung, and blood diseases and blood resources. Attendance by the public will be limited to space available.

For the agenda, list of participants, and meeting summary, contact: Ms. Janyce N. Hedetniemi, Chief, Planning and Coordination Branch, Office of Program Planning and Evaluation, National Heart, Lung, and Blood Institute, National Institutes of Health, Building 31, Room 5A03, Bethesda, Maryland 20892, (301) 496–5031.

Dated: May 31, 1988.

James B. Wyngaarden,

Director, NIH.

[FR Doc. 88–12798 Filed 6–6–88; 8:45 am]

BILLING CODE 4140–01–M

DEPARTMENT OF THE INTERIOR

Minerals Management Service

Development Operations Coordination Document

AGENCY: Minerals Management Service; Interior.

ACTION: Notice of the receipt of a proposed Development Operations Coordination Document (DOCD).

SUMMARY: Notice is hereby given that Mobil Exploration & Producing U.S. Inc. has submitted a DOCD describing the activities it proposes to conduct on Lease OCS 053, Block 128, Eugene Island Area, offshore Louisiana. Proposed plans for the above area provide for the development and production of hydrocarbons with support activities to be conducted from an existing onshore base located at Morgan City, Louisiana.

DATE: The subject DOCD was deemed submitted on May 25, 1988.

ADDRESS: A copy of the subject DOCD is available for public review at the Public Information Office, Gulf of Mexico OCS Region, Minerals Management Service, 1201 Elmwood Park Boulevard, Room 114, New Orleans, Louisiana (Office Hours: 8 a.m. to 4:30 p.m., Monday through Friday).

FOR FURTHER INFORMATION CONTACT: Mr. Lars T. Herbst, Minerals Management Service, Gulf of Mexico OCS Region, Field Operations, Plans, Platform and Pipeline Section, Exploration/Development Plans Unit; Telephone (504) 736–2533.

SUPPLEMENTARY INFORMATION: The purpose of this Notice is to inform the public, pursuant to section 25 of the OCS Lands Act Amendments of 1978, that the Minerals Management Service is considering approval of the DOCD and that it is available for public review.

Revised rules governing practices and procedures under which the Minerals Management Service makes information contained in DOCDs available to affected States, executives of affected local governments, and other interested parties became effective December 13, 1979 (44 FR 53685). Those practices and procedures are set out in revised § 250.34 of Title 30 of the CFR.

Date: May 25, 1988.

J. Rogers Pearcy,

Regional Director, Gulf of Mexico OCS Region.

[FR Doc. 88–12751 Filed 6–6–88; 8:45 am]

BILLING CODE 4310–MR–M

National Park Service

Golden Gate National Recreation Area Advisory Commission; Meeting

Notice is hereby given in accordance with the Federal Advisory Committee Act that a meeting of the Golden Gate National Recreation Area Advisory Commission will be held at 7:30 p.m. (PDT) on Thursday, July 7, 1988, at Building 201, Fort Mason, San Francisco, California.

The Advisory Commission was established by Public Law 92–589 to provide for the free exchange of ideas between the National Park Service and the public and to facilitate the solicitation of advice or other counsel from members of the public on problems pertinent to the National Park Service systems in Marin, San Francisco and San Mateo Counties.

Members of the Commission are as follows:

Mr. Frank Boerger, Chairman
Ms. Amy Meyer, Vice Chair
Mr. Ernest Ayala
Mr. Richard Bartke
Dr. Howard Cogswell
Brig. Gen. John Crowley, USA (ret)
Mr. Margot Patterson Doss
Mr. Neil D. Eisenberg
Mr. Jerry Friedman
Mr. Steve Jeong
Ms. Daphne Greene
Ms. Gimmy Park Li
Mr. Gary Pinkston
Mr. Merritt Robinson
Mr. R. H. Sciaroni
Mr. John J. Spring
Dr. Edgar Wayburn
Mr. Joseph Williams

The first agenda item will be a presentation by the United States Army on the proposal to expand the Post Exchange at the Presidio of San Francisco, Building T–135, by 26,000 square feet to provide increased retail space and a consolidation of services and activities presently found elsewhere on post. The addition will be to the west and south of the existing building. It will contain the Garden Shop from the Four Seasons Store, Building 609, which has been demolished. The Post Exchange building is at the 35 percent design stage and construction is planned to begin in the summer of 1988 and be completed in 14 months. The former Post Exchange and the Four Seasons Store which have been demolished for the site clearance total the equivalent square footage of the proposed one-story addition (26,000 square feet).

The second agenda item will be a presentation by the U.S. Army on a proposal to upgrade the motor pool area and facilities located at Fort Scott in the northwest section of the Presidio of San Francisco. Approximately one-half acre of the existing two-acre dirt parking area would be paved and existing asphalt areas would be resurfaced as necessary. Improved drainage structures and concrete curbs would be constructed around the perimeter of the parking area. Other work at the site include rehabilitating the perimeter fence and replacement of the west and east gates at the site. The fence adjacent to Lincoln Boulevard is to be moved 30 feet east to allow for screening tree plantings.

The third agenda item will be a presentation by the staff of Golden Gate National Recreation Area on the Environmental Assessment on options for development of the Presidio Bayfront/Crissy Field area in San Francisco. Four alternatives are considered for this San Francisco shoreline site. Each alternative would implement the approved General Management Plan for the Golden Gate National Recreation Area, which recommended restored dunes, natural landscaping, lawn, parking, and visitor amenities, such as restrooms and picnic facilities. The amount and location of parking and the balance between the urban and natural landscapes varies under each alternative. Twenty acres of open space will be created by removal of paving and nonhistoric structures. New and restored landscapes would include dunes, grassland, lawn and a seasonal wetland reminiscent of Crissy Field's past as a saltwater marsh. One alternative considers a saltwater lagoon.

The formal presentation of the Crissy Field Bayfront options were presented at the Golden Gate National Recreation Area Advisory Commission meeting on March 10, 1988. A presentation of broad development plans was made before the GGNRA Advisory Commission on November 10, 1987. Options for the

Golden Gate National Recreation Area portions of Presidio Bayfront/Crissy Field were developed with the assistance of John Northmore Roberts, Landscape Architects and Land Planners, of Berkeley, California, under the auspices of the Golden Gate National Park Association. Plans for those Presidio Bayfront/Crissy Field lands under U.S. Army management were developed by the Directorate of Engineering and Housing at the Presidio of San Francisco. The San Francisco City Planning Commission staff has also participated in the formulation of these options.

The meeting is open to the public. Persons wishing to receive the Environmental Assessment for the Crissy Field plans should contact the Staff Assistant, Golden Gate National Recreation Area, Building 201, Fort Mason, San Francisco, California 94123 or telephone (415) 556–4484.

This meeting will be recorded for documentation and transcribed for dissemination. Minutes of the meeting will be available to the public after approval of the full Advisory Commission. A transcript is available after July 28, 1988. For copies of the minutes contact the Office of the Staff Assistant, Golden Gate National Recreation Area, Building 201, Fort Mason, San Francisco, California 94123.

Stanley T. Albright,

Regional Director, Western Region.

[FR Doc. 88–12747 Filed 6–6–88; 8:45 am]

BILLING CODE 4310-70-M

National Register of Historic Places; Pending Nominations; California et al.

Nominations for the following properties being considered for listing in the National Register were received by the National Park Service before May 28, 1988. Pursuant to § 60.13 of 36 CFR Part 60 written comments concerning the significance of these properties under the National Register criteria for evaluation may be forwarded to the National Register, National Park Service, U.S. Department of the Interior, Washington, DC 20243. Written comments should be submitted by June 22, 1988.

Carol D. Shull,

Chief of Registration National Register.

CALIFORNIA

Butte County

Chico vicinity, *Honey Run Covered Bridge*, Honey Run Humbug Rd.

Contra Costa County

Richmond, *Ford Motor Company Assembly Plant*, 1414–1422 Harbour Way, S.

Los Angele County

Los Angeles, *Machell–Seaman House*, 2341 Scarff St.

San Bernardino County

Colton, *Carnegie Public Library Building*, 380 N. La Cadena Dr.

San Luis Obispo County

San Luis Obispo, *Pacific Coast Railway Company Grain Warehouse*, 65 Higuera St.

Santa Clara County

Gilroy, *Gilroy Free Library*, 195 Fifth St.

Sonoma County

Healdsburg, *Healdsbury Carnegie Library*, 221 Matheson St.

Petaluma, *Free Public Library of Petaluma*, 20 Fourth St.

IOWA

Johnson County

Iowa City, *Ashton, Ned, House*, 820 Park Rd.

Wright County

Clarion, *Burlington, Cedar Rapids and Northern Railroad Passenger Station*, 302 S. Main

KENTUCKY

Bourbon County

Paris, *Duncan Avenue Historic District*, Duncan, Stoner, Vine, and Massie Sts.

McCracken County

Paducah, *Lincoln School*, S. Eighth St., between Ohio and Tennessee Sts.

LOUISIANA

Madison County

Tallulah, *Kell House*, 502 N. Mulberry St.

Union County

Farmerville, *Stein, Daniel, House*, 208 W. Bayou

MAINE

Cumberland County

East Harpswell, *East Harpswell Free Will Baptist Church*, Cundys Harbor Rd.

New Gloucester vicinity, *Universalist Meeting House*, ME 231, Intervale

North Harpsell, *Union Church*, ME 123

Yarmouth, *Central Parish Church*, 146 Main St.

Hancock County

Von Mach Site (ME 151/02)

Lincoln County

Boothbay Harbor, *Auld–McCobb House*, Oak St.

Penobscot County

Eddington Bend (Site 74–8)

Bangor, *Veazie, Jones P., House*, 88 Fountain St.

Somerset County

Norridgewock, *Eaton School*, Jct. of Main St. and Mercer Rd.

North Anson vicinity, *Bailey Farm Windmill*, ME 16

Waldo County

North Islesboro vicinity, *Free Will Baptist Church and Cemetery*, Church Rd.

Washington County

Addison vicinity, *Indian River Baptist Church*, ME 187, Indian River

York County

Waterboro vicinity, *First Baptist Church*, West side, Jct. of West Rd. and Federal St.

MASSACHUSETTS

Berkshire County

Sheffield, *Sheffield Plain Historic District*, Roughly one-half mile of US 7, S from Cook Rd.

Essex County

Peabody, *Peabody, George, House*, 205 Washington St.

Hampshire County

Northampton, *Fort Hill Historic District*, 124, 130, 134, 144, 148, and 135 South St.

Middlesex County

Melrose, *Melrose Public Library*, 63 W. Emerson St.

Suffolk County

Boston, *Goodwin, Ozias, House*, 7 Jackson Ave.

MINNESOTA

St. Louis County

Ely vicinity, *Burntside Lodge Historic District*, Off CR 88

NEBRASKA

Adams County

Pauline vicinity, *Antioch School*, Near Crooked Creek

Buffalo County

Meisner, George, House,

Butler County

David City, *Thorpe's Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 457–½ D St.

Surprise, *Surprise Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, SE. corner, intersection of Miller and River Sts.

Chase County

Champion, *Champion Mill*, Mill St. and Second St.

Cherry County

Valentine vicinity, *Bryan Bridge*, US 20

Cheyenne County

Lodgepole, *Lodgepole Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, W. side of Oberfelder at Front

Colfax County

Clarkson, *Z.C.B.J. Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Fourth and Pine

Dawes County

Crawford, *Army Theatre (Opera House Buildings in Nebraska 1867–1917 MPS)*, Fort Robinson State Park

Dawson County

Cozad, *Allen's Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 100th E. Eighth

Dodge County

Snyder, *Schneider's Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 104 Ash

Fillmore County

Geneva, *Auditorium, The (Opera House Buildings in Nebraska 1867–1917 MPS)*, 160 N. Ninth

Hamilton County

Hampton, *IOOF Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, N. Third and B Sts.

Jefferson County

Diller, *Diller, Anna C., Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Commercial and Hilton

Johnson County

Tecumseh, *Tecumseh Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 123 S. Third

Knox County

Bloomfield, *Pospeshil Theatre (Opera House Buildings in Nebraska 1867–1917 MPS)*, 123 Broadway

Verdigre, *Z.C.B.J. Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Fourth Ave. and Main

Merrick County

Central City, *Ellen, Martha, Auditorium (Opera House Buildings in Nebraska 1867–1917 MPS)*, 706 C Ave.

Nemaha County

Auburn, *New Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 921 Central Ave.

Nuckolls County

Lawrence, *Lawrence Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Second and Calvert Sts.

Pawnee County

Steinauer, *Steinauer Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 215 Main

Table Rock, *Table Rock Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Houston St.

Polk County

Stromsburg, *Wilson, Victor E., House*, 518 Main St.

Richardson County

Falls City, *Gehling's Theatre (Opera House Buildings in Nebraska 1867–1917 MPS)*, 1592 Stone St.

Saline County

Friend, *Warren's Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, 511 Second St.

Sheridan County

Rushville, *Gourley's Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Second St.

Webster County

Bladen, *IOOF Hall and Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Main St.

York County

Gresham, *Clem's Opera House (Opera House Buildings in Nebraska 1867–1917 MPS)*, Main and Post Sts.

NEW JERSEY

Bergen County

Norwood, *Church of the Holy Communion*, Summit Ave.

NEW MEXICO

Santa Fe County

Santa Fe, *Archbishop Lamy's Chapel*, Bishop Lodge Rd.

NEW YORK

Columbia County

Livingston, *Richmond Hill*, CR 31

Dutchess County

New Hackensack, *Horton, Joseph, House*, NY 376, New Hackensack Rd.

Westchester County

Mount Kisco, *St. Mark's Cemetery*, E. Main St., corner of St. Mark's Pl.

NORTHERN MARIANA ISLANDS

Tinian Island

Magpo Valley Latte Sites District

OREGON

Benton County

Corvallis vicinity, *Irwin, Richard S., Barn*, 26208 Finley Refuge Rd.

Correction:

The following property was eroneously listed in Georgia under Atkinson County in our annual list dated Tuesday, May 24, 1988, under Properties Determined Eligible for the National Register in Fiscal Year 1986, and should read as follows:

HAWAII

Honolulu County

Honolulu, *Ala Wai Canal*, Oahu Island (10/28/85)

[FR Doc. 88-12723-Filed 6-6-88; 8:45 am]

BILLING CODE 4310-70-M

INTERSTATE COMMERCE COMMISSION

[Ex Parte No. 473]

Railroad Cost of Capital—1987

AGENCY: Interstate Commerce Commission.

ACTION: Notice of decision.

SUMMARY: On June 6, 1988, the Commission served a decision to update its estimate of the railroad industry's cost of capital for 1987. The composite cost of capital rate for 1987 is found to be 11.6 percent, based on a current cost of debt of 9.3 percent, a cost of preferred equity capital of 7.9 percent, a cost of common equity capital of 12.6 percent, and a 30.6 percent debt/0.5 percent preferred equity/68.9 percent common equity capital structure mix. The cost of capital finding made in this proceeding will enable the Commission to make its annual determination of railroad revenue adequacy for 1987.

FOR FURTHER INFORMATION CONTACT: Ward L. Ginn, Jr., (202) 275–7489, (TDD for hearing impaired: (202) 275–1721).

SUPPLEMENTARY INFORMATION: The cost of capital finding in this decision should be utilized to evaluate the adequacy of railroad revenues for 1987 under the standards and procedures promulgated in Ex Parte No. 393 (Sub-No. 1), *Standards for Railroad Revenue Adequacy*, 3 I.C.C. 2d 261 (1986). This finding may also be utilized in proceedings involving the prescription of maximum reasonable rate levels.

Additional information is contained in the Commission's decision. To purchase a copy of the full decision, write to Dynamic Concepts, Inc., Room 2229, Interstate Commerce Commission Building, Washington, DC 20423, or call (202) 289–4357/4359 (DC Metropolitan area), (assistance for the hearing impaired is available through TDD services (202) 275–1721 or by pickup from Dynamic Concepts, Inc., in Room 2229 at Commission headquarters).

Decided: May 31, 1988.

By the Commission, Chairman Gradison, Vice Chairman Andre, Commissioners Sterrett, Simmons, and Lamboley.

Noreta R. McGee,

Secretary.

[FR Doc. 88-12756 Filed 6-6-88; 8:45 am]

BILLING CODE 7035-01-M

[Docket No. AB-55 (Sub-No. 246X)]

Exemption; CSX Transportation, Inc.; Abandonment Exemption; Portsmouth, VA

Applicant has filed a notice of exemption under 49 CFR 1152 Subpart F—*Exempt Abandonments* to abandon its 0.32-mile line of railroad between Valuation Stations 6018+32, and 6035+30 in Portsmouth, VA.

Applicant has certified (1) that no local traffic has moved over the line for at least 2 years and that overhead traffic is not moved over the line or may be rerouted, and (2) that no formal complaint filed by a user of rail service on the line (or by a state or local government entity acting on behalf of such user) regarding cessation of service over the line either is pending with the Commission or any U.S. District Court, or has been decided in favor of the complainant within the 2-year period. The appropriate state agency has been notified in writing at least 10 days prior to the filing of this notice.

As a condition to use of this exemption, any employee affected by the abandonment shall be protected pursuant to *Oregon Short Line R. Co.-Abandonment-Goshen*, 360 I.C.C. 91 (1979). To address whether this condition adequately protects affected employees, a petition for partial revocation under 49 U.S.C. 10505(d) must be filed.

Provided no formal expression of intent to file an offer of financial assistance has been received, the exemption will be effective July 7, 1988 (unless stayed pending reconsideration). Petitions to stay regarding matters that do not involve environmental issues [1] and formal expressions of intent to file an offer of financial assistance under 49 CFR 1152.27(c)(2) [2] must be filed by June 17, 1988, and petitions for reconsideration, including environmental, energy, and public use concerns, must be filed by June 27, 1988 with: Office of the Secretary, Case Control Branch, Interstate Commerce Commission, Washington, DC 20423.

A copy of any petition filed with the Commission should be sent to applicant's representative: Lawrence H. Richmond, Esq., CSX Transportation, 100 North Charles Street, Baltimore, MD 21201.

If the notice of exemption contains false or misleading information, use of the exemption contains false or misleading information, use of the exemption is void *ab initio*.

Applicant has filed an environmental report which addresses environmental or energy impacts, if any, from this abandonment.

The Section of Energy and Environment (SEE) will prepare an environmental assessment (EA). SEE will serve the EA on all parties by June 12, 1988. Other interested persons may obtain a copy of the EA from SEE by writing to it (Room 3115, Interstate Commerce Commission, Washington, DC 20423) or by calling Carl Bausch, Chief, SEE at (202) 275-7316).

A notice to the parties will be issued if use of the exemption is conditioned upon environmental or public use conditions.

Decided: May 26, 1988.

By the Commission, Jane F. Mackall, Director, Office of Proceedings.

Noreta R. McGee,

Secretary.

[FR Doc. 88-12522 Filed 6-6-88; 8:45 am]

BILLING CODE 7035-01-M

[1] A stay will be routinely issued by the Commission in those proceedings where an informal decision on environmental issues (whether raised by a party or by the Section of Energy and Environment in its independent investigation) cannot be made prior to the effective date of the notice of exemption. *See* Ex Parte No. 274 (Sub-No. 8), *Exemption of Out-of-Service Rail Lines*, served March 8, 1988.

[2] *See Exemption of Rail Abandonments or Discontinuance—Offers of Financial Assistance*, 4 I.C.C.2d 164, (1987), and final rules published in the Federal Register on December 22, 1987 (52 FR 48440-484-6).

DEPARTMENT OF LABOR

Mine Safety and Health Administration

[Docket No. M-88-85-C]

Quarto Mining Co.; Petition for Modification of Application of Mandatory Safety Standard

Quarto Mining Company, 1800 Washington Road, Pittsburgh, Pennsylvania 15241 has filed a petition to modify the application of 30 CFR 75.1003-2(f) (requirements for movement of off-track mining equipment in areas of active workings where energized trolley wires or trolley feeder wires are present; pre-movement requirement; certified and qualified persons) to its Powhatan No. 4 Mine (I.D. No. 33-01157) located in Monroe County, Ohio. The petition is filed under section 101(c) of the Federal Mine Safety and Health Act of 1977.

A summary of the petitioner's statements follows:

1. The petition concerns the requirement that a minimum vertical clearance of 12 inches be maintained between the farthest projection of the unit of equipment which is being moved and the energized trolley feeder wires at all times during the movement or transportation of such equipment.

2. Petitioner states that the mine is requesting relief only for movement of longwall shields. The longwall shields, when collapsed and loaded onto equipment dollies for moving, are lower than the normal rolling stock i.e. the mine cars. Twelve inches of radical clearance is provided from all trolley wire for shields loaded on dollies. All fire resistant fluid that can be removed from the shields without disassembly is removed prior to transporting them.

3. As an alternate method, petitioner proposes that prior to moving a shield, which has been loaded on a dolly, passed energized trolley wire the following procedures would be followed:

(a) When the shields are fully collapsed and loaded for movement on the equipment, dolly measurements would be taken to verify that they are lower than rolling stock;

(b) Nonconductive standards such as plastic pipe would be mounted on each end of the dolly extending to 48 inches above the rail to allow the motorman to ascertain any low top or wire conditions;

(c) The top and wire side of each shield would be covered with fire resistant material;

(d) The shields and dollies would be examined by a certified person to ensure that coal dust, float dust, loose coal, oil, grease, and other combustible materials have been cleared up and not permitted to accumulate on either unit;

(e) The shield would be effectively grounded to the dolly;

(f) A qualified person, would examine the trolley wires, trolley feeder wires, and associated automatic circuit interrupting devices for the entire route to ensure proper short circuit protection exists;

(g) A mine car would be transported over the entire route to physically assure all crossings and clearance;

(h) All shields would to securely anchored to the equipment dolly to prevent shifting and or separation from the dolly. The shields would be blocked on each end by steel which is an integral part of the dolly. Two chain binders and a chain would hold down the shields securely to the dolly and would also prevent the shields from slipping off the sides;

(i) The trip of shields would be moved at a reduced speed to lessen the likelihood of the shields shifting or the dollies coming off the track;

(j) Any shield which does not meet the requirements of 3(a) would be moved in full compliance with the standard; and

(k) All personnel involved with the move would be reinstructed as to the new procedures.

4. Petitioner states that the proposed alternate method will provide the same degree of safety for the miners affected as that afforded by the standard.

Request for Comments

Persons interested in this petition may furnish written comments. These comments must be filed with the Office of Standards, Regulations and Variances, Mine Safety and Health Administration, Room 627, 4015 Wilson Boulevard, Arlington, Virginia 22203. All comments must be postmarked or received in that office on or before July 7, 1988. Copies of the petition are available for inspection at that address.

Date: June 1, 1988.

Patricia W. Silvey,

Director, Office of Standards, Regulations and Variances.

[FR Doc. 88-12819 Filed 6-6-88; 8:45 am]

BILLING CODE 4510-43-M

Occupational Safety and Health Administration

[V-88-1]

Varience Applications; Doe Run Co.

AGENCY: Occupational Safety and Health Administration Labor.

ACTION: Notice of application for permanent variance.

SUMMARY: This notice announces the application of the Doe Run Company for a permanent variance from the provision in the lead standard [29 CFR 1910.1025(f)(2), Table II] limiting the use of half-mask, air-purifying respirators equipped with high efficiency filters, to areas where the lead concentration in air is not in excess of 500 micrograms per cubic meter of air. The applicant has requested that it be authorized, under specified conditions, to permit employees to wear such respirators where they are exposed to lead at concentrations in excess of that limitation.

DATES: The last date for interested persons to submit comments is July 7, 1988. The last date for affected employers and employees to request a hearing is July 7, 1988.

ADDRESSES: Send comments or requests for a hearing to: Office of Variance Determination, Occupational Safety and Health Administration, U.S. Department of Labor, Third Street and Constitution Avenue NW., Washington, DC 20210.

FOR FURTHER INFORMATION CONTACT:

James J. Concannon, Director, Office of Variance Determination at the above address, Telephone: (202) 523-7193.

or the following Regional and Area Offices:

US Department of Labor—OSHA, 911 Walnut Street Room 406, Kansas City, Missouri 64106

US Department of Labor—OSHA, 4300 Goodfellow Boulevard—Building 105E, St. Louis, Missouri 63120.

SUPPLEMENTARY INFORMATION:

Notice of Application

Notice is hereby given that the Doe Run Company, 7733 Forsyth Boulevard, Clayton, Missouri 63105, has made application pursuant to section 6(d) of the Occupational Safety and Health Act of 1970 (84 Stat. 1596; 29 U.S.C. 655) and 29 CFR 1905.11 for a variance from the standard prescribed in 29 CFR 1910.1025(f)(2), respirator selection.

The address of the place of employment that will be affected by the application is as follows: Herculaneum Smelting Division, Herculaneum, Missouri 63048.

The purpose of 29 CFR 1910.1025(f)(2) is to protect employees from excessive lead exposure by requiring employers to provide employees with respirators appropriate for the concentration of lead in air.

The applicant certifies that employees who would be affected by the variance have been notified of the application by giving a copy of it to their authorized employee representatives and by posting a copy at all places where notices to employees are normally posted. Employees have also been informed of their right to petition the Assistant Secretary for a hearing.

Regarding the merits of the application, the applicant contends that the practices and conditions it proposes to use will provide a place of employment which is as safe and healthful as that provided under the occupational health standard for lead.

The Doe Run Company operates a lead smelter in southwest Missouri with a smelter design capacity of 225,000 tons annually, which represents approximately 36 percent of the total United States refined lead capacity. In fiscal 1986 [11/85-10/86] the smelter produced 181,000 tons of refined lead.

Under the provisions of the lead standard, specifically 29 CFR 1910.1025(e)(1), Doe Run is required to implement engineering, work practice and administrative controls, to the extent feasible, to reduce and maintain employee exposure to airborne lead to or below 100 micrograms per cubic meter ($\mu g/m^3$) of air, averaged over an 8-hour period. By June 29, 1991, the applicant must comply with a permissible exposure limit (PEL) of 50 $\mu g/m^3$ through the use of engineering and work practice controls, except to the extent it can demonstrate that such controls are not feasible.

During the time period necessary to install the above-referenced controls, or in work situations where such controls are not sufficient to reduce exposures to or below the PEL, Doe Run may utilize respiratory protection. When respirators are used, Table II (29 CFR 1910.1025(f)(2), Table II) of the standard specifies the type of respiratory protection depending on the airborne concentration of lead or condition of use. This table assigns a protection factor of 10 for negative-pressure, half-mask respirators, thereby establishing a maximum airborne lead concentration of 500 $\mu g/m^3$ for which such a respirator may be used. The applicant is seeking a permanent variance from this restrictive protection factor.

The applicant asserts that airborne levels within the smelter may exceed the level of 500 $\mu g/m^3$ for some operations and, moreover, during upset conditions or maintenance operations, airborne lead levels may often exceed 500 $\mu g/m^3$.

Compliance with Table II in these situations, Doe Run states, is infeasible due to the variability in duration of exposure and the inability to determine the need for greater protective measures until industrial hygiene sampling has been conducted and laboratory results returned. In light of those factors, the applicant seeks to utilize a protection factor of 25 for negative pressure respirators.

The applicant further states that it has developed an extensive respirator protection program at the smelter which provides, in part, quantitative fit testing and employee training in respirator usage. Based upon this program and available evidence, Doe Run stipulates that it has determined that a protection factor greater than 10 can be assigned to a negative pressure respirator. Quantitative fit test results performed on its employees, states the applicant, yielded a fit factor with a geometric mean of 1470 during the second half of 1985. During this time period, no employee had a fit factor less than 286.

Distribution of fit test results for this time period is as follows:

FREQUENCY DISTRIBUTION OF PROTECTION FACTORS

(June 1, 1985–Dec. 31, 1985)

Range	Frequency	Cumulative frequency	Percent	Cumulative percent
200	0	0	0.0	0.0
200 to 999	97	97	20.0	20.0
1000 to 4999	387	484	79.7	99.7
5000+	2	486	0.3	100.0

Further, according to Doe Run, the American National Standards Institute (ANSI) has also concluded that a protection factor higher than 10 can be assigned to a negative pressure respirator if the employee has been quantitatively fit tested (ANSI Z88.2–1980). Moreover, Doe Run asserts, data from the National Institute for Occupational Safety and Health's work at the Doe Run Herculaneum smelter indicates that a half-mask negative-pressure respirator with a high efficiency filter will provide a geometric mean protection factor of 180 when used in a smelter environment. Therefore, Doe Run states that it is confident that by the strict enforcement of it's respirator protection program, a protection factor of at least 25 could be assigned to a negative pressure respirator.

Doe Run states that in lieu of complying with 29 CFR 1910.1025(f)(2) it will provide respirators, at no cost to its employees, and shall require the use of said respirators during the time period necessary to install engineering or work practice controls, in work situations in which feasible engineering and work practice controls are not sufficient to reduce airborne lead exposures to or below the PEL, and/or whenever any employee requests a respirator.

In addition, when respirators are required, the applicant states that half-mask negative pressure respirators, with high-efficiency filters, will be provided to employees who work in operations having airborne concentrations of lead not exceeding 25 times the exposure limit, only if said employees demonstrate a quantitative fit test fit factor of 250 or greater. Quantitative fit tests will be performed at the time of initial fitting and at least semiannually for all exposed employees.

Doe Run further alleges that, with respect to any employee who is wearing a half-mask negative pressure respirator in accordance with this permanent variance and who has a rise in his/her blood lead level from the previous sampling test of 10 μg/100g of whole blood or greater, it will perform a quantitative fit test to ensure that the fit factor is 250 or greater. In addition, the applicant states that it will evaluate such employee's respirator usage, hygiene habits and lead-related work practices. Based on the quantitative fit test and the evaluation, the Company agrees to take all reasonable and appropriate corrective steps to protect the health of the employee including, if necessary, requiring the employee to wear a powered air-purifying respirator in lieu of a half-mask negative pressure respirator.

Doe Run alleges that it will also continue to enforce and, if warranted, revise its written respirator program. This program provides, in part, that Doe Run clean an employee's respirator at the end of each shift, and after it has been dried in an oven, wrap it in plastic and return it to the individual employee's storage bin.

The applicant contends that it will also provide powered air-purifying respirators in lieu of half-mask negative pressure respirators whenever an employee requests the use of said respirator or when the use of said respirator is necessary to protect the health of an employee, and that it shall select respirators from those approved for protection against lead dust, fume and mist by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

In summary, the applicant contends that it has demonstrated by a preponderance of the evidence that the practices and conditions it proposes to use will provide a place of employment which is as safe and healthful as that provided under the occupational health standard for lead.

All interested persons, including employers and employees who believe they would be affected by the grant or denial of this application for variance, are invited to submit written data, views, and arguments relating to the issues raised in the application no later than July 7, 1988.

In addition, employers and employees who believe they would be affected by a grant or denial of the variance may request a hearing on the application no later than July 7, 1988, in conformity with the requirements of 29 CFR 1905.15. Submission of written comments and requests for a hearing should be in quaduplicate, and must be addressed to the Office of Variance Determination at the above address.

Signed at Washington, DC, this 1st day of June 1988.

John A. Pendergrass,

Assistant Secretary.

[FR Doc. 88–12818 Filed 6–6–88; 8:45 am]

BILLING CODE 4510–26–M

Pension and Welfare Benefits Administration

[Application No. D–7155] et al.

Proposed Exemptions; Telephone Real Estate Equity Trust et al.

AGENCY: Pension and Welfare Benefits Administration, Labor.

ACTION: Notice of proposed exemptions.

SUMMARY: This document contains notices of pendency before the Department of Labor (the Department) of proposed exemptions from certain of the prohibited transaction restrictions of the Employee Retirement Income Security Act of 1974 (the Act) and/or the Internal Revenue Code of 1954 (the Code).

Written Comments and Hearing Requests

All interested persons are invited to submit written comments or requests for a hearing on the pending exemptions, unless otherwise stated in the Notice of Pendency, within 45 days from the date of publication of this Federal Register Notice. Comments and requests for a hearing should state the reasons for the writer's interest in the pending exemption.

ADDRESS: All written comments and requests for a hearing (at least three copies) should be sent to the Pension and Welfare Benefits Administration, Office of Regulations and Interpretations, Room N–5669, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210.

Attention: Application No. stated in each Notice of Pendency. The applications for exemption and the comments received will be available for public inspection in the Public Documents Room of Pension and Welfare Benefit Programs, U.S. Department of Labor, Room N–4677, 200 Constitution Avenue NW., Washington, DC 20210.

Notice to Interested Persons

Notice of the proposed exemptions will be provided to all interested persons in the manner agreed upon by the applicant and the Department within 15 days of the date of publication in the **Federal Register**. Such notice shall include a copy of the notice of pendency of the exemption as published in the **Federal Register** and shall inform interested persons of their right to comment and to request a hearing (where appropriate).

SUPPLEMENTARY INFORMATION: The proposed exemptions were requested in applications filed pursuant to section 408(a) of the Act and/or section 4975(c)(2) of the Code, and in accordance with procedures set forth in ERISA Procedure 75–1 (40 FR 18471, April 28, 1975). Effective December 31, 1978, section 102 of Reorganization Plan No. 4 of 1978 (43 FR 47713, October 17, 1978) transferred the authority of the Secretary of the Treasury to issue exemptions of the type requested to the Secretary of Labor. Therefore, these notices of pendency are issued solely by the Department.

The applications contain representations with regard to the proposed exemptions which are summarized below. Interested persons are referred to the applications on file with the Department for a complete statement of the facts and representations.

Telephone Real Estate Equity Trust (the Trust) Located in New York, New York

[Exemption Application No. D–7155]

Proposed Exemption

The Department is considering granting an exemption under the authority of section 408(a) of the Act and section 4975(c)(2) of the Code and in accordance with the procedures set forth in ERISA Procedure 75–1 (40 FR 18471, April 28, 1975). If the exemption is granted the restrictions of section 406(a) of the Act and the sanctions resulting from the application of section 4975 of the Code, by reason of section 4975(c)(1)(A) through (D) of the Code, shall not apply to (1) certain leases (the Leases) by the Trust of space in two commercial real properties (the Properties) located in Hampton, Virginia (Executive Towers) and Portland, Oregon (Parkside) to the Equitable Life Assurance Society of the United States (Equitable), Manufacturers Hanover Consumer Services (MHCS), Security Pacific Corporation (SPC), Read Commercial Properties, Inc. (Read), Prudential-Bache Securities, Inc. (Prudential-Bache) and General Electric Company (GE), each of which is a party in interest or an affiliate of a party in interest with respect to the Trust; (2) the proposed potential amendments, renewals or extensions of the Leases; and (3) the proposed leasing by the Trust of space in the Properties to any other persons or entities that may be parties in interest with respect to the Trust (except for fiduciaries with respect to the Properties),[1] including the amendments, renewals and extensions thereof; provided that the terms and conditions of any leases subject to this exemption, including any amendments, renewals or extensions thereof, are at least as favorable to the Trust as those which the Trust could obtain in arm's-length transactions with unrelated parties; and provided further that any such leases, including any amendments, renewals or extensions thereof, are approved on behalf of the Trust by Eastdil Advisers, Inc.

Effective Date: The effective date of the proposed exemption, if granted, will be May 1, 1984 as to the Executive Towers lease to Equitable; December 5, 1986 as to the Parkside lease to Equitable; May 1, 1984 as to the lease to MHCS; February 29, 1984 as to the lease to SPC; April 1, 1987 as to the lease to Read; June 22, 1983 as to the lease to Prudential-Bache, and December 20, 1982 as to the leases to GE.

Summary of Facts and Representations

1. The Trust

The Trust is a group trust which is utilized for the investment on an undivided basis of certain real estate assets of its participating plans (the Plans). The Plans are employee benefit plans established by the companies resulting from the reorganization of American Telephone and Telegraph Company (AT&T) and its subsidiaries, pursuant to the Plan of Reorganization approved by the U.S. District Court for the District of Columbia in the matter of *U.S.* v. *Western Electric Co., Inc., et. al.* (Civil Action No. 82–0192). The assets of the Plans' predecessor plans were held in the Bell System Pension Plan Trust (the BSPP) and the Bell System Management Pension Plan Trust (the BSMPP). On January 1, 1984 the trusts for the BSPP and the BSMPP were merged into the Bell System Trust (the BST). Substantially all of the non-real estate assets in the BST were transferred to a new AT&T trust. The BST, retaining the real estate assets, was amended and restated as the Trust. As of January 1, 1986, the Trust covered approximately 1,226,000 participants and had net assets of approximately $4.218 billion. To promote diversification, AT&T has utilized the professional services of more than a hundred independent trustees and investment managers to manage the Trust assets.

2. Eastdil

A subsidiary of Eastdil Realty, Inc., Eastdil Advisers, Inc. (Eastdil) is a registered investment advisor under the Investment Advisors Act of 1940, as amended. Eastdil's stated purpose is the investment and management of real estate assets for large pension plans and has more than $1 billion in pension plan assets currently under management. As of December 31, 1986, Eastdil was managing approximately $650 million in real estate assets of the Trust.

3. The Properties

Executive Towers is a commercial office building located at 2101 Executive Drive in Hampton, Virginia. Eastdil organized a Delaware corporation, Executive Towers, Inc. (ETI), to hold title to Executive Towers on behalf of the Trust, to collect income therefrom and distribute such income to the Trust. All of the officers and directors of ETI are employees of Eastdil. ETI is wholly owned by the Trust and is exempt from Federal income taxation under section 501(c)(2) of the Code.

Parkside is a commercial office building located at 2020 SW Fourth Avenue in Portland, Oregon. It is the sole asset of the Parkside Center Company (the Joint Venture), a joint venture formed to take title to, operate, lease, dispose of and otherwise deal with Parkside. The joint venturers are the Oregon Pacific Investment and Development Company and Parktel I, Inc. (Parktel), a Delaware corporation wholly owned by the Trust and organized by Eastdil to hold the Trust's interest in the Joint Venture, to collect income therefrom and to distribute such income to the Trust. All of the officers and directors of Parktel are employees of Eastdil. Eastdil represents that Parktel is exempt from Federal income taxation under section 501(c)(2) of the

[1] Fiduciaries as used here include the American Telephone and Telegraph Company and its affiliates and Eastdil Advisers, Inc. and its affiliates.

Code. Under the terms of the agreement establishing the Joint Venture, all of the leases of space in Parkside must be satisfactory in form and substance to Parktel and Parktel's counsel and all tenants in Parkside must be satisfactory in all respects to Parktel. All proposed leases must be submitted to Parktel at least twenty days prior to the anticipated execution thereof, and Parktel has the right to approve or disapprove such leases in its sole discretion.

4. The Tenants

(a) Equitable is a life insurance company organized and incorporated in New York with its headquarters in New York City. Equitable is engaged as an investment manager of certain assets of the Trust other than the Properties. Equitable was engaged in this fiduciary capacity on behalf of the Trust prior to the executions of its Leases of space in the Properties.

(b) MHCS is engaged in the provision of consumer finance services, the making of first and second mortgage loans and small consumer loans. On May 1, 1984, the parent corporation of MHCS, Manufacturers Hanover Corporation (MHC), purchased 100 percent of the stock of C.I.T., Inc. (CIT), which was engaged in substantially the same business as MHCS and which was not affiliated with MHC or MHCS prior to such stock purchase. Until December 31, 1985, a subsidiary of MHC, Manufacturers Hanover Trust Company (MHTC), was a trustee with respect to certain assets of the Trust other than the Properties.

(c) SPC is a public corporation which is the parent corporation of Security Pacific National Bank (SPNB), which served as ancillary trustee with respect to certain assets of the Trust other than the Properties in 1984 and 1985. Two other subsidiaries of SPC were or are tenants in the Properties: the Security Pacific Financē Corporation (SPFC), engaged in the provision of consumer credit services, and the Security Pacific Finance Management Corporation (SPFMC), engaged in the provision of payroll and leasing services to certain of its affiliates.

(d) Read is a Virginia corporation engaged in the management and leasing of real property. Read is wholly owned by Read Consolidated Companies (RCC), a Virginia partnership with ownership interests in various entities engaged in real property development and management, including Read Commercial Properties Atlanta, Inc. (Read Atlanta), a Georgia corporation wholly owned by Read Interstate Companies, a partnership in which RCC has an 85 percent ownership interest. On April 1, 1987, Read Atlanta entered into an agreement with Eastdil to manage certain commercial real property in Atlanta, Georgia which is owned by Artel I, Inc., a title-holding corporation wholly owned by the Trust.

(e) Prudential-Bache is a registered broker-dealer and investment banking firm engaged in the sale of securities, insurance products and other financial services. It is a wholly-owned subsidiary of the Prudential Insurance Company of America (Prudential). Effective January 1, 1984, Prudential entered into a group annuity contract with the Trust and a separate investment management agreement to manage certain assets of the Trust, not including the Properties, on a discretionary basis.

(f) GE is a public corporation which is the parent corporation of General Electric Financial Services, Inc. (GEFS). In June of 1986 GEFS purchased 80 percent of all outstanding stock of Kidder Peabody & Company, Inc. (Kidder Peabody). GEFS subsequently formed a wholly-owned subsidiary, KPC, to hold the Kidder Peabody stock purchased by GEFS. Kidder Peabody is a service provider with respect to certain of the Plans participating in the Trust by virtue of Kidder Peabody's rendering of securities brokerage services to such Plans.

5. The Leases

(a) On Feburary 2, 1984, ETI entered into a lease (the ET Lease) with Equitable under which Equitable leased approximately 3,653.05 square feet of space in Executive Towers out of a total of approximately 130,000 square feet of rentable space. The ET Lease provided for occupancy commencing May 1, 1984 with an initial term of three years. The ET Lease was renewed on April 30, 1987 for an additional term of five years. The ET Lease provides for an initial base rent subject to automatic annual increases proportionate to increases in the taxes and operating expenses of Executive Towers. Upon the May 1, 1987 renewal of the ET Lease, the base rent was increased.

On December 5, 1986, the Joint Venture entered into a lease (the Parkside Lease) with Equitable under which Equitable leased 9,800 square feet in Parkside out of a total of 218,810 rentable square feet. The Parkside Lease provided for occupancy commencing March 1, 1987 for an initial term ending February 29, 1992. The Parkside Lease provides for a monthly base rent which increases incrementally according to a schedule in the Parkside Lease. The rent is also subject to annual increases proportionate to increases in taxes and operating expenses in accordance with a rider to the Parkside Lease. Under the Parkside Lease, Equitable has a right of first refusal to lease adjacent vacant space prior to any lease of such space to a third party. In the Parkside Lease the Joint Venture agreed to reimburse Equitable in an amount not to exceed $34,000 for the monthly rental payments which Equitable was obliged to make under an existing lease for space in a competing commercial office building which was to expire April 30, 1987. Eastdil, as a fiduciary of the Trust, represents that this reimbursement agreement was an inducement for Equitable to enter into the lease, that such tenant inducements are common in the real estate industry and that the terms of such reimbursement agreement were reasonable under the surrounding facts and circumstances.

(b) On February 24, 1983, ETI entered into a lease (the CIT Lease) with CIT under which CIT leases 885.50 square feet in Executive Towers, approximately .68 percent of the rentable space in Executive Towers. The CIT Lease provided for occupancy commencing July 1, 1983 and terminating on June 30, 1988 unless sooner amended, terminated or extended as provided in the CIT Lease. As a result of MHC's purchase of the stock of CIT, the CIT Lease was assinged to MHCS as of January 1, 1987. Under the CIT Lease, MHCS pays a base rent subject to an annual increase equal to MHC's proportionate share of the annual increase in operating expenses and real estate taxes, based on the proportion of the entire rentable square footage in Executive Towers demised under the CIT Lease. On March 4, 1987 MHCS notified ETI of the intention of MHCS to vacate the premises demised by the CIT Lease. MHCS has vacated the premises but will continue to pay rent under the CIT Lease until the earlier of the CIT Lease's termination or the lease of the premises by ETI to another party.

(c) On February 29, 1984, ETI entered into a lease with SPFC (the SP Lease) under which SPFC leased 1009.57 square feet, or approximately .77 percent, of the rentable square footage in Executive Towers. The SP Lease provided for a base rent subject to an annual increase equal to SPFC's proportionate share of the annual increase in operating expenses and real estate taxes, based on the proportion of the entire rentable square footage in Executive Towers demised under the SP Lease.

The SP Lease was renewed by SPFMC on March 20, 1987 for a term commencing July 1, 1987 and terminating

on June 30, 1990. Under the renewed SP Lease, SPFDMC leases 1168.24 square feet, or approximately .89 percent, of the rentable square footage in Executive Towers. The base rent under the renewed SP Lease is subject to an annual increase equal to SPFC's proportionate share of the annual increase in operating expenses and real estate taxes.

(d) On September 23, 1985, ETI entered into a lease (the Read Lease) with Read under which Read leased 6,189.14 square feet, or approximately 4.7% of the rentable square footage, in Executive Towers. The Read Lease provided for occupancy commencing on September 23, 1985 and terminating on August 31, 1990, unless sooner amended, terminated or extended as provided in the Read Lease. The Read Lease provides for an annual base rent which will increase incrementally each year of its five-year term in accordance with a schedule incorporated into the Read Lease. The base rent is also subject to an annual increase equal to Read's proportionate share of the annual increase in operating expenses and real estate taxes of Executive Towers, based on the proportion of the entire square footage in Executive Towers demised under the Read Lease.

(e) On June 22, 1983, the Joint Venture entered into a lease (the PB Lease) with Prudential-Bache under which Prudential-Bache leased 11,619 square feet, on approximately 5.31 percent of the rentable square footage, in Parkside. The PB Lease provided for occupancy commencing September 1, 1983 and terminating on September 1, 1988, unless sooner terminated, amended or extended as provided in the PB Lease. The PB Lease provides for a monthly base rent which increase in increments according to a schedule incorporated into the PB Lease. The base rent is also subject to annual increases equal to Prudential-Bache's proportional share of the annual increases in operating expenses and real estate taxes of Parkside, based on the proportion of the entire square footage in Parkside demised under the PB Lease. The PB Lease gives Prudential-Bache a right of first refusal to lease adjacent vacant space prior to any lease to a third party. The rental rate for any such additional space will be the rental rate in effect for Prudential-Bache with respect to the other space which is the subject of the PB Lease.

(f) On December 20, 1982, ETI entered into a lease (the GE Lease #1) with GE under which GE leased 1333.97 square feet, or approximately 1.02 percent of the rentable square footage, in Executive Towers. The GE Lease #1 provided for occupancy commencing on February 1, 1983 and terminating on January 31, 1988 unless sooner extended, modified or terminated in accordance with the lease's terms. In a June 13, 1983 addendum to the GE Lease #1, ETI and GE added 666.99 square feet to the space leased under the GE Lease #1. In a second addendum, ETI and GE agreed to renew the GE Lease #1 for an additional term commencing February 1, 1988 and terminating January 31, 1991. The GE Lease #1 provides for an annual base rent which is subject to a yearly increase equal to GE's proportionate share of the annual increase in Executive Towers' real estate taxes and operating expenses, based on the proportion of the entire rentable square footage in Executive Towers which is demised under the GE Lease #1.

(g) On May 12, 1986, ETI entered into an additional, separate lease (the GE Lease #2) with GE under which GE leased 7907.79 square feet, or approximately 6.03 percent, of the rentable square footage in Executive Towers. The GE Lease #2 provided for occupancy commencing on July 1, 1986 and terminating on June 30, 1991, unless sooner extended, modified or terminated in accordance with the lease's terms. The GE Lease #2 provides for an initial annual base rent which increases annually in the amount of five percent of the preceding year's annual rental.

(h) Each of the Leases may be terminated by the lessor, either ETI or the Joint Venture, upon the occurrence of an event of default as set forth in each Lease, including the lessee's failure to pay rent when due and any default in the performance or observance of any other covenant or condition of such Lease which continues afer notice to the lessee for a certain period specified in each Lease.

6. Eastdil represents that it is independent of the various lessees under the Leases and not related to such lessees in any way affecting its judgment as a fiduciary on behalf of the Trust. Eastdil represents that the Leases pertaining to Executive Towers were negotiated by ETI under Eastdil's control and direction and have been at all times subject to the review and approval of Eastdil, acting in its capacity as an investment manager of the Trust. With respect to the Leases pertaining to Parkside, Eastdil represents that such Leases were negotiated and executed in accordance with the provisions of the Joint Venture agreement establishing Parktel's right to review and approve Parkside leases in advance of their execution.

Eastdil represents that the Leases were negotiated in arm's-length transactions and that the Leases are standard commercial office leases, in both form and substance, which are utilized generally for all tenants of Executive Towers and Parkside. Eastdil maintains that the negotiations resulting in the Leases reflect common industry practices and the practices established for similar leases in Executive Towers and Parkside. Eastdil represents that the terms and conditions of the Leases are as good or better than those which ETI and Parktel could obtain in arm's-length transactions with unrelated parties. Eastdil represents that the terms of the Leases are comparable to those of similar leases in the Properties and in similar commercial office buildings in the same geographical areas of the Properties at the time of the Leases' executions and that the rentals provided under the Leases are not less than the fair market rental values of the demised premises at the times of the Leases' executions.

Eastdil represents that it has determined that the Leases constitute transactions which are prudent and in the best interests of the Trust and the participants and beneficiaries of the Plans. Eastdil notes that the Leases are for fixed terms which will not be amended, renewed or extended unless a determination is made on behalf of the Trust by Eastdil that such amendment, renewal or extension would be in the best interests of the Trust and the Plans.

7. Eastdil is requesting that the exemption posed herein be applicable on a prospective basis for any future leases in the Properties which may be executed with parties in interests (except for fiduciaries with respect to the Properties) with respect to the Trust. Eastdil represents that this request for prospective relief is necessitated by practical business considerations stemming from the large size of the Trust and the Plans and the large number of parties in interest who deal with them. Eastdil maintains that ETI and Parktel require the ability to negotiate and enter into leases of the Properties in the ordinary course of business. Eastdil also represents that the requested prospective relief for amendments, renewals or extensions of the Leases or of future leases will provide ETI and Parktel with additional flexibility which will expand the potential value of lease transactions involving the Properties, thereby increasing the investment return to the Trust.

8. In summary, Eastdil represents that the past and proposed transactions satisfy the requirements of section

408(a) of the Act for the following reasons: (1) Each Lease was negotiated and entered into in arm's-length transactions on behalf of the Trust by ETI and Parktel, under the control and direction of Eastdil, an independent fiduciary of the Trust which is unrelated to the various lessees; (2) Any amendments, renewals or extensions of the Leases and any executions of future leases in the Properties with parties in interest with respect to the Trust, or their affiliates, including any amendments, renewals or extensions thereof, will require the approval of Eastdil; (3) The Leases are, and any future leases subject to this proposed exemption will be, standard commercial office leases which are utilized generally for all tenants of the Properties and which reflect common industry practices; and (4) The rentals provided under the Leases are and will be no less than the fair market rental values of the demised premises at the times of the Leases' executions.

FOR FURTHER INFORMATION CONTACT: Ronald Willett of the Department, telephone (202) 523-8881. (This is not a toll-free number.)

Harris Trust and Savings Bank (Harris) Located in Chicago, Illinois

[Application Nos. D-7277, D-7278 and D-7279]

Proposed Exemption

The Department is considering granting an exemption under the authority of section 408(a) of the Act and section 4975(c)(2) of the Code and in accordance with the procedures set forth in ERISA Procedure 75-1 (40 FR 18471, April 28, 1975). If the exemption is granted, the restrictions of section 406(a)(1) (A) through (D) of the Act and the sanctions resulting from the application of section 4975 of the Code, by reason of section 4975(c)(1) (A) through (D) of the Code, shall not apply to the lending by Harris to Merrill Lynch Canada, Inc. (Merrill Lynch Canada) of securities that are assets of employee benefit plans and trusts for which Harris acts as trustee, co-trustee, investment manager, custodian or agent, provided the following conditions are met.

1. Neither Merrill Lynch Canada nor an affiliate of Merrill Lynch Canada has discretionary authority or control with respect to the investment of the plan assets involved in the transaction, or renders investment advice (within the meaning of 29 CFR 2510.3-21(c)) with respect to those assets;

2. The plan receives from Merrill Lynch Canada (either by physical delivery or by book entry in a securities depository) by the close of Harris' business on the day in which the securities lent are delivered to Merrill Lynch Canada, collateral consisting of cash, securities issued or guaranteed by the United States Government or its agencies or instrumentalities, or irrevocable bank letters of credit issued by a person other than Merrill Lynch Canada or an affiliate thereof, or any combination thereof, having, as of the close of business on the preceding business day, a market value or, in the case of letters of credit a stated amount, equal to not less than 100 percent of the then market value of the securities lent. All such collateral will be held within the United States;

3. Prior to the making of any such loan, Merrill Lynch Canada shall have furnished Harris with (1) the most recent available audited statement of Merrill Lynch Canada's financial condition, (2) the most recent available unaudited statement of its financial condition (if more recent than such audited statement), and (3) a representation that, at the time the loan is negotiated, there has been no material adverse change in its financial condition since the date of the most recent financial statement furnished to the plan that has not been disclosed to Harris. Such representation may be made by Merrill Lynch Canada's agreeing that each such loan shall constitute a representation by Merrill Lynch Canada that there has been no such material adverse change;

4. The loan is made pursuant to a written loan agreement, the terms of which are at least as favorable to the plan as an arm's-length transaction with an unrelated party would be. Such agreement may be in the form of a master agreement covering a series of securities lending transactions;

5. (a) The plan (1) receives a reasonable fee that is related to the value of the borrowed securities and the duration of the loan, or (2) has the opportunity to derive compensation through the investment of cash collateral. Where the plan has that opportunity, the plan may pay a loan rebate or similar fee to Merrill Lynch Canada, if such fee is not greater than the plan would pay in a comparable transaction with an unrelated party;

(b) The plan receives the equivalent of all distributions made to holders of the borrowed securities during the term of the loan, including, but not limited to, cash dividends, interest payments, shares of stock as a result of stock splits and rights to purchase additional securities;

6. If the market value of the collateral at the close of trading on a business day is less than 100 percent of the market value of the borrowed securities at the close of trading on that day, Merrill Lynch Canada shall deliver, by the close of business on the following business day, an additional amount of collateral (as described in paragraph 2 above) the market value of which, together with the market value of all previously delivered collateral, equals at least 100 percent of the market value of all the borrowed securities as of such preceding day.

Notwithstanding the foregoing, part of the collateral may be returned to Merrill Lynch Canada if the market value of the collateral exceeds 100 percent of the market value of the borrowed securities, as long as the market value of the remaining collateral equals at least 100 percent of the market value of the borrowed securities;

7. The loan may be terminated by the plan at any time, whereupon Merrill Lynch Canada shall deliver certificates for securities identical to the borrowed securities (or the equivalent thereof in the event of reorganization, recapitalization or merger of the issuer of the borrowed securities) to the plan within (1) the customary delivery period for such securities, (2) five business days, or (3) the time negotiated for such delivery by the plan and Merrill Lynch Canada, whichever is lesser; and

8. In the event the loan is terminated, and Merrill Lynch Canada fails to return the borrowed securities or the equivalent thereof within the time described in paragraph 7, above, (i) the plan may, under the terms of the loan agreement, purchase securities identical to the borrowed securities (or their equivalent as described above) and may apply the collateral to the payment of the purchase price, any other obligations of Merrill Lynch Canada under the agreement, and any expenses associated with the sale and/or purchase, and (ii) Merrill Lynch Canada is obligated, under the terms of the loan agreement, to pay, and does pay to the plan the amount of any remaining obligations and expenses not covered by the collateral plus interest at a reasonable rate.

Notwithstanding the foregoing, Merrill Lynch Canada may, in the event that it fails to return borrowed securities as described above, replace non-cash collateral with an amount of cash not less than the then current market value of the collateral, provided such replacement is approved by Harris.

If Merrill Lynch Canada fails to comply with any condition of this exemption in the course of engaging in a securities lending transaction, the plan fiduciary who caused the plan to engage in such transaction shall not be deemed to have caused the plan to engage in a

transaction prohibited by section 406(a)(1)(A) through (D) of the Act solely by reason of Merrill Lynch Canada's failure to comply with the conditions of the exemption.

For purposes of this class exemption the term "affiliate" of another person shall include: (i) Any person directly or indirectly, through one or more intermediaries, controlling, controlled by, or under common control with such other person; (ii) Any officer, director, or partner, employee or relative (as defined in section 3(15) of the Act) of such other person; and (iii) Any corporation or partnership of which such other person is an officer, director or partner. For purposes of this definition the term "control" means the power to exercise a controlling influence over the management or policies of a person other than an individual.

Summary of Facts and Representations

1. Harris, an Illinois chartered banking corporation, is the third largest bank in Illinois and is among the largest U.S. pension trustees. Harris also is an indirect wholly-owned subsidiary of Bank of Montreal, which is one of the five major Canadian banking companies. The proposed exemption is requested on behalf of the Employees Savings and Profit Sharing Plan of Bank of Montreal/Harris; the Employees Retirement Plan of Bank of Montreal/Harris; the Harris Trust for Collective Investment of Employee Benefit Accounts (the Collective Investment Trust), a declaration of trust for the collective investment of assets of employee benefit trusts of which Harris or an affiliated bank is acting as trustee or co-trustee or as agent for the trustee or trustees thereof; and about 160 other pension and profit sharing plans for which Harris acts as trustee, investment manager, custodian or agent. As of January 1, 1987, approximately 1,500 plans had assets held in the Collective Investment Trust. The various plans mentioned above are collectively referred to as the Plans.

2. Harris, in its fiduciary capacity as agent, investment manager, custodian or trustee of the Plans, regularly engages in securities lending transactions on behalf of the Plans in order to enhance the investment returns of the Plans. In cases where the borrower of the securities is a party in interest with respect to the Plans, Harris generally relies on Prohibited Transaction Exemption (PTE) 81–6 (46 FR 7527, January 23, 1981, as amended at 52 FR 18754, May 19, 1987). PTE 81–6 is a class exemption that permits, under certain conditions, the lending of securities that are assets of employee benefit plans to banks and certain broker-dealers which are parties in interest with respect to such plans.[2]

3. Harris proposes to engage in securities lending transactions on behalf of the Plans with Merrill Lynch Canada, an indirect wholly-owned subsidiary of Merrill Lynch, Pierce, Fenner & Smith (Merrill Lynch). The securities involved in the lending transactions will be securities of United States corporations which are regularly traded on U.S. and/or Canadian stock exchanges. The proposed securities lending transactions would comply in all respects with the provisions of PTE 81–6 except that the borrower is not a broker-dealer registered under the Securities Exchange Act of 1934 (the 1934 Act). PTE 81–6 covers broker-dealers which are registered under the 1934 Act as well as those which are exempted from registration under section 15(a)(1) of the 1934 Act as dealers in exempted Government securities (as defined in section 3(a)(12) of the 1934 Act). Merrill Lynch Canada does not provide broker-dealer services in the United States and thus is not required to register under the 1934 Act. The applicant believes that Merrill Lynch Canada is at times a party in interest with respect to some or all of the Plans because of the widespread use of its parent, Merill Lynch, to provide brokerage services to the Plans.[3] Such use of Merrill Lynch often occurs without the knowledge or control of either Harris or Merrill Lynch Canada.

4. The applicant maintains that, if Merrill Lynch Canada were not a subsidiary of Merrill Lynch, the proposed securities lending transactions would not be prohibited transactions even though Merrill Lynch Canada is not registered under the 1934 Act. The only reason the proposed transactions would be prohibited with respect to Merrill Lynch Canada, according to the applicant, is because the prospective borrower is a subsidiary of a United States broker-dealer which is itself registered under the 1934 Act. Merrill Lynch Canada is a Nova Scotia corporation. The applicant represents that its activities are subject to Canadian laws which provide regulation comparable to registration under the 1934 Act for a U.S. broker-dealer.

5. The applicant represents that Canadian securities laws were derived mainly from the perceived need for more comprehensive protection for investors as a result of the financial crisis that began in 1929. As with Canadian law in general, however, comprehensive regulation of the securities industry is centered at the Provincial rather than the Federal level. Each Canadian Province has written provisions for the registration of securities and for the regulation of persons engaging in the sale of securities. Regulatory and enforcement authority is vested in a Provincial Securities Commission or similarly denominated entity. According to the applicant, Provincial securities regulations generally parallel U.S. requirements in that they mandate that primary securities offerings may be made only after the filing of a prospectus containing complete disclosure. Such regulations also require registration of securities dealers, enforce capitalization requirements for dealers, license securities exchanges, and vest regulatory, investigative and criminal enforcement authority in the Securities Commissions. Additionally, a privately funded national assurance fund exists for the protection of securities investors.

6. The applicant points out that the proposed exemption is virtually identical to PTE 81–6. Accordingly, the same protections afforded to plans relying on PTE 81–6 will be present for the participants and beneficiaries of any Plans engaging in the described transactions. In regard to the collateral requirements described in conditions 2 and 6 of the proposed exemption, the applicant also points out that all the collateral for the loans of securities will be held within the United States. The letters of credit or other forms of collateral specified in the exemption would be held at Harris as trustee or agent for the Plans. Such collateral would provide an immediate, independent source of funds available to the appropriate Plans in the event that a securities loan is terminated and Merrill Lynch Canada fails to return the borrowed securities or equivalent to the Plans within a certain period of time.

7. In summary, the applicant represents that the proposed transactions will satisfy the statutory criteria of section 408(a) of the Act because, among other things: (1) All the conditions specified in PTE 81–6 for the protection of plans engaging in transactions in reliance on that class exemption will be met in regard to the transactions proposed in the

[2] PTE 81–6 requires, among other conditions, that the borrower of the securities has no discretionary authority regarding the plan assets involved in the transaction, that the lending plan receives collateral equal to 100 percent of the market value of the loaned securities, and that the loan is made under a written agreement the terms of which are at least as favorable as the plan could obtain in an arm's-length transaction with an unrelated party.

[3] Section 3(14) of the Act defines the term "party in interest" with respect to a plan to include a corporation which is 50 percent or more owned by an entity that provides services to the plan.

application; (2) the securities involved in the proposed lending transactions will be securities of U.S. corporations which are regularly traded on U.S. and/or Canadian stock exchanges; (3) the applicant maintains that the proposed transactions would not be prohibited except for the described relationship between Merrill Lynch Canada and Merrill Lynch; (4) the activities of Merrill Lynch Canada are subject to Canadian laws which provide regulation comparable to registration under the 1934 Act for a U.S. broker-dealer; and (5) all the collateral for any securities loans entered into under the proposed exemption will be held within the United States.

FOR FURTHER INFORMATION CONTACT: Paul Kelty of the Department, telephone (202) 523–8883. (This is not a toll-free number.)

Popham, Haik, Schnobrich & Kaufman, Ltd. 401(k) Profit Sharing Plan and Trust (the Plan) Located in Minneapolis, Minnesota

[Application No. D–7327]

Proposed Exemption

The Department is considering granting an exemption under the authority of section 408(a) of the Act and section 4975(c)(2) of the Code and in accordance with the procedures set forth in ERISA Procedure 75–1 (40 FR 18471, April 28, 1975). If the exemption is granted the restrictions of section 406(a) of the Act and the sanctions resulting from the application of section 4975 of the Code, by reason of section 4975(c)(1)(A) through (D) of the Code shall not apply to the past purchase by the individually directed accounts (the Accounts) in the Plan held by certain shareholders (the Shareholders), who are also employees and/or officers and directors of Popham, Haik, Schnobrich & Kaufman, Ltd. (the Employer), the Plan sponsor and a party in interest with the respect to the Plan, of 89,000 shares of stock owned by the Employer/Plan sponsor; provided the terms and conditions of the transactions were as favorable to the Plan as those which could have been obtained in an arm's-length transaction between unrelated parties.

EFFECTIVE DATE: If granted, this exemption will be effective March 25, 1987.

Summary of Facts and Representations

1. The Plan is a profit sharing plan with individually directed accounts and 182 participants. Total plan assets were $4,479,082 as of June 30, 1986. The Employer is a law firm with offices in Minneapolis, Minnesota, Denver, Colorado, and Washington, DC. The independent trustee of the Plan is the Marquette Bank, Minneapolis, N.A. (the Trustee).

2. On March 25, 1987, the nine Shareholders [4] directed the Trustee to purchase 89,000 shares of Radersburg Mining Company (Radersburg) common stock (the Stock) for their Accounts in the Plan from the Employer at a price of $1.00 per share. The applicant represents that the price was determined by reference to an arm's-length sales transaction of 37,000 shares of the Stock between Neil Croonquist and Thomas Kelm, parties unrelated to the Plan or Employer, on March 24, 1987 for $1.00 per share. The Employer had acquired the Stock in September, 1986 from its client, Radersburg, for $1.00 per share in full settlement of outstanding legal fees. Also in September, 1986, seventeen creditors converted Radersburg debts into the Stock at $1.00 per share.

3. The applicant further represents that the Shareholders and the Trustee were in full compliance with all Securities and Exchange Commission rules and regulations regarding the transaction. The Plan paid no fees or commissions in connection with the purchase. Subsequent to the purchase, the Accounts of the nine Shareholders held between .68%–10.58% of their Accounts' assets in the Stock. Each of the nine Shareholders has represented that he desired that the purchase be consummated on behalf of his individually directed account in the Plan.

4. An independent appraisal of the Stock was performed on August 12, 1987 by Peter L. Hauser, Vice President of Equity Securities Trading Co., Inc. of Minneapolis, Minnesota. Mr. Hauser represents that he has more than twenty years' experience in the securities industry and is qualified to evaluate the Stock. He further represents that approximately .1% of his income in 1987 was derived from the partners of the Employer. He determined that, as of March 25, 1987, the fair market value of the Stock was $1.00 per share.

5. In summary, the applicant represents that the transaction met the statutory criteria contained in section 408(a) of the Act because: (1) The transaction involved no more than 10.58% of the assets of any of the Accounts; (2) the purchase price paid by the Plan was determined by reference to arm's-length transactions between unrelated parties; and (3) the nine Shareholders were the only Plan participants affected by the transaction and each has represented that he desired the transaction to be consummated.

Notice to Interested Persons: Because the nine Shareholders are the sole Plan participants to be affected by the transaction, the Department has determined that there is no need to distribute the notice of pendency of the proposed exemption to interested persons. Comments and requests for hearing must be received within 30 days of the date of publication of this notice of proposed exemption.

FOR FURTHER INFORMATION CONTACT: Mrs. Betsy Scott of the Department, telephone (202) 523–8194. (This is not a toll-free number.)

Morison Securities, Inc. (Morison) Located in Minneapolis, Minnesota

[Application No. D–7336]

Proposed Exemption

The Department is considering granting an exemption under the authority of section 4975(c)(2) of the Code and in accordance with the procedures set forth in ERISA Procedure 75–1 (40 FR 18471, April 28, 1975). If the exemption is granted the sanctions resulting from the application of section 4975 of the Code, by reason of section 4975(c)(1)(A) through (E) of the Code shall not apply to the acquisition by various individuals who are clients of Morison of certain public limited partnership units (the Units) from their individual retirement accounts (the IRAs), their Keogh plans (the Keoghs) or their profit sharing plans (the PS Plans) for cash, provided the IRAs, Keoghs and PS Plans receive no less than the fair market value of the Units on the dates of the sales.[5]

Summary of Facts and Representations

1. Morison is a retail securities Broker/Dealer, registered with the NASD, and located in Minneapolis, Minnesota. Various clients of Morison have set up self-directed qualified plans. These include 175 IRAs, 6 Keoghs, and 3 PS Plans. These 184 plans each have only one participant.

[4] The nine Shareholders are: Ray Haik, D. William Kaufman, Denver Kaufman, James Lockhart, Robert Minish, Roger Schnobrich, James Steilen, G. Marc Whitehead and Rolfe Worden.

[5] Because the IRAs meet the conditions described in 29 CFR 2510.3–2(d), there is no jurisdiction under Title I of the Act with respect to the IRAs. Because there are no employees covered under the Keoghs and PS Plans, there is no jurisdiction under Title I of the Act with respect to the Keoghs and PS Plans pursuant to 29 CFR 2510.3–3(b). However, there is jurisdiction with respect to the IRAs, PS Plans and the Keoghs under Title II of the Act pursuant to section 4975 of the Code.

2. Each of the subject plans was established for the sole purpose of purchasing the Units, which are certain public limited partnership units, mainly in the oil and gas industry. The two largest investments are in Damson Oil & Gas (Damson) whose A and B Units are traded publicly on the AMEX and whose IPX and IPY Units are publicly traded on the OTC Market, and in the Western Real Estate Fund, whose Units are publicly traded on the OTC Market. Damson's 8501 and 851E Units are not publicly traded.

3. As the plans are self-directed, the Units must be held by an independent custodian. Morison does not, due to the type of Broker-Dealer it is, maintain any client securities or funds. The plan participants each want to purchase the Units from their respective IRAs, Keoghs and PS Plans. Morison has requested the prohibited transaction exemption on behalf of its clients to permit each to purchase the Units from his plan for cash. No commissions will be paid on the sales.

4. For those Units which are publicly traded, the sales price for the subject transactions will be the closing price on the day preceding the sale. If there is no public market value for the Units, the price will be determined by the Unit sponsor's estimate of fair market value. Morison represents that the Unit sponsor is independent of the IRAs, Keoghs and PS Plans, and is also best able to arrive at a value as it has all of the facts regarding the investment. Morison represents that in some limited cases where a public market does not exist and the Unit sponsors are unwilling to offer a fair market value, the sales price would be determined by independent third party valuations.

5. In summary, the applicant represents that the proposed transactions satisfy the criteria of section 4975(c)(2) of the Code because: (a) The sales will be one-time transactions for cash, and no commissions will be charged on the sales; (b) the sales price for the Units will be determined by the market price, or if not publicly traded, the fair market value as established by the Unit sponsor or independent expert; and (c) the one participant in each IRA, Keogh or PS Plan will be the only participant to be affected by the particular transaction, and the transaction will not occur unless the participant desires that it be consummated.

FOR FURTHER INFORMATION CONTACT: Gary H. Lefkowitz of the Department, telephone (202) 523-8881. (This is not a toll-free number.)

Sammons Trucking Amended and Restated Profit Sharing Plan (the Plan), Located in Missoula, Montana

[Application No. D-7340]

Proposed Exemption

The Department is considering granting an exemption under the authority of section 408(a) of the Act and section 4975(c)(2) of the Code and in accordance with the procedures set forth in ERISA Procedure 75-1 (40 FR 18471, April 28, 1975). If the exemption is granted the restrictions of section 406(a) of the Act and the sanctions resulting from the application of section 4975 of the Code, by reason of section 4975(c)(1) (A) through (D) of the Code shall not apply, effective June 3, 1975, to: (1) The sales by the Plan of five parcels of unimproved real property (the Properties) to Robert R. and Mary Lynn Van Derhoff (the Van Derhoffs), parties in interest with respect to the Plan; and (2) extensions of credit by the Plan to the Van Derhoffs in conjunction with the sales of the Properties; provided that the terms and conditions of such transactions are at least as favorable to the Plan as those which the Plan could obtain in arm's length transactions with unrelated parties.

Effective date: The effective date of the proposed exemption, if granted, will be June 3, 1975.

Summary of Facts and Representations

1. The Plan is a defined contribution pension plan which is sponsored by the Sammons Trucking Company (the Employer), a Montana closely-held corporation engaged in the business of interstate commercial transport. As of September 14, 1987, there where 59 active participants in the Plan, which had total net assets of $1,932,531 as of March 31, 1987. Investment decisions on behalf of the Plan are the responsibility of the Plan's trustees, James D. Basolo and Hal W. Fullerton (the Trustees), each of whom is an officer of the Employer. The Van Derhoffs, who are related as father and daughter, represent that since 1974, their business, Van Derhoff Realty, located in Plains, Montana, has been a provider of property management and brokerage services to the Plan.

2. The Trustees represent that commencing in 1975, on behalf of the Plan they embarked on an investment program which consisted of the purchase of undeveloped real property, the subdivision of such property and the sales of the subdivided parcels by contracts for deed involving extensions of credit by the Plan to the purchasers of the parcels. As of March 31, 1985 the Plan had executed sixty-five such contracts resulting from sales of subdivided parcels of real property between 1975 and 1985. Five of these sales and extensions of credit (the Contracts) were made to one or both of the Van Derhoffs. The Trustees are requesting an exemption for the Plan's sales of real property and extensions of credit to the Van Derhoffs under the Contracts, the terms of which are described herein.

3. Under each Contract, the buyer made payments as per the Contract terms to a designated Bank escrow agent which was required to convey the subject property to the buyer by a warranty deed upon payment of the entire purchase price plus interest. The buyer acknowledged under each Contract that no representations of any kind concerning the subject property were being made by the seller and each Contract specifically provided that it superseded any and all prior agreements between the parties pertaining to the sale of the subject property. Each Contract granted the buyer the right, within 60 days written notice to the seller, to accelerate payment under the Contract at any time during the Contract's term and to pay any portion or all of the unpaid principal balance of the purchase price, together with interest accrued to the date of such payment. According to default provisions in each Contract, the seller had the right to declare the Contract forefeited and all Contract rights of the buyer to be nullified if the buyer should remain in default on any terms of the Contract for thirty days after written notice of such default. Specific terms of each Contract are summarized as follows:

(A) Under a Contract executed on June 3, 1975 and closed on July 11, 1975, the Plan sold to Robert R. Van Derhoff a 10.193 acre parcel of unimproved real property designated as Tract Eleven in Survey No. 50A in Sanders County, Montana for a purchase price of $7,000 payable as follows: $500 in cash paid on or before the Contract's execution and the balance of $6,500 to be paid over ten years commencing July 15, 1975 in amortized monthly installments of $77.16 including interest of 7.5 percent per annum effective June 15, 1975.

(B) Under a Contract executed on September 29, 1977 and closed on October 7, 1977, the Plan sold to Robert

R. Van Derhoff a 10.385 acre parcel of unimproved real property and a 20.030 acre parcel of unimproved real property designated as Tracts Twenty-five and Forty-six, respectively, in Survey No. 50A in Sanders County, Montana for a purchase price of $14,174 payable as follows: $2,274 in cash paid on or before the Contract's execution and the balance of $11,900 to be paid over ten years commencing November 10, 1977 in monthly installments of $141.27 including interest of 7.5 percent per annum effective October 10, 1977.

(C) Under a Contract executed on March 21, 1980 and closed on August 15, 1980, the Plan sold to Robert R. Van Derhoff a 22.94 acre parcel of unimproved real property designated as Tract 1–A in Survey No. 486 in Sanders County, Montana for a purchase price of $18,000 payable as follows: $1,500 in cash on or before the Contract's execution and the balance of $16,500 to be paid over 15 years commencing September 15, 1980 in amortized monthly installments of $177.38 including interest at ten percent per annum effective August 15, 1980.

(D) Under a Contract executed on June 14, 1983 and closed on June 15, 1983, the Plan sold to Robert R. Van Derhoff a 3.86 parcel of unimproved real property designated as Tract 1–J in Survey No. 662 in Sanders County, Montana for a purchase price of $10,800 payable as follows: $2,100 in cash on or before the Contract's execution and the balance of $8,700 to be paid over ten years commencing July 15, 1983 in amortized monthly installments of $115.01 including interest of ten percent per annum effective June 14, 1983.

(E) Under a Contract executed and closed on May 4, 1984, the Plan sold to Mary Lynn Van Derhoff a 2.99 acre parcel of unimproved real property designated as Parcel E in Survey No. 726 in Sanders County, Montana for a purchase price of $9,000 payable as follows: $1,800 in cash upon the Contract's execution and the balance of $7,200 to be paid over ten years commencing June 1, 1984 in amortized monthly installments of $95.18 including interest of ten percent per annum effective May 4, 1984.

5. The Trustees represent that all decisions and determinations on behalf of the Plan with respect to the Contracts were made by the Plan's Administrative Committee (the Committee), consisting of the Trustees and a third member, James O. Bendickson, an officer of the Employer. The Trustees represent further that no member of the Committee is related in any way to the Van Derhoffs and that the Committee determined that the Van Derhoffs were not related in any way to any employee of the Employer or any Plan participant. The Trustees represent that the Van Derhoffs did not influence the decision of the Committee with respect to any sale of property to them. Maintaining that the subject transactions were entered into without knowledge by the Committee or the Van Derhoffs that the Contracts constituted prohibited transactions under the Act or the Code, the Trustees acknowledge that all of the Contracts were paid in full by the Van Derhoffs by April 10, 1987 after the Internal Revenue Service informed the Trustees that the Contracts appeared to be prohibited by the Act and the Code. The Trustees state that the Contracts were entered into in the ordinary course of business on behalf of the Plan and that the purchase price and other terms for the sale of the property under each Contract were determined by the Committee independently of the Van Derhoffs to be arms-length, at or above the fair market value of each subject property. The Trustees state further that the interest rate and other terms of the Plan's commensurate extension of credit under each Contract were established by the Committee pursuant to the same procedures utilized on behalf of the Plan in all real estate sales under contracts for deed on the basis of the prevailing rates offered by local commercial lenders and the prevailing rates charged in seller-financed arrangements at the time of each Contract in the same geographic locale of the subject property.

6. In summary, the Trustees represent that the transactions satisfied the criteria of section 408(a) of the Act for the following reasons: (1) All terms and conditions of the Contracts were established on behalf of the Plan by the Committee, which is unrelated to the Van Derhoffs; (2) Under the Contracts the Plan received purchase prices of no less than the fair market value of each of the Properties; (3) The terms of the extensions of credit under the Contracts were equivalent to those between unrelated parties in similar transactions at the same times and in the same geographic locales as those involved in the Contracts; and (4) The Plan's interests under the Contracts were represented at all times by the Trustees, who are independent of the Van Derhoffs.

For Further Information Contact: Ronald Willett of the Department, telephone (202) 523–8881. (This is not a toll-free number.)

Andes/Buchanan Medical Corporation Defined Benefit Pension Plan (the Pension Plan) and the Andes-Buchanan Medical Corporation Money Purchase Pension Plan (the M/P Plan; Together, the Plans), Located in Fullerton, California

[Application No. D–7402]

Proposed Exemption

The Department is considering granting an exemption under the authority of section 408(a) of the Act and section 4975(c)(2) of the Code and in accordance with the procedures set forth in ERISA Procedure 75–1 (40 FR 18471, April 28, 1975). If the exemption is granted the restrictions of section 406(a), 406 (b)(1) and (b)(2) of the Act and the sanctions resulting from the application of section 4975 of the Code, by reason of section 4975(c)(1) (A) through (E) of the Code, shall not apply to the proposed purchase by the Plans of a certain promissory note (the Note) which is secured by a deed of trust against certain real property owned by F.V. Ltd., an unrelated party, from the Jerry P. Andes and Barbara J. Andes Revocable Estate Trust (the Andes Trust), a party in interest with respect to the Plans, provided that the price paid for the Note is the lesser of either the outstandng principal balance on the Note or the fair market value of the Note on the date of purchase.

Summary of Acts and Representations

1. The Pension Plan is a defined benefit pension plan which, as of September 30, 1987, had seven participants and total assets of $706,944.71. The M/P Plan is a money purchase pension plan which, as of September 30, 1987, had six participants and total assets of $758,459.45. Jerry P. Andes, M.D., (Dr. Andes) and Dennis Buchanan, M.D., (Dr. Buchanan) are the trustees of the Plans (the Trustees), and the decision-makers with respect to the Plans' investments.

2. The Plans are sponsored by the Andes/Buchanan Medical Corporation (the Employer). The Employer is a California medical corporation located at 220 Laguna Road, Fullerton, California. The shareholders of the Employer are Dr. Andes and Dr. Buchanan. Dr. Andes is the President of the Employer.

3. Dr. Andes and his wife, Barbara J. Andes, are the trustees of the Andes Trust. The Andes Trust is an estate trust, owned by Dr. Andes and Barbara Andes, which is a party in interest with respect to the Plans. Prior to January 1980, the Andes Trust owned a limited partnership interest in F.V. Ltd. (the

Partnership), a California limited partnership. The applicant states that the Partnership is an unrelated party with respect to the Plans and the Employer, and that the Plans have never held either an equity or debt interest in the Partnership. The general partner of the Partnership is DVM, Inc. (DVM), a California corporation whose president and principal shareholder is William J. Carden (Mr. Carden). DVM is a general partner in several real estate limited partnerships in southern California. The applicant states that both DVM and Mr. Carden are unrealated parties with respect to the Plans and the Employer.

4. On January 14, 1980, the Andes Trust liquidated its interest in the Partnership. The Andes Trust received the Note in partial consideration for its interest in the Partnership. The original face amount of the Note was $170,000. The obligors on the Note are DVM, as the general partner of the Partnership, and Mr. Carden. The Note bears simple interest at the rate of 10 percent per annum. Since April 2, 1980, principal and interest on the Note have been payable in quarterly installments of $4,800. On January 2, 1990, the Note provides for the payment in five equal annual installments of unpaid principal and interest. The applicant states that all payments on the Note have been made in a timely manner. The outstanding principal balance on the Note was $143,600, as of January 1, 1988.

The collateral for the Note is a first deed of trust on a certain parcel of commercial real property located at 10221 thru 10231 Slater Avenue, Fountain Valley, California (the Property). There is a second deed of trust in favor of the Mitsubishi Bank of California in the amount of $3,909,500. The Property is approximately 2.65 acres of real estate with a two building office complex of approximately 115,434 square feet. The Property was appraised on August 24, 1983 by William L. Reinhart, SRPA, and William V. Shrewsbury, MAI, independent, qualified real estate appraisers in Newport Beach, California, as having a fair market value of $5,585,000.

5. The Note was appraised on March 21, 1988 by Mark Zane Freilich a/k/a Mark Zane (Mr. Zane), President of Interbranch, Inc., a California corporation engaged in mortgage brokerage and various other financial services. Mr. Zane represents that he is an independent, qualified appraiser for the Note.

Mr. Zane states that in his opinion, the fair market value of the Note, as of March 21, 1988, was the current outstanding principal balance of the Note as of that date. Mr. Zane represents that his valuation of the Note was based on the current value of the Note's terms and conditions, the Note's lien position with respect to other encumbrances, and the security for the Note based on the value of the Property as appraised by independent, qualified appraisers. Mr. Zane also represents that he will update his appraisal of the Note at the time of the proposed transaction and that the appraisal will reflect any accrued but unpaid interest as of the date of purchase.

6. The Trustees propose to have the Plans purchase the Note for cash at the lesser of either the outstanding principal balance on the Note or the fair market value of the Note on the date of purchase. Each of the Plans would acquire a 50 percent interest in the Note. The Plans will not pay any commissions or other expenses with respect to the proposed transaction.

7. Mr. Zane has provided a declaration dated March 9, 1988 (the Declaration), in which he has agreed to serve as an independent fiduciary of the Plans for purposes of the proposed transaction. Mr. Zane acknowledges in the Declaration that he understands his duties, responsibilities and liabilities under the Act in acting as a fiduciary for the Plans. Mr. Zane states that he is qualified to act as a fiduciary of the Plans because he has been involved in numerous transactions involving pension plans investing in various types of mortgage interests and has been often called upon to advise plan trustees with respect to the safety and diversity of their portfolios. Mr. Zane states further that he is not related in any way to any officer, director or employee of the Employer.

8. Mr. Zane has analyzed the investment portfolios of the Plans to determine whether the Note would be both an appropriate and desirable investment for the Plans, based on the Note's rate of return, the character and diversification of the other assets of the Plans, and the probable liquidity needs of the Plans. Mr. Zane states that his review of the Plans' portfolios indicates that the Plans are substantially lacking in investments of a medium term which is precisely the type of investment which the Note represents for the Plans. Mr. Zane states further that the 10% annual return on the Note would be in excess of anything earned by the Plans' portfolios at the present time. Mr. Zane also believes that the security for the Note is excellent, based on the Note's senior lien position and the priority of its recording date. In addition, Mr. Zane states that the principal and interest payments on the Note have been timely made and that the Note is a well seasoned investment. Finally, Mr. Zane notes that immediately following the proposed acquisition of the Note by the Plans, each Plan's interest in the Note will represent less than 10% of each Plan's total assets. Thus, Mr. Zane states that the proposed transaction will not adversely affect the liquidity needs of the Plans.

Mr. Zane concludes that the proposed transaction would be in the best interests of the Plans. Mr. Zane states that his conclusion is based on his total analysis of the Note as an investment for the Plans, taking into account the terms of the Note and the investment policies and objectives of the Plans, as established by the Employer. In addition, Mr. Zane states that he will monitor the proposed transaction on behalf of the Plans and will take whatever actions are necessary to safeguard the Plans' interests.

9. In summary, the applicant represents that the proposed transaction will satisfy the statutory criteria of section 408(a) of the Act because: (a) The purchase of the Note will be a one-time transaction for cash; (b) the Plans will purchase the Note at a price which is the lesser of either the outstanding principal balance of the Note or the fair market value of the Note, as established by a qualified, independent appraiser, as of the date of the transaction; (c) the Plans will not pay any commissions or other expenses with respect to the transaction; (d) Mr. Zane, a qualified independent fiduciary, has determined that the proposed transaction is in the best interests of the Plans; and (e) Mr. Zane will monitor the proposed transaction on behalf of the Plans to ensure that the Plans' interests are safeguarded.

For Further Information Contact: Mr. E.F. Williams of the Department, telephone (202) 523-8883. (This is not a toll-free number.)

General Information

The attention of interested persons is directed to the following:

(1) The fact that a transaction is the subject of an exemption under section 408(a) of the Act and/or section 4975(c)(2) of the Code does not relieve a fiduciary or other party in interest or disqualified person from certain other provisions of the Act and/or the Code, including any prohibited transaction provisions to which the exemption does not apply and the general fiduciary responsibility provisions of section 404 of the Act, which among other things require a fiduciary to discharge his duties respecting the plan solely in the interest of the participants and

beneficiaries of the plan and in a prudent fashion in accordance with section 404(a)(1)(B) of the Act; nor does it affect the requirement of section 401(a) of the Code that the plan must operate for the exclusive benefit of the employees of the employer maintaining the plan and their beneficiaries.

(2) Before an exemption may be granted under section 408(a) of the Act and/or section 4975(c)(2) of the Code, the Department must find that the exemption is administratively feasible, in the interests of the plan and of its participants and beneficiaries and protective of the rights of participants and beneficiaries of the plan; and

(3) The proposed exemptions, if granted, will be supplemental to, and not in derogation of, any other provisions of the Act and/or the Code, including statutory or administrative exemptions and transitional rules. Furthermore, the fact that a transaction is subject to an administrative or statutory exemption is not dispositive of whether the transaction is in fact a prohibited transaction.

(4) The proposed exemptions, if granted, will be subject to the express condition that the material facts and representations contained in each application are true and complete, and that each application accurately describes all material terms of the transaction which is the subject of the exemption.

Signed at Washington, DC, this 2d day of June 1988.

Robert J. Doyle,

Acting Associate Director, Regulations and Interpretations, Pension and Welfare Benefits Administration, U.S. Department of Labor.

[FR Doc. 88-12821 Filed 6-6-88; 8:45 am]

BILLING CODE 4510-29-M

NUCLEAR REGULATORY COMMISSION

Application for License To Export Nuclear Facilities or Materials

Pursuant to 10 CFR 110.70(b), "Public notice of receipt of an application", please take notice that the Nuclear Regulatory Commission has received the following application for an export license. A copy of the application is on file in the Nuclear Regulatory Commission's Public Document Room located at 1717 H Street, NW., Washington, DC.

A request for a hearing or petition for leave to intervene may be filed within 30 days after publication of this notice in the Federal Register. Any request for hearing or petition for leave to intervene shall be served by the requester or or petitioner upon the applicant, the Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, DC 20555, the Secretary, U.S. Nuclear Regulatory Commission, and the Executive Secretary, U.S. Department of State, Washington, DC 20520.

In its review of applications for licenses to export production or utilization facilities, special nuclear materials or source material, noticed herein, the Commission does not evaluate the health, safety or environmental effects in the recipient nation of the facility or material to be exported. The information concerning this application follows.

NRC EXPORT APPLICATION

Name of Applicant, Date of Appl., Date Received, Application Number	Material Type	Material in Total Element	Kilograms Total Isotope	End Use	Country of Destination
Edlow Int'l. Co., 5-23-88, 5-26-88; XSNM02384.	93.3% Enriched	16.478	15.247	Fuel for TRIGA III at Petesti	Romania.

For the Nuclear Regulatory Commission.

Dated this 31st day of May 1988 at Rockville, Maryland.

Marvin R. Peterson,

Assistant Director for International Security, Office of Governmental and Public Affairs.

[FR Doc. 88-12785 Filed 6-6-88; 8:45 am]

BILLING CODE 7590-01-M

SECURITIES AND EXCHANGE COMMISSION

[Release No. 34-25761; File No. SR-NASD-88-17]

Self-Regulatory Organizations; National Association of Securities Dealers, Inc; Proposed Rule Change Adding Section 3 to Article VII and Amending Article XI, Section 4 of the NASD By-Laws

Pursuant to section 19(b)(1) of the Securities Exchange Act of 1934 ("Act"), 15 U.S.C. 78s(b)(1), notice is hereby given that on May 13, 1988, the National Association of Securities Dealers, Inc. ("NASD") filed with the Securities and Exchange Commission ("Commission") the proposed rule change as described in Items, I, II, and III below, which Items have been prepared by the self-regulatory organization. The Commission is publishing this notice to solicit comments on the proposed rule change from interested persons.

I. Self-Regulatory Organization's Statement of the Terms of Substance of the Proposed Rule Change

The proposed rule change adds section 3 to Article VII and amends Article XI, section 4 of the NASD By-Laws, giving the NASD Board of Governors ("Board") and a proposed Committee ("Committee"), comprised of the NASD Chairman of the Board, the NASD President, and a member of the Executive Committee, the authority to respond promptly to emergency conditions that may arise as a result of extraordinary market conditions.

II. Self-Regulatory Organization's Statement of the Purpose of, and Statutory Basis for, the Proposed Rule Change

In its filing with the Commission, the self-regulatory organization included statements concerning the purpose of, and statutory basis for, the proposed rule change and discussed any comments it received on the proposed rule change. The text of these statements may be examined at the places specified in Item IV below. The self-regulatory organization has prepared summaries, set forth in sections (A), (B), and (C) below, of the most significant aspects of such statements.

A. Self-Regulatory Organization's Statement of the Purpose of, and Statutory Basis for, the Proposed Rule Change

Under current NASD procedure, the Executive Committee of the Board is delegated the authority, pursuant to Article XI, section 4 of the NASD By-Laws, to exercise the powers of the Board between Board meetings. Generally, the Executive Committee acts via telephone conference calls or by mail. During highly volatile market conditions, however, it is necessary at times to be able to respond immediately to these conditions. As a result of the precipitous market decline in October

1987, the Board has determined to approve the proposed rule change as a means of ensuring the continued efficient operation of the NASD trading systems, over-the-counter ("OTC") markets, and member firms, in times of highly volatile market conditions.[1] The proposed rule change is summarized below.

Proposed Rule Change

Proposed section 3 to Article VII of the NASD By-Laws, grants the Board—or between Board meetings, a proposed Committee, consisting of the NASD Chairman of the Board (or the Vice Chairman in his absence), the NASD President, and a member of the Executive Committee—the authority to take any action regarding the following:

(1) Operation of NASD quotation, execution, and other systems, and the participation therein of any person or the trading therein of any security;

(2) Operation of, trading in, OTC markets; and

(3) Operation of firms' offices or systems.

The proposed rule change also provides that the exercise of this authority shall occur only if the NASD President, in his discretion, concludes that convening a meeting of the Board or the Executive Committee is not practical or appropriate. The proposed rule change further provides that the NASD President shall report immediately any emergency action taken by the proposed Committee to the Executive Committee and to the Board.

The proposed amendment to Article XI, Section 4 of the NASD By-Laws is a technical amendment. The purpose of the amendment is to clarify the procedure by which the Board delegates authority to the Executive Committee to act between meetings of the Board.

The NASD believes the proposed rule change is consistent with section 15A(b)(6) of the Act. In pertinent part, section 15A(b)(6) mandates that the rules of a national securities association be designed to promote just and equitable principles of trade and to remove impediments to, and perfect the mechanism of, a free and open market. The NASD believes that by providing the NASD with a method of responding promptly to emergency conditions, the proposed rule change will assist in enhancing the fair and orderly functioning of the OTC market.

B. Self-Regulatory Organization's Statement on Burden on Competition

The NASD does not believe that the proposed rule change imposes any burden on competition not necessary or appropriate in furtherance of the Act.

C. Self-Regulatory Organization's Statement on Comments on The Proposed Rule Change Received from Members, Participants, or Others.

The proposed rule change was published for comment in NASD Notice to Members 88–8 on January 20, 1988. As a result of the notice, the NASD received seven comment letters.[2] Five of the comment letters generally favored the proposed rule change; the two remaining comment letters either requested clarification of the terms used in the proposed rule change or expressed concern that the proposed rule change was overly broad. Among the five comment letters in favor of the proposed rule change, one commentator indicated that is was in "wholehearted agreement" with the proposed rule change. Another commentator indicated that it strongly endorsed the proposal's adoption but recommended that the Board be given notice of any actions taken pursuant to the emergency authority granted by the proposed rule change concurrently with the actions being taken. Two of the commentators in support of the proposed rule change recommended that certain language changes be made to the proposed provisions. One of these commentators believed that because meetings of the Executive Committee and Board may be "many weeks away," the term "promptly" should be deleted from the provisions of paragraph (c) to the proposed rule change. Similarly, the other commentator who recommended language changes suggested that paragraph (c) be changed to provide that the proposed Committee notify the Board or Executive Committee of any actions taken by "mail, telephone or telegraph," as opposed to "at its next meeting." The fifth commentator in favor of the proposed rule change stated, in pertinent part, that while it had "no problem" with emergency powers being delegated to a committee, the delegated power should be limited to operation of the OTC market, NASDAQ, or any related trading system, and not extend to the operation of firms' offices or systems. This commentator also suggested that there should be a "time frame" within which the emergency directives issued by the Committee pursuant to proposed section 3 be in effect. This commentator suggested that beyond that time, the directives should be reviewed by the Board.

The remaining two comment letters did not generally endorse the proposed rule change. One of these commentators indicated, instead, that it would be helpful to understand what constitutes "highly volatile markets." The other commentator expressed concern, in part, that the grant of authority in proposed section 3 is too broad, and recommended that a third member of the Executive Committee be included as a member of the proposed Committee empowered to act in emergencies.

After considering the comment letters received in response to Notice to Members 88–8, the Board detemined to approve the proposed rule change with two changes. First, the Board determined to increase the number comprising the proposed Committee authorized to take emergency action pursuant to proposed section 3, from two members to three, as suggested by one of the commentators. The third Committee member would be selected from the Executive Committee. The second change approved by the Board is the requirement that the NASD President report immediately to the Executive Committee and to the Board any action taken pursuant to proposed section 3, as also suggested by a commentator.

III. Date of Effectiveness of the Proposed Rule Change and Timing for Commission Action

Within 35 days of the date of publication of this notice in the Federal Register or within such longer period (i) as the Commission may designate up to 90 days of such date if it finds such longer period to be appropriate and publishes its reasons for so finding or (ii) as to which the self-regulatory organization consents, the Commission will:

A. By order approve such proposed rule change, or

B. Institute proceedings to determine whether the proposed rule change should be disapproved.

IV. Solicitation of Comments

Interested persons are invited to submit written data, views, and arguments concerning the foregoing. Persons making written submissions should file six copies thereof with the Secretary, Securities and Exchange

[1] Pursuant to the provisions of section 19(b)(3)(A) of the Act, a similar rule proposal granting emergency powers jointly to the NASD Chairman of the Board (or the Vice Chairman in his absence) and the NASD President was filed with the Commission on October 27, 1987. Under the terms of the rule filing, the grant of emergency authority remained in effect until November 13, 1987. *See* File No. SR-NASD-87-48; Securities Exchange Act Release No. 34-25157, 52 FR 46013 (Dec. 3, 1987).

[2] The Notice to Members, a list of the commentators, and the comment letters are attached as Exhibit 2 to the rule filing.

Commission, 450 Fifth Street NW., Washington, DC 20549. Copies of the submissions, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission, and any person, other than those that may be withheld from the public in accordance with the provisions of 5 U.S.C. 552 will be available for inspection and copying in the Commission's Public Reference Room. Copies of the filing will also be available for inspection and copying at the principal office of the NASD. All submissions should refer to file number SR-NASD-88-17 and should be submitted by June 28, 1988.

For the Commission, by the Division of Market Regulation, pursuant to delegated authority, 17 CFR 200.30-3(a)(12).

Jonathan G. Katz,

Secretary.

Dated: May 27, 1988.

[FR Doc. 88-12774 Filed 6-6-88; 8:45 am]

BILLING CODE 8010-01-M

[Release No. 34-25763; File No. SR-NYSE-87-10]

Self-Regulatory Organizations; Order Approving Proposed Rule Change by the New York Stock Exchange, Inc. Relating to Regulatory Review Requirements

I. Introduction and Background

The New York Stock Exchange, Inc. ("NYSE" or "Exchange") submitted, on March 27, 1987, copies of a proposed rule change, and on August 28, 1987, copies of an amendment to that proposal, pursuant to section 19(b)(1) of the Securities Exchange Act of 1934 ("Act") [1] and Rule 19b-4 thereunder,[2] to amend NYSE Rules 342, 351 and 476 to supplement the existing internal compliance procedures of members and member organizations by imposing additional trade review, inquiry, and reporting requirements.[3]

In its initial filing, the NYSE stated that the purpose of the initiative is to strengthen the supervisory and compliance processes of members and member organizations by requiring them to demonstrate to the Exchange that they are meeting their obligations and responsibilities in these areas. In particular, the proposed amendments would require the affected entities to review member, employee, and proprietary trades for violations of securities laws and Exchange rules prohibiting insider trading and the use of manipulative or deceptive devices, require the production of an annual compliance report, mandate the collection and reporting of customer complaint statistics, and require key compliance officials to pass a compliance official examination.

Notice of the proposed rule change and its amendment ("NYSE Amendment No. 1"), together with the terms of substance of the proposals, was given by the issuance of Commission releases (Securities Exchange Act Release Nos. 24363, April 17, 1987; 24941, September 25, 1987) and by publication in the **Federal Register** (52 FR 13781, April 24, 1987; and 52 FR 36655, September 30, 1987).[4] Twenty-one comments were received from 18 commentators regarding the proposal.[5]

II. Description of the Proposal

A. Proprietary and Employee Trading Review

Proposed NYSE Rule 342.21(a) requires members and member organizations to subject to review procedures trades for their own accounts, for the accounts of associated members, allied members, employees, and their families,[6] in NYSE-listed securities and related financial instruments.[7] According to the Rule, the trade review procedures reasonably must be designed to identify trades that are or may be violative of the provisions of the Act, the rules thereunder, and the rules of the Exchange, pertaining to insider trading and manipulative and deceptive practices. Paragraph (b) of proposed Rule 342.21 requires the member or member organization to conduct an internal investigation into any reviewed trade that appears to have violated those laws or rules. Finally, the Exchange, at its discretion, can exclude certain classes of persons, trades, or securities from the reviewing and investigation requirements. In this context the NYSE has indicated that it intends to exclude from the review process proprietary trades of fewer than 1,000 shares, provided other safeguards are established.

B. Annual Compliance Report

Proposed Rule 342.30 requires members and member organizations to prepare a report on supervisory and compliance efforts undertaken during the previous year and to submit the report to its chief executive officer or managing partner by April 1 of each year. The report must include a tabulation of customer complaints and internal investigations, identification and analysis of significant compliance problems, and plans for future systems or procedures to prevent and detect future compliance problems. Further, the report must include a discussion of the preceding year's compliance efforts in the areas of antifraud, investment banking, sales practices, books and records, finance and operations and supervision.[8]

C. Reporting Requirements

Proposed Rules 351 (d) and (e) enhance the reporting requirements of members and member organizations to

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[1] 15 U.S.C. 78s(b)(1).

[2] 17 CFR 240.19b-4 (1987).

[3] The terms "member" and "member organization" have specific meanings under the NYSE Constitution. According to Article I, section 3(h), a member is defined as "a natural person who is a member of the Exchange" (*i.e.*, a sole proprietor). Member organizations, according to Article I, section 3(k), include member firms (partnerships) and member corporations.

[4] The NYSE filed another amendment to its proposal, which the Commission did not publish for comment because the amendments are of a non-substantive nature. *See* letter from James E. Buck, Senior Vice President, NYSE to Sharon Lawson, Branch Chief, Division of Market Regulation, SEC dated April 22, 1988 ("NYSE Amendment No. 2").

[5] *See* notes 13 to 28 and accompanying text, *infra*, summarizing comments received.

[6] *See* NYSE Amendment No. 1, at 5. The NYSE, in its amendment to the filing, noted that it would define what is meant by "family members" in an information memorandum circulated to members and member organizations.

[7] *See* proposed NYSE Rule 342.22. This section defines "related financial instrument" as (a) any stock underlying an NYSE listed stock option or included in an index stock group underlying an NYSE listed stock index option; (b) any stock option on an NYSE listed stock; (c) any stock index option that includes an NYSE listed stock or bond as one of the index's component securities; (d) any stock index futures contract that includes an NYSE listed stock or bond as one of the index's component securities; and (e) any option on any such futures contract.

[8] The NYSE recently filed a rule proposal to supplement the requirements of Rule 342.30. Proposed Rule 354 would require that a copy of the annual report be furnished to the control person (as defined in NYSE Rule 2) of the member organization. If the control person is itself an organization, the report must be delivered to the general counsel and the audit committee of the control person. Finally, if the member organization has no control person, the rule would require that the report be furnished to the audit committee of the board of directors of the member organization. The proposal has been published for comment by the Commission. *See* Securities Exchange Act Release No. 25402 (February 26, 1988), 53 FR 7272. The NYSE also has noted that the first annual report would be due in April 1989. That report would cover all relevant trading information from the date of the approval of the rule until the end of the trading year, and should include full year information on subjects upon which the member or member organization already maintains records (*i.e.* customer complaints). *See* NYSE Amendment No. 2.

the NYSE. Rule 351(d) requires these entities to report to the Exchange, on a periodic basis, statistical information regarding customer complaints. Rule 351(e) institutes a reporting requirement to the Exchange for trades that are subject to the review procedures of Rule 342.21. Pursuant to paragraph (e), each member, or the senior officer or partner of each member organization, must certify, on a quarterly basis, that adequate review procedures have been established and carried out for proprietary trades and those employee trades subject to review,[9] and there is no reasonable cause to believe that the reviewed trades violate the Act, the rules thereunder, or the rules of the Exchange pertaining to insider trading or manipulative and deceptive devices, or that the trade presently is subject to an internal investigation.[10] If a trade is subject to an internal investigation, the member must report the quarterly progress of such investigation to the Exchange.

D. Compliance Official Examination

Proposed Rule 342.13(b) requires members, and the person or persons responsible for direct day to day compliance activity within a member organization, as well as any person with direct supervision over ten or more persons engaged in compliance activity, to pass a Compliance Official Qualification Examination. Further, if the member or member organization does business with the public, the compliance official or officials must also pass the General Securities Sales Supervisor Qualification (Series 8) Exam. The rule includes a waiver provision, for all or part of the examination requirements, if good cause is demonstrated.[11]

E. Compliance with Information Requests

The NYSE proposal contains three procedural provisions designed to ensure timely compliance by members and member organizations with information requests. Proposed Rule 342.20 states that a member or member organization must comply with any request by the Exchange for "detailed information regarding trades" effected in NYSE listed stocks or related financial instruments by the date required by the Exchange. Amendments to Rule 476(a)(11) make the failure to respond in a timely manner actionable pursuant to NYSE disciplinary procedures. Finally, proposed amendments to NYSE Rule 476A add violations of Rule 342.20 and 476(a)(11) to the list of Exchange rule violations eligible to be processed pursuant to the NYSE's minor rule violation plan.[12]

III. Summary of Comments

As noted above, 21 comments were received regarding the NYSE proposal.[13] With the exception of two separate comments from the Subcommittee on Broker-Dealer Matters of the Comittee on Federal Regulation of Securities, Section on Business Law of the American Bar Association ("ABA"),[14] the remaining comments were from broker-dealers, or law firms or groups representing broker-dealers. Each commentator was critical of at least certain aspects of the NYSE proposal, and one commentator specifically requested the Commission to disapprove substantial portions of the proposal as being inconsistent with the Act.[15] The NYSE also filed two comments, supporting its position and responding to some of the criticisms of the commentators.[16]

Twelve commentators objected to the trade review requirements of Rule 342.21 and the corresponding reporting requirement of Rule 351(e), as being excessively burdensome while adding little or no corresponding benefit to the surveillance and compliance efforts of the members and the NYSE.[17] A number of commentators claimed that the proposed rules actually would be detrimental to the supervisory and compliance processes of members and member organizations. Three commentators claimed that the requirements of the rule would hinder compliance procedures by not permitting firms to "break" a suspicious trade without finding a violation.[18]

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[9] The Exchange has noted that all employee trades need not be reviewed each quarter, so long as each employee account is reviewed at least once per year.

[10] *See* proposed Rule 351(e). This section provides a specific format for the required certification.

[11] *See* proposed Rule 342.13(b). The rule states that any waiver request will be evaluated in light of the scope of the member or member organization's activity, previous related employment, and the examination requirements of other self-regulatory organizations ("SROs").

[12] The Commission adopted amendments to paragraph (c) of Rule 19d–1 to allow SROs to submit, for Commission approval, plans for the abbreviated reporting of minor rule violations. *See* Securities Exchange Act Release No. 21013 (June 1, 1984), 49 FR 23838. Under the amendment, any disciplinary action taken by the SRO for violation of an SRO rule that has been designated a minor rule violation pursuant to the plan shall not be considered "final" for the purposes of section 19(d)(1) of the Act if the sanction imposed consists of a fine not exceeding $2,500 and the sanctioned person has not sought an adjudication, including a hearing, or otherwise exhausted his or her administrative remedies. The Commission previously approved a minor rule violation plan filed by the NYSE. The NYSE plan permits the imposition of a sanction pursuant to an abbreviated disciplinary procedure. A respondent in such an action may avail himself of the protections of a full disciplinary proceeding by contesting the charge, or may terminate the proceeding by paying the appropriate fine. *See* Securities Exchange Act Release No. 22415 (September 17, 1985), 50 FR 38600.

[13] Six of the 21 comments were received by the Commission; the remaining 15 were directed to the NYSE and then forwarded to the Commission. Four of these fifteen comments were submitted to the NYSE in response to an early draft of the proposed rule, and were forwarded to the Commission by the NYSE with the initial proposal.

[14] *See* letters from Lewis S. Black, Chairman, Federal Regulation of Securities Committee, Section on Business Law, ABA, to Jonathan G. Katz, Secretary, SEC, dated May 14, 1987 ("May 14 ABA letter") and November 23, 1987 ("November 23 ABA letter").

[15] *See* November 23 ABA letter at 8.

[16] *See* letter and attached memorandum from Richard P. Bernard, Milbank, Tweed, Hadley & McCloy (NYSE counsel) to Howard Kramer, Assistant Director, Division of Market Regulation, SEC, dated August 27, 1987 ("August 27 NYSE Letter"); letter from Raymond J. Hennessey, Vice President, NYSE, to Brandon Becker, Associate Director, Division of Market Regulation, SEC, dated February 17, 1987 ("February 17 NYSE letter").

[17] *See* May 14 ABA letter; letter from Robert F. Price, Alex Brown and Sons, to Jonathan G. Katz, Secretary, SEC, dated July 30, 1987 ("Alex Brown"); letter from G. Fredrick Kastin, President, Robert W. Baird Inc., to Robert Birnbaum, President, NYSE, dated June 22, 1987 ("Baird"); letter from Theodore W. Push, Executive Vice President, Bateman, Eichler, Hill Richards, to Robert Birnbaum, dated June 23, 1987 ("Bateman Eichler"); letter from Alvin H. Einbender, Executive Vice President, Bear Stearns, to Robert Birnbaum, dated March 3, 1987 ("Bear Stearns"); letter from R. Patrick Shepherd, General Counsel, J.C. Bradford & Co. to Jonathan G. Katz, dated July 23, 1987 ("Bradford"); letter from Philip J. Purcell, Chairman, Dean Witter Financial Services, to John J. Phelan, Chairman, NYSE, dated July 13, 1987 ("Dean Witter"); letter from Stephen Robert, Chairman, Oppenheimer & Co., Inc. to Robert Birnbaum, dated June 15, 1987 ("Oppenheimer"); letter from George A. Jensen, Peper, Martin, Jensen, Maichel and Hetlage, (Counsel to A.G. Edwards and Sons); to Jonathan G. Katz, dated July 1, 1987 ("Peper, Martin"); letter from Addison L. Piper, Chief Executive Officer, Piper, Jaffray and Hopwood, to David Marcus, Executive Vice Presdident, NYSE, dated June 9, 1987 ("Piper Jaffray"); letter from Saul S. Cohen, Rosenman and Colin, to Robert Birnbaum, dated March 20, 1987 ("Rosenman"); letter from Edward O'Brien, President, Securities Industry Association, to John Phelan, dated July 10, 1987 ("SIA"). *See also* May 14 ABA letter, which argued that because the proposed procedures would be more burdensome than beneficial, they are violative of section 6(b)(8) of the Act.

[18] *See* May 14 ABA letter; Bradford; SIA. These commentators noted that compliance departments will often break, or cancel, a suspicious proprietary or employee trade, and by doing so, resolve the investigation without making an official finding that a violation has occurred. According to these commentators, this intermediate step is not available under the requirements of Rules 342.21 and 351(e).

Bradford and the SIA both stated that the requirement that each trade be reviewed would undermine advancements that have been made and resources that have been dedicated to the development of sophisticated computer mechanisms for the detection of anomalous trading. Baird and Piper, Jaffray claimed that the rules would lead to an adversarial relationship between the compliance and trading staffs of a firm, thereby limiting the free flow of information between those two groups.

Other commentators believed that the entire review process was inappropriate. Several criticized the specific requirement that firms investigate any trade that "appears that it may have violated" insider trading or antifraud rules. The ABA and the SIA claimed that member organizations should not be placed in the position of making a determination on the legality of a trade, but instead only should be responsible for referring suspicious or anomalous trades to the Exchange. The ABA stated that the NYSE was "impermissibly seeking to shift its responsibilities under law to private organziations, which have not been authorized by Congress to assume such responsibilities." [19] Some commentators claimed that such an obligation would present serious due process problems,[20] while others suggested that the filing of these investigative reports could result in litigation against broker-dealers. The SIA noted that even a good faith failure in the review process could result in a claim against the member or member organization for filing a false report with the Exchange. Further, a number of commentators expressed concern that the trade review and subsequent reports would lead to liability for libel and slander, and that the reports will provide a very damaging paper trail to plaintiffs in those litigations.[21] Finally, the ABA and Oppenheimer claimed that the reporting requirements would violate the attorney-client privilege that exists between compliance and trading staffs.

Commentators also were critical of the proposed compliance report requirement of Rule 342.30. As with the trade review proposals, these criticisms centered on the perceived lack of effectiveness of the proposal, and the potential for leaving members and member organizations open to civil liability.[22] Four commentators expressed the opinion that the compliance report would not only be ineffective, but would actually hinder compliance efforts. The ABA and the SIA claimed that a variety of informal compliance tools would become standardized and publicized by the production of the annual report, thereby destroying the effectiveness of such tools by creating a "road map" for their evasion. Alex. Brown viewed the rule as a formalization of the internal review process. Such a formalization, according to the firm, would be inefficient, because the decision as to the form an internal review should take is better left to the diverse member organizations. The SIA opined that pinpointing the chief executive officer or managing partner as the recipient of the report was unrealistic in light of the size and diversification of many member organizations.[23] The SIA and Peper Martin both recommended that instead of the report, periodic meetings between supervisory and compliance officials and senior management should be held. These commentators believed that such meetings are more likely to produce candid assessments of compliance efforts and problems than the production of a written annual report.

The majority of commentators favored the concept of a compliance official examination, with only four commentators expressing minor criticisms about the specifics of the NYSE proposal. Alex. Brown noted that, for officials with supervisory responsibility over a narrow area of a diversified firm, the existing Series 8 and Series 24 examinations are sufficient to demonstrate overall knowledge of the securities laws and Exchange rules, therefore making redundant the requirement that those officials take the newly created NYSE exam. Similarly, the ABA stated that such individuals should not be responsible for passing the entire exam, but only that portion that pertains directly to the individual's area of responsibility. The SIA and the ABA each argued that the good cause waiver provision did not go far enough, and that significant related employment experience should be grounds for an automatic exemption from the requirement. Finally, Bateman Eichler stated that all present supervisory and compliance officials should be exempted pursuant to a broad grandfathering provision.

Four commentators objected to the additional procedures designed to ensure prompt compliance with Exchange information requests. Alex. Brown commented that the proposed rule could be interpreted to require a firm to gather information on customer trades, which would be inappropriate because such an activity is "outside the province of the broker-dealer." [24] Other comments were less specific. All four commentators focused on the "date specified" timetable built into the Rule.[25] These commentators believed that such a timetable was unfair, because it permitted the Exchange to fine a member or member organization for failure to respond in a timely fashion, even if the time limit imposed by the Exchange was unreasonable. The SIA elaborated on the perceived unfairness of the rule by noting that noncompliance could be caused by something outside the control of the member organization, such as a computer failure.[26] Finally, the ABA noted that the "date specified" language was so unfair as to violate the "fair procedure for disciplining members" language of sections 6(b)(7) and 6(d) of the Act.[27] The ABA continues to maintain that the provision is violative of the Act, despite the fact that the NYSE has amended the language of the rule from "date specified" to "date required." [28]

IV. Discussion

The Commission reviewed carefully the filing submitted by the NYSE, as well as the comments and criticisms submitted by the ABA, SIA, and the NYSE member community, to determine whether the proposed rules are consistent with the Act, including the

[19] November 23 ABA letter at 4.

[20] *See* Bateman Eichler; May 14 ABA letter. Bateman Eichler claimed that by reporting "apparent" violations, those under scrutiny were placed "in the position of appearing guilty until proven innocent." The ABA found the requirement especially burdensome because, in its opinion, the determination would force member organizations to institute a variety of due process protections into its internal investigation procedures, thereby hindering those procedures.

[21] *See* November 23 ABA letter; Baird; Bateman Eichler; Bradford; SIA.

[22] Four commentators felt that the publication of such a document would be damaging to the defense efforts of a member organization in a civil litigation. *See* Baird; Bateman Eichler; Bradford; Peper Martin.

[23] The SIA also noted that the restriction on delegation of this responsibility inherent in the proposed rule would be inconsistent with NYSE Rule 342(b)(1), which allows the delegation of compliance and supervisory duties to qualified principals and employees.

[24] *See* comments of Alex. Brown.

[25] *See* May 14 ABA letter; comments of Alex. Brown; Bateman Eichler; SIA. In response to such criticisms, the NYSE changed the language of the proposed rule from "date specified" to "date required." The Exchange believes that the change clarifies that it can adjust deadlines for members and member organizations which show reasonable grounds for not meeting an information deadline.

[26] The SIA argued, in the alternative, that a "date specified" clause was less objectionable if the information requested was limited to information gathered in the ordinary course of business.

[27] *See* 15 U.S.C. 78f(b)(7), 78f(d).

[28] *See* November 23 ABA letter at 8.

requirements set forth in section 6(b) of the Act.[29]

We believe that both the increased surveillance mandated by proposed Rule 342.21, which requires members and member organizations to review proprietary and employee trades, and proposed Rule 351(e), which sets forth the reporting requirements for trades subject to the review procedures of Rule 342.21, are consistent with the requirements of the Act. First, we note that the increased surveillance mandated by these rules should have a positive impact upon the compliance efforts of Exchange members and member organizations, consistent with the oversight responsibilities imposed upon the NYSE as a self-regulatory organization under the Act. Further, section 19(g)(1) of the Act provides that every self-regulatory organization shall comply with the provisions of the Act, the rules and regulations thereunder, and its own rules, and enforce compliance, in the case of a national securities exchange, with such provisins by its members and persons associated with its members. Indeed, section 6(b)(1) of the Act specifically provides that, to be registered, a national securities exchange must have the ability to enforce compliance by its members with the Act, the rules thereunder, and the rules of the exchange.[30]

By requiring members and member organizations to establish review procedures that reasonably are designed to identify trades that may violate prohibitions against insider trading and manipulative and deceptive devices under the Act, we believe that NYSE Rule 342.21 will enhance compliance with section 15(b)(4)(E) of the Act.[31] Section 15(b)(4)(E), in effect, requires broker-dealers to establish procedures, and a system for applying such procedures, to prevent and detect violations of the Act by persons under its supervision. Moreover, mandating such a thorough review will not only increase the possibility of detecting illegal trades, but also will have a deterrent effect on insider trading and manipulative and deceptive practices.

The NYSE has stated that it disagrees with the argument raised by commentators that Rule 342.21 would place members and member organizations in the improper position of making an adjudicatory "finding" on the legality of a trade. The Exchange argued that the language of Rule 342.21 does not require a legal finding, but only triggers a responsibility to investigate any trade that raises a suspicion of a possible violation.[32] The Commission agrees with the reasoning of the NYSE. We note that 351(e) does not require a member or member organization to report whether it actually found a violation of securities laws with respect to a trade subject to an internal investigation under Rule 342.21. Instead 351(e) requires the member or member organization to report the status of the investigation including, upon its completion, whether any internal disciplinary action was taken or referral to an SRO was made. Accordingly, if an investigation of a suspicious trade raises questions concerning violations of securities laws, it would, under the proposed rule, be fully permissible for the member or member organization to refer it to the NYSE for further review. We believe this is consistent with the current obligations of NYSE members and member organizations under the Act and existing Exchange rules.[33] We also note that the obligations of Rule 342.21 are not so inflexible as to prohibit members and member organizations from taking the intermediate step of "breaking" an individual trade. Breaking a trade, however, may not relieve the member or member organizations of its responsibility to investigate further, or report or refer the investigation to the Exchange. An investigation that uncovers the possibility of serious or egregious conduct in an employee or proprietary account should not terminate with the firm merely breaking the trade. The Commission emphasizes, however, that the firm's obligation to go beyond breaking a trade does not derive solely from Rule 351(e) but instead may be required in order for the firm to comply with section 15(b)(4)(E) of the Act.[34]

Further, the Commission does not find convincing the argument that the volume of the trade review requirements will place to severe a burden on members and member organizations. First, acknowledging the increased administrative responsibilities that will be placed on members and member organizations, the NYSE has provided that those entities may use sampling techniques to review trades,[35] and that not all employee trades must be reviewed quarterly, so long as each employee account is reviewed once per year.[36] Moreover, Rule 342.21 provides the Exchange with discretion to exclude classes of persons and trades from review. In this context, the Exchange has stated that it anticipates excluding proprietary trades of less than 1,000 shares from the review process, provided that members and member organizations can develop reliable methods for detecting attempts to split large trades to avoid review.[37]

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[29] *See* 15 U.S.C. 78s(b)(7) and (8). The majority of comments, directly or indirectly, raise issues stemming from these two sections. The comments addressing proposed Rule 342.20, concerning compliance with information requests implicate the "fair procedure for disciplining members" provision of section 6(b)(7). Further, the comments concerning the perceived burdens of increased trade review and reporting and the collection of customer complaint statistics involve section 6(b)(8), in that the commentators suggest that the proposed rules would impose a burden not necessary or appropriate in furtherance of the purposes of the Act by increasing responsibilities without gaining any tangible increase in supervisory or compliance efforts.

[30] *See* 15 U.S.C. 78f(b). Section 6(b) generally sets forth the requirements to be registered as a national securities exchange, while section 19 sets forth the oversight responsibilities of self-regulatory organizations.

[31] *See* 15 U.S.C. 78o(b)(4)(E)(i).

[32] *See* February 17 NYSE letter at 5.

[33] We note that if no internal disciplinary action is taken or referral made, the member or member organizations would be required to sign a statement that there is no reasonable cause to believe the examined trade violated prohibitions against insider trading and manipulative and deceptive devices.

[34] *See* text accompanying note 18, *supra*.

[35] *See* November 23 ABA letter at 3. The ABA expressed concern about the lack of any generally accepted standards of sampling techniques. The Commission is aware that most firms have developed sampling techniques for the review of proprietary and employee trading in order to comply with section 15(b)(4)(E). Those techniques vary substantially based on the size and nature of a firm's business. Accordingly, the Commission believes it would be impractical for the NYSE to specify appropriate sampling techniques for its entire membership in the Rule. We note, however, that the NYSE has stated its willingness to assist firms in developing acceptable review procedures. *See* August 27 NYSE letter at 9.

[36] In response to the ABA comment concerning the use of sampling techniques for the review of proprietary trades, the NYSE has indicated that sampling techniques would be permissible to review such trades under the proposed rules. The NYSE notes, however, that because the Rule 351(e) statement covers all proprietary trades occurring during the period reviewed, not just those actually reviewed as with employee trades, it may be necessary to review all proprietary trades if one or more of the sampled trades raise questions. If, however, sampled trades reveal questionable activity in only a limited area (*e.g.*, the block trading desk), the member or member organization may only need to review all trades within that discrete area. The Commission believes it is important for members and member organizations to review both employee and proprietary trades. Further, we believe that the NYSE decision to provide alternative reporting requirements for employee trades to reduce the burden of reviewing every employee every quarter, while maintaining a higher level of review in those cases where the proprietary trades actually reviewed indicate questionable trades, is consistent with the Act.

[37] *See* NYSE Amendment No. 1 at 3. The Commission notes, however, that any exemptive interpretations of Rule 342.21 would require prior Commission approval pursuant to Commission Rule 19b-4.

The NYSE, in its comments, also responded to criticisms raised by the commentors that the trade review procedures of proposed Rule 342.21 and 351(e) might expose the firm to defamation actions. In particular, the NYSE noted that the reporting requirements of Rule 351(e) do not differ dramatically from those of existing Rule 351(a).[38] Further, the Exchange noted that, to its knowledge, no member or member organization has ever been found to have defamed any person as a result of those reporting requirements. Finally, the NYSE argued that any person made in this context would likely enjoy the absolute privilege of statement or opinion.[39] Irrespective of the validity of this argument, the Commission emphasizes that the reporting requirements of Rule 351(e) do not alter substantially the existing reporting requirements for members and member organizations under the Act and Exchange rules, but simply implement a mandatory procedure for such reporting. Accordingly, the procedures should not provide additional exposure to defamation claims.

The Commission also believes that the annual report requirement under proposed Rule 342.30 will improve significantly the compliance efforts of member organizations, by ensuring that the chief executive officer or managing partner is focusing sufficient attention on supervisory and compliance obligations. It is important for the top executive of a member organization to understand the firm's compliance efforts and problems. Moreover, as the report also would have to be made available to the NYSE at the request of the Exchange, it can be an effective aid to the NYSE in understanding changes in member and member organizations compliance procedures. The Commission also finds that some of the negative comments concerning the annual report are based on the mistaken assumption that the report will be available for public dissemination, therefore compromising the effectiveness of some compliance tools. The proposed Rule does not indicate that the annual report would be made available to the public. In response to comments concerning the availability of information contained in the report, the NYSE stressed that the report is an internal summary prepared for the chief executive officer or managing partner, and need not be generally circulated, either inside or outside the firm.[40]

The Commission also has reviewed the proposed compliance official exam and customer compliant reporting requirements and believe they are consistent with the Act. The compliance official exam will ensure that those persons responsible for day to day compliance activity will have the requisite specialized knowledge of broker-dealer compliance responsibilities under the federal securities laws and NYSE rules. The good cause exemption of the rule, among other things, will permit the NYSE to exempt employees with narrow supervisory responsibility from all or parts of the examination, if appropriate. Further, the customer complaint statistics will provide the Exchange with information valuable to the execution of its oversight responsibilities. The statistics can highlight to the NYSE any problem areas or other trends in a firm's compliance program.

The Commission also finds that the proposed rules concerning member compliance with information requests are consistent with the requirements of the Act. In order to effect its supervisory and compliance role over members and member organizations, it is necessary for the Exchange to have the ability to set timetables for the receipt of information, and the disciplinary authority to compel members to comply with such requests. Because the timetable set by the NYSE will vary depending upon the circumstances of particular investigation, it would be inappropriate to establish a minimum notice period for members and member organizations to respond to information requests. In addition, setting a minimum notice period could be detrimental during an emergency situation.

Some commentators expressed concern about the NYSE's ability to impose summary fines for the failure to produce information, in that an unreasonable deadline set by the Exchange can result in a summary fine being imposed against a member or member organization who in good faith attempted to produce the requested information on a timely basis. To address this concern, the NYSE noted that the language of the Rule is intended to make clear that the Exchange can adjust deadlines for members and member organizations that show reasonable grounds for not meeting an initial deadline. Further, the due process protections built into the NYSE disciplinary actions, as well as Commission review of NYSE disciplinary proceedings, offer protection to members and member organizations. Included within the due process protections of the NYSE disciplinary system are the procedural safeguards of the NYSE summary sanction process.[41] As noted above, any member or member organization that is the respondent in a summary action pursuant to NYSE Rule 476A automatically may receive a full disciplinary hearing simply by contesting the charge. Further, the maximum amount that the Exchange may fine a member or member organization pursuant to this procedure is $5,000. Finally, the NYSE has stated, and the Commission concurs, that reasonableness would be an issue in any proceeding brought as the result of a violation of Rule 342.20.[42] In light of the above, the Commission believes that the provisions concerning compliance with information requests are consistent with section 6(b)(7) of the Act.

V. Conclusion

The Commission believes that the proposed rules adequately balance the need to ensure that firms have reasonable and effective procedures in place to detect securities law violations with the need to avoid imposing unnecessary compliance costs or impeding firms' flexibility in determining what specific surveillance and compliance procedures are necessary to effectively meet its supervisory obligation. Therefore, the Commission finds that the NYSE's proposal is consistent with the requirements of the Act, specifically sections 6(b)(1) and 19(g) of the Act, which require that national securities exchanges must ensure member and member organization compliance with the Act, its rules and the rules of the exchange. Although the rules impose more specific requirements than currently exist on members and member organizations to show they are meeting their compliance and surveillance obligations, the Commission believes these additional requirements will aid firms and the NYSE in fulfilling their obligations under the Act.

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[38] For example, Rule 351(a)(1) requires a member organization to report to the Exchange whenever a member, allied member, or employee has violated any provision of any securities law or regulation, or engaged in conduct which is inconsistent with just and equitable principles of trade.

[39] *See* February 17 NYSE letter at 4.

[40] *See* February 17 NYSE letter at 5. Proposed NYSE Rule 354 would, however, require a member organization to circulate the report to the CEO, managing partner or audit committee of the control person of the member organization. *See* note 8 *supra*.

[41] The Commission notes that it has determined that the procedural protections included within the summary sanction process meet the due process requirements of the Act.

[42] *See* February 17 NYSE letter at 6.

In particular, consistent with sections 6(b)(1) and 19(g), the rules will enhance compliance by members and member organizations with rules and regulations pertaining to insider trading, manipulative and deceptive devices, and supervisory responsibilities of member firms. For these same reasons, the proposed rules are consistent with section 6(b)(5) of the Act, which requires that rules of an exchange be designed to prevent fraudulent and manipulative acts and practices, to promote just equitable principles of trade and to protect investors and the public interest. Finally, while the rules impose an increased burden on NYSE members and member organizations, we believe that consistent with section 6(b)(8), the burden is justified by the positive effects it will have on member compliance with the Act.

Based on the above, the Commission finds that the proposed rule changes are consistent with the requirements of the Act and the rules and regulations thereunder applicable to a national securities exchange and, in particular, the requirements of sections 6 and 19 and rules and regulations thereunder.

It is therefore ordered, pursuant to section 19(b)(2) of the Act, that the above mentioned proposed rule change be, and hereby is, approved.

By the Commission.

Jonathan G. Katz,

Secretary.

Dated: May 27, 1988.

[FR Doc. 88-12775 Filed 6-6-88; 8:45 a.m.]

BILLING CODE 8010-01-M

Self-Regulatory Organizations; Applications for Unlisted Trading Privileges and of Opportunity for Hearing; Cincinnati Stock Exchange, Inc.

June 1, 1988.

The above named national securities exchange has filed applications with the Securities and Exchange Commission pursuant to section 12(f)(1)(B) of the Securities Exchange Act of 1934 and Rule 12f-1 thereunder, for unlisted trading privileges in the following securities:

Apple Bank for Savings,
Common Stock, $1.00 Par Value (File No. 7-3494).
Dime Savings Bank, NY,
Common Stock, $1.00 Par Value (File No. 7-3495).

These securities are listed and registered on one or more other national securities exchange and are reported in the consolidated transaction reporting system.

Interested persons are invited to submit on or before June 21, 1988, written data, views and arguments concerning the above-referenced applications. Persons desiring to make written comments should file three copies thereof with the Secretary of the Securities and Exchange Commission, 450 Fifth Street, NW., Washington, DC 20549. Following this opportunity for hearing, the Commission will approve the applications if it finds, based upon all the information available to it, that the extensions of unlisted trading privileges pursuant to such applications are consistent with the maintenance of fair and orderly markets and the protection of investors.

For the Commission, by the Division of Market Regulation, pursuant to delegated authority.

Jonathan G. Katz,

Secretary.

[FR Doc. 88-12776 Filed 6-6-88; 8:45 am]

BILLING CODE 8010-01-M

Self-Regulatory Organizations; Applications for Unlisted Trading Privileges and of Opportunity for Hearing; Philadelphia Stock Exchange, Inc.

June 1, 1988.

The above named national securities exchange has filed applications with the Securities and Exchange Commission pursuant to section 12(f)(1)(B) of the Securities Exchange Act of 1934 and Rule 12f-1 thereunder, for unlisted trading privileges in the following securities:

Ausimont N.V.,
Capital Stock, L2, 990 Par Value (File No. 7-3496).
New Plan Realty Trust,
Shares of Beneficial Interest, No Par Value (File No. 7-3497).
The New Hall Land and Farming Company,
Limited Partnership Units (File No. 7-3498).
National Convenience Stores, Inc.,
Common Stock, $0.41 ⅔ Par Value (File No. 7-3499).
Nevada Power Company,
Common Stock, $1.00 Par Value (File No. 7-3500).
The Monarch Machine Tool Company,
Common Stock, No Par Value (File No. 7-3501).
Morrison Knudsen Corporation,
Common Stock, $3.33 ⅓ Par Value (File No. 7-3502).
Motel 6, L.P.,
Depositary Units (File No. 7-3503).
Murray Ohio Manufacturing Company,
Common Stock, $2.50 Par Value (File No. 7-3504).

These securities are listed and registered on one or more other national securities exchange and are reported in the consolidated transaction reporting system.

Interested persons are invited to submit on or before June 21, 1988, written data, views and arguments concerning the above-referenced application. Persons desiring to make written comments should file three copies thereof with the Secretary of the Securities and Exchange Commission, 450 5th Street, NW., Washington, DC 20549. Following this opportunity for hearing, the Commission will approve the application if it finds, based upon all the information available to it, that the extensions of unlisted trading privileges pursuant to such applications are consistent with the maintenance of fair and orderly markets and the protection of investors.

For the Commision, by the Division of Market Regulation, pursuant to delegated authority.

Jonathan G. Katz,

Secretary.

[FR Doc. 88-12777 Filed 6-6-88; 8:45 am]

BILLING CODE 8010-01-M

Self-Regulatory Organizations; Applications for Unlisted Trading Privileges and of Opportunity for Hearing; Philadelphia Stock Exchange, Inc.

June 1, 1988.

The above named national securities exchange has filed applications with the Securities and Exchange Commission pursuant to section 12(f)(1)(B) of the Securities Exchange Act of 1934 and Rule 12f-1 thereunder, for unlisted trading privileges in the following securities:

Century Telephone Enterprises, Inc.,
Common Stock, $1.00 Par Value (File No. 7-3505).
Corroon & Black Corporation,
Common Stock, $0.12 Par Value (File No. 7-3506).
Interpublic Group of Companies, Inc.,
Common Stock, $0.10 Par Value (File No. 7-3507).
Iow Resources, Inc.,
Common Stock, No Par Value (File No. 7-3508).

These securities are listed and registered on one or more other national

securities exchange and are reported in the consolidated transaction reporting system.

Interested persons are invited to submit on or before June 21, 1988, written data, views and arguments concerning the above-referenced application. Persons desiring to make written comments should file three copies thereof with the Secretary of the Securities and Exchange Commission, 450 5th Street, NW., Washington, DC 20549. Following this opportunity for hearing, the Commission will approve the application if it finds, based upon all the information available to it, that the extensions of unlisted trading privileges pursuant to such applications are consistent with the maintenance of fair and orderly markets and the protection of investors.

For the Commission, by the Division of Market Regulation, pursuant to delegated authority.

Jonathan G. Katz,

Secretary.

[FR Doc. 88-12778 Filed 6-6-88; 8:45 am]

BILLING CODE 8010-01-M

[Rel. No. IC-16420; 812-6923]

The Enterprise Group of Funds, Inc. et al.; Application

June 1, 1988.

AGENCY: Securities and Exchange Commission ("SEC").

ACTION: Notice of Application for Exemption under the Investment Company Act of 1940 ("1940 Act").

Applicants: The Enterprise Group of Funds, Inc. ("Fund") together with Liquid Green Trust ("Trust") and Liquid Green Tax-Free Trust ("Tax-Free Trust") ("Affiliated Money Market Funds"), (the Fund Trust and Tax-Free Trust collectively referred to as "Applicants").

Relevant 1940 Act Sections: Exemptions requested pursuant to section 6(c) from the provisions of sections 2(a)(32), 2(a)(35), 22(c) and 22(d) and Rule 22c-1 thereunder, and pursuant to section 11(a) to approve certain exchange offers.

Summary of Application: Applicants seek an order (1) to permit the Fund's Growth Portfolio, Growth and Income Portfolio, Aggressive Growth Portfolio, International Growth Portfolio, GNMA Portfolio, Government Securities Portfolio, Corporate Bond Portfolio, High-Yield Bond Portfolio, Tax-Exempt Bond Portfolio, and Precious Metals Portfolio (the "Portfolios") (and all subsequently created series of the Fund) to assess a contingent deferred sales charge ("CDSC") on certain redemptions of their shares; (2) to permit the deferral of any applicable CDSC in connection with offers of exchange between and among the Fund's Portfolios (and all subsequently created series of the Fund) and the Affiliated Money Market Funds (and subsequently created Affiliated Money Market Funds); (3) to permit the Affiliated Money Market Funds to assess such CDSCs on behalf of the Portfolios on redemptions of shares of the Affiliated Money Market Funds which are issued in exchange for shares of the Portfolios; (4) to permit the Portfolios and the Affiliated Money Market Funds to waive the charge with respect to certain redemptions described herein; and (5) to permit offers of exchange among any of the Portfolios and any of the Affiliated Money Market Funds as described herein.

Filing Date: The application was filed on November 20, 1987 and amended and restated on May 23, 1988.

Hearing or Notification of Hearing: If no hearing is ordered, the application will be granted. Any interested person may request a hearing on this application or ask to be notified if a hearing is ordered. Any requests must be received by the SEC by 5:30 p.m. on June 21, 1987. Request a hearing in writing, giving the nature of your interest, the reason for the request, and the issues you contest. Serve the Applicants with the request, either personally or by mail, and also send a copy to the Secretary of the SEC, along with proof of service by affidavit, or, in the case of an attorney-at-law, by certificate. Request notification of the date of a hearing by writing to the Secretary of the SEC.

ADDRESSES: Secretary: SEC, 450 5th Street NW., Washington, DC 20549; Applicants: The Enterprise Group of Funds, Inc., Suite 102, 250 Piedmont Avenue NE., Atlanta, Georgia 30365; Liquid Green Trust and Liquid Green Tax-Free Trust, 429 North Pennsylvania Street, Indianapolis, Indiana 46204.

FOR FURTHER INFORMATION CONTACT: Regina Hamilton, Staff Attorney (202) 272-2856, or Karen L. Skidmore, Branch Chief (202) 272-3023 (Office of Investment Company Regulation).

SUPPLEMENTARY INFORMATION: Following is a summary of the application; the complete application is available for a fee from either the SEC's Public Reference Branch in person or the SEC's commercial copier: (800) 231-3282 (in Maryland (301) 258-4300).

Applicants' Representations

1. The Fund was incorporated in 1968 as Alpha Fund, Inc. Among other changes, under an Agreement and Plan of Merger, effected on September 15, 1987, the Fund's name was changed and the Fund was reincorporated as a Maryland, series corporation. The Fund is registered under the 1940 Act as an open-end, management, series investment company. Its shares are offered for sale to the public through broker-dealers pursuant to a distribution agreement with Enterprise Fund Distributors, Inc. ("Enterprise Distributors"), a wholly-owned subsidiary of The Mutual Life Insurance Company of New York ("MONY"), and the Fund's principal underwriter. The Fund's investment adviser is Enterprise Capital Management, Inc. ("Enterprise Capital"), also a MONY subsidiary. The Affiliated Money Market Funds are registered under the 1940 Act as open-end, diversified, management investment companies. Another MONY subsidiary, Unified Management Corporation ("UMC"), is their investment adviser. UMC is under common control with Enterprise Capital and Enterprise Distributors, and the Fund and the Affiliated Money Market Funds hold themselves out to investors as related companies for purposes of investment and investor services.

2. Applicants have requested that any order issued by the Commission on this application also extend (1) to all series of the Fund which may be organized in the future which issue and sell shares subject to the CDSC and exchange privilege on substantially the same basis as described in the application; and (2) to the Liquid Green Government Trust, a third money market Fund to be created in 1988 as an Affiliated Money Market fund, and any other subsequently created Affiliated Money Market Funds. The order sought applies only to Applicants and these future entities, and not to their predecessors, and is prospective in nature. Applicants will not rely on any such exemptive order as authority for any exchanges which occurred prior to the issuance of the order. The CDSC will apply only as to purchases made after the issuance of the order requested.

3. The Fund proposes to offer shares of ten series, the Fund's Portfolios, without the imposition of a front-end sales charge, and proposes to impose a CDSC upon redemption by investors of shares of these Portfolios and any shares of the Affiliated Money Market Funds for which they may have been exchanged, with certain exceptions noted below.

4. the CDSC will be imposed if a shareholder redeems an amount which does not represent Reinvestment Value,

as defined below, and which causes the current value of the shareholder's account to fall below the total dollar amount of that shareholder's purchases of shares of the Portfolios ("Purchase Payments") within the preceding five years.

5. The CDSC imposed upon redemption will not, in the aggregate, exceed 5% of the aggregate Purchase Payments made by the investor. No CDSC will be imposed upon redemption on amounts derived from: (i) appreciation in the net asset value of a shareholder's holdings ("Net Appreciation Value"), (ii) increases in the value of a shareholder's holdings representing reinvestment of dividend and capital gain distributions ("Reinvestment Value"), or (iii) net Purchase Payments applied to Fund shares more than five years prior to the redemption date ("Old Capital").

6. Applicants state that the amount of the CDSC, if any, will depend upon the year during which the shares being redeemed were purchased. The appropriate percentage will then be applied to the amount of the redemption subject to the sales load. In determining the rate of any CDSC, it will be assumed that a redemption is made of shares held by an investor for the longest period of time within the applicable five-year period. This will result in any such charge being imposed at the lowest possible rate. When the CDSC is imposed, the amount of the CDSC will be 5.0% if the redemption occurs during the same twelve-month period during which the shares being redeemed were purchased; 4.0% if the redemption occurs during the next prior twelve-month period; 3.0% if the redemption occurs during the third twelve-month period; 2.0% if the redemption occurs during the fourth twelve-month period; 1.0% if the redemption occurs during the fifth twelve-month period; and 0% if the redemption occurs during the sixth or subsequent years following the date of purchase.

7. Applicants also propose to waive the CDSC with respect to the following redemptions: (a) Redemptions effected pursuant to the Fund's Systematic Withdrawal Plan; (b) redemptions following the death or disability, as defined in Section 72(m)(7) of the Internal Revenue Code, of a shareholder; (c) redemptions of shares as to which the Distributor paid no commission to a selling broker (which can only be shares purchased by: (i) MONY and its subsidiaries; (ii) directors and employees of MONY and its subsidiaries; (iii) selling brokers, their employees, and their registered representatives; (iv) employees of the Portfolio Managers; (v) directors of the Fund; and (vi) spouses, minor children, and employee benefit plans of the foregoing for which the orders were placed by the employee or director); (d) involuntary redemptions of small accounts effected by directors of the Fund; (e) redemptions effected by an investment company registered under the Investment Company Act of 1940 in connection with the combination of the investment company with the Fund or any of its Portfolios by merger, acquisition of assets, or any other transaction. In addition, the Applicants propose that shareholders who reinvest in a Portfolio within 30 days of a redemption pursuant to a reinstatement privilege will receive a credit, upon notice to the Transfer Agent, against the amount of the CDSC, if any, paid upon the redemption. Applicants will meet all of the conditions set forth in Rule 22d–1 under the 1940 Act when allowing and administering any such waivers of, or credit against, the CDSC.

8. Each Portfolio finances its own distribution expenses pursuant to a plan adopted under Rule 12b–1 under the Act (the "Plan"). The Plan provides that each of the Portfolios will accrue daily and pay monthly to Enterprise Distributors a distribution fee equal on an annual basis to 1.25% of that Portfolio's average daily net assets. Enterprise Distributors will also receive the proceeds of all unwaived CDSCs imposed on redemptions. The Fund's Board of Directors has approved the Plan in accordance with Rule 12b–1 and determined that the Plan and use of fees collected pursuant to the Plan comply with Rule 12B–1. In its periodic review of the Plan pursuant to Rule 12b–1, the Board will consider, among other things, the use by Enterprise Distributors of revenues raised by the CDSC.

9. Both Affiliated Money Market Funds have distribution plans adopted under Rule 12b–1 and have distribution agreements with UMC. Under the distribution agreement between the Trust and UMC, the Trust pays no fee to UMC other than its investment advisory fee. Under the distribution agreement between the Tax-Free Trust and UMC, the Tax-Free Trust pays UMC an annual distribution fee, payable monthly, of .25% of the average daily net asset value of the Tax-Free Trust to $500 million, .20% of the next $1 billion, and 0.15% in excess of $1.5 billion. The board of directors of each Affiliated Money Market Fund has approved its distribution plan in accordance with Rule 12b–1, and such plans and the use of fees collected pursuant to those plans comply with Rule 12b–1.

10. The Applicants currently offer exchange privileges and will defer the CDSC in those circumstances where Portfolio shares are exchanged for those of any other Portfolio, Portfolio shares are exchanged for shares of an Affiliated Money Market Fund, and Affiliated Money Market Fund shares acquired by an exchange from a Portfolio are exchanged for other Affiliated Money Market Fund shares or Portfolio shares, all exchanges being at the respective net asset values of the shares.

11. When a Fund shareholder exchanges his investment from one Portfolio into another, the shareholder will be subject to a CDSC upon the ultimate redemption for cash of the Fund shares unless he qualifies for a waiver of the CDSC based upon the sum of the time periods in which he was invested in each Portfolio. The Affiliated Money Market Funds will assess, collect and transfer to Enterprise Distributors the appropriate CDSC on redemptions of Affiliated Money Market Fund investments acquired in an exchange from the Fund. In the case when a Fund shareholder exchanges shares of a Portfolio into one of the Affiliated Money Market Funds (and subsequently into another Affiliated Money Market Fund), the period of time during which the shareholder holds such Affiliated Money Market Fund shares will not be included for purposes of calculating the Fund's CDSC (*i.e.*, the CDSC period will be tolled). If the directors of either Affiliated Money Market Fund intend to increase the 12b–1 fee above .25%, Applicants will notify the staff of the Division of Investment Management of the SEC, and, if the staff believes that such increase raises any question as to whether the CDSC should be "tolled" during the period an investment is made in the Affiliated Money Market Fund, Applicants will seek and secure an exemptive order prior to instituting any such increase to continue to permit such tolling. In the event that an investor makes a direct investment in an Affiliated Money Market Fund, regardless of whether or not that investor holds Affiliated Money Market Fund shares obtained in an exchange from a Portfolio, the conversion into Portfolio shares of the Affiliated Money Market Fund shares obtained through such a direct investment may not be accomplished through an exchange but rather must be accomplished through a redemption from the Affiliated Money Market Fund as a new direct investment in a Portfolio.

12. If a shareholder transfers his shares to another individual or entity, no CDSC will be assessed upon the transfer. However, if the receiving shareholder subsequently redeems the transferred shares, he will be subject to the CDSC, which will be calculated as if the receiving shareholder had acquired the transferred shares in the same manner and at the same time as the transferring shareholder. The Applicants undertake that they will not encourage or promote any transfer of Fund or Affiliated Money Market Fund shares, and recordation of such a transfer on the books of the Fund or Affiliated Money Market Fund will not be deemed to constitute the encouragement or promotion of any such transfer.

13. While dealers will be notified of the availability of the exchange privilege, dealers or other persons involved in the distribution of shares of the Fund and the Affiliated Money Market Funds will not receive advice from Enterprise Distributors or UMC as to the suitability of an investment in a Portfolio or an Affiliated Money Market Fund; will not actively solicit exchanges; and will not contact investors by telephone to notify them of the exchange privilege. In addition, Enterprise Distributors has established adequate internal monitoring and review procedures to ensure that such exchanges are made at the request of investors rather than for the dealers' personal gain. Moreover, Enterprise Distributors requires by the terms of its dealer agreement that a participating dealer make its books and records available to Enterprise Distributors and further agrees to comply with all applicable federal and state laws and rules, as well as the rules and regulations of all agencies having jurisdiction.

14. A nominal service fee of $5.00 per exchange will be levied on all such exchanges. Applicants reserve the right not to allow the exercise of the exchange privilege in less than two-week intervals. Applicants further reserve the right to discontinue or modify the exchange privilege on a prospective basis at any time, including a modification of the amount or terms of the service fee, upon 60 days' written notice mailed to shareholders at their address of record. With respect to any such modification other than a termination of the exchange privilege or a reduction of the service fee, the Applicants will apply for an exemptive order to amend any order issued pursuant to their current request. All reserved rights to discontinue or modify the exchange privilege will be disclosed in the Fund's prospectus and any other sales literature or advertising referring to the exchange privileges.

15. Applicants have undertaken to file an amendment during the notice period to clarify that various representations regarding the exemptive relief requested have been agreed to by Applicants as conditions to securing such relief, and to elucidate other matters.

Applicants' Legal Conclusions

1. The Applicants submit that the requested exemption under Section 6(c) and the approval under Section 11(a) are appropriate and in the public interest and consistent with the protection of investors and the purposes fairly intended by the policy and provisions of the 1940 Act.

2. The contingent deferred sales charge is fair, equitable and in the best interests of Fund shareholders because they will have the advantage of greater investment dollars working for them from the time of their purchase of the Fund's shares than with the traditional front-end sales charge. With respect to the proposed waivers of the contingent deferred sales charge for certain classes of Fund shares, any such waivers will comply witht the requirements of Rule 22d–1 of the 1940 Act which permits scheduled variations in, or elimination of, front-end sales loads.

3. The proposed exchange privileges enable shareholders of the Fund and the Affiliated Money Market Funds to exchange their shares at relative net asset value and provide a high degree of flexibility in the shareholder's financial planning. In the absence of such relief permitting deferral of the contingent deferred sales charge, a Fund shareholder who sought to shift his investment into an Affiliated Money Market Fund would generally be required to pay the contingent deferred sales charge at the time of such exchange. This would mean that the amount invested upon the exchange would be less than the net asset value of the investor's shares immediately prior to the exchange.

4. The tolling of the contingent deferred sales charge period while an investment is made in an Affiliated Money Market Fund is necessary and appropriate in the public interest and consistent with the protection of investors because (a) redemptions of Affiliated Money Market Fund shares (other than those acquired by exchange from the Fund) are not subject to a contingent deferred sales charge, (b) the Affiliated Money Market Funds are subject to a minimal distribution related fee (*i.e.*, a maximum of .25%) which is far less than those paid by the Portfolios (*i.e.*, 1.25%) and is not passed along to the Enterprise Distributor, and (c) the amounts exchanged from the Fund to the Affiliated Money Market Funds are not included in the assets of any Portfolio of the Fund for the purposes of determining the amount payable by the Portfolio under the Fund's 12b–1 Plan.

Applicants' Conditions

If the requested order is granted, the Applicants agree to the following conditions:

1. Applicants will comply Rule 12b–1 under the 1940 Act now in effect and as it may be revised in the future.

2. The Applicants will comply with the provisions of Rule 22d–1 under the 1940 Act.

3. Applicants will comply with the provisions of Rule 11a–3 under the 1940 Act as it is proposed, as it may be adopted, and as it may be revised in the future, except that the Fund and the Affiliated Money Market Funds will not be served by exactly the same investment adviser and/or principal underwriter.

For the Commission, by the Division of Investment Management, pursuant to delegated authority.

Jonathan G. Katz,

Secretary.

[FR Doc. 88–12805 Filed 6–6–88; 8:45 am]

BILLING CODE 8010–01–M

[Rel. No. IC–16417; 811–4999]

Federated Short-Intermediate Corporate Trust; Application

June 1, 1988.

AGENCY: Securities and Exchange Commission ("SEC").

ACTION: Notice of application for deregistration under the Investment Company Act of 1940 (the "1940 Act").

Applicant: Federated Short-Intermediate Corporate Trust.

Relevant 1940 Act Section: Section 8(f) and Rule 8f–1 therefore.

Summary of Application: Applicant seeks an order declaring that it has ceased to be an investment company.

Filing Date: The application on Form N–8F was filed on March 10, 1988, and a letter to correct a typographical error was filed on May 31, 1988.

Hearing or Notification of Hearing: If no hearing is ordered, the application will be granted. Any interested person may request a hearing on this

application, or ask to be notified if a hearing is ordered. Any requests must be received by the SEC by 5:30 p.m., on June 27, 1988. Request a hearing in writing, giving the nature of your interest, the reason for the request, and the issues you contest. Serve the Applicant with the request, either personally or by mail, and also send it to the Secretary of the SEC, along with proof of service by affidavit or, for lawyers, by certificate. Request notification of the date of a hearing by writing to the Secretary of the SEC.

ADDRESSES: Secretary, SEC, 450 Fifth Street NW., Washington, DC 20549. Applicant, Federated Investors Tower, Pittsburgh, PA. 15222.

FOR FURTHER INFORMATION CONTACT: Paul J. Heaney, Financial Analyst (202) 272–3047 or Brion R. Thompson, Special Counsel (202) 272–3016 (Division of Investment Management).

SUPPLEMENTARY INFORMATION: Following is a summary of the application; the complete application on Form N–8F is available for a fee from either the SEC's Public Reference Branch in person or the SEC's commercial copier who may be contacted at (800) 231–3282 (in Maryland (301) 258–4300).

Applicant's Representations

1. On January 21, 1987, Applicant filed Form N–8A to register under the 1940 Act as an open-end, diversified management investment company. On January 28, 1987, Applicant filed Form N–1A pursuant to the Securities Act of 1933 to register an indefinite number of shares of beneficial interest at no par value. This registration statement became effective on April 10, 1987. Applicant never made a public offering of its securities and is not a party to any litigation or administrative proceeding. Applicant does not have any assets or liabilities. Applicant has no shareholders and is not now engaged, nor does it propose to engage, in any business activities other than those necessary for the winding-up of its affairs.

2. On March 4, 1988, Applicant was dissolved, pursuant to its Declaration of Trust and applicable law of the State of Massachusetts.

For the SEC, by the Division of Investment Management, under delegated authority.

Jonathan G. Katz,

Secretary.

[FR Doc. 88–12806 Filed 6–6–88; 8:45 am]

BILLING CODE 8010–01–M

SMALL BUSINESS ADMINISTRATION

[Declaration of Disaster Loan Area #2315]

Kentucky; Declaration of Disaster Loan Area

Bell County in the State of Kentucky constitutes a disaster area because of damages from a devastating tornado, severe storms and high winds which occurred on May 9, 1988. Applications for loans for physical damage may be filed until the close of business on August 1, 1988, and for economic injury until the close of business on March 1, 1989, at the address listed below:

Diaster Area 2 Office, Small Business Administration, 120 Ralph McGill Blvd., 14th Floor, Atlanta, Georgia 30308,

or other locally announced locations. The interest rates are:

Homeowners With Credit Available Elsewhere—8.000%
Homeowners Without Credit Available Elsewhere—4.000%
Businesses With Credit Available Elsewhere—8.000%
Businesses Without Credit Available Elsewhere—4.000%
Businesses (EIDL) Without Credit Available Elsewhere—4.000%
Other (Non-Profit Organizations Including Charitable and Religious Organizations)—9.000%

The number assigned to this disaster is 231512 for physical damage and for economic injury the number is 662400.

(Catalog of Federal Domestic Assistance Programs Nos. 59002 and 59008)

Date: June 1, 1988.

James Abdnor,

Administrator.

[FR Doc. 88–12792 Filed 6–6–88; 8:45 am]

BILLING CODE 8025–01–M

Region VII Advisory Council; Public Meeting; Missouri

The U.S. Small Business Administration, Region VII Advisory Council, located in the geographical area of Kansas City, will hold a public meeting from 9:00 a.m. to 12:00 noon, on Thursday, June 30, 1988, at the Federal Reserve Bank, 925 Grand Avenue, Visitor's Center Assembly Room, Kansas City, Missouri, to discuss such matters as may be presented by members, staff of the U.S. Small Business Administration, or others present.

For further information, write or call John Scott, Deputy District Director, U.S. Small Business Administration, Professional Building, 1103 Grand Avenue, Kansas City, Missouri 64106, (816) 374–5557.

Jean M. Nowak,

Director, Office of Advisory Councils.

June 1, 1988.

[FR Doc. 88–12793 Filed 6–6–88; 8:45 am]

BILLING CODE 8025–01–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[Summary Notice No. PE–88–19]

Petition for Exemption; Summary of Petitions Received; Dispositions of Petitions Issued

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of petitions for exemption received and of dispositions of prior petitions.

SUMMARY: Pursuant to FAA's rulemaking provisions governing the application, processing, and disposition of petitions for exemption (14 CFR Part 11), this notice contains a summary of certain petitions seeking relief from specified requirements of the Federal Aviation Regulations (14 CFR Chapter I), dispositions of certain petitions previously received, and corrections. The purpose of this notice is to improve the public's awareness of, and participation in, this aspect of FAA's regulatory activities. Neither publication of this notice nor the inclusion or omission of information in the summary is intended to affect the legal status of any petition or its final disposition.

DATE: Comments on petitions received must identify the petition docket number involved and must be received on or before June 27, 1988.

ADDRESS: Send comments on any petition in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attn: Rules Docket (AGC–10), Petition Docket No. _____, 800 Independence Avenue SW., Washington, DC 20591.

FOR FURTHER INFORMATION CONTACT: The petition, any comments received, and a copy of any final disposition are filed in the assigned regulatory docket and are available for examination in the Rules Docket (AGC–10), Room 915G, FAA Headquarters Building (FOB 10A), 800 Independence Avenue SW., Washington, DC 20591; telephone (202) 267–3132.

This notice is published pursuant to paragraphs (c), (e), and (g) of § 11.27 of Part 11 of the Federal Aviation Regulations (14 CFR Part 11).

Issued in Washington, DC, on May 26, 1988.

Denise D. Hall,

Manager, Program Management staff.

PETITIONS FOR EXEMPTION

Docket No.	Petitioner	Regulations affected	Description of relief sought
25254	Omniflight Helicopters, Inc	14 CFR 43.3(h)	To allow petitioner's pilots to replace medical oxygen cylinders on petitioner's helicopters after such cylinders have been depleted.
25554	Stoddard-Hamilton Aircraft, Inc	14 CFR 21.191	To allow petitioner to operate under the limitations for amateur-built aircraft with the following exclusion: Only FAA-certificated mechanics holding an airframe and powerplant rating, or appropriately rated repair stations, may perform condition inspections in accordance with Appendix D of Part 43.
25581	Bannock Regional Medical Center	14 CFR 135.271(g)	To allow certain crewmembers to be assigned to conduct training, public relations, and routine transportation missions while on a Hospital Emergency Medical Evacuation Service (HEMES) mission.

PETITIONS FOR EXEMPTION

Docket No.	Petitioner	Regulations affected	Description of relief sought; disposition
24441	Northern Pacific Transport, Inc	14 CFR 91.31(a)	To extend and amend Exemption No. 4666, as amended, that allows petitioner to operate certain DC-6 airplanes at 5 percent increased zero fuel and landing weights subject to certain conditions and limitations. Grant, May 16, 1988, Exemption No. 4666B.
25528	Ketchum Air Service Inc	14 CFR 43.3(g)	To allow pilots employed by petitioner to perform the preventive maintenance functions of removing and/or replacing the passenger seats of aircraft used under Part 135. Grant, May 19, 1988, Exemption No. 4932.

[FR Doc. 12725 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

Organization, Functions, and Authority Delegations: Manhattan, KS

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Flight service station closure—Manhattan, Kansas.

SUMMARY: Notice is hereby given that on July 2, 1988, the Flight Service Station at Manhattan, Kansas, will be closed. Thereafter services to the general public will be provided by the Flight Service Station at Wichita, Kansas. This information will be reflected in the next issue of the FAA Organizational Statement.

(Sec. 313(a), 72 Stat. 752; 49 U.S.C. 1354)

Issued in Kansas City, Missouri, on May 24, 1988.

Paul E. Marchbanks,

Acting Manager, Air Traffic Division.

[FR Doc. 88-12721 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

Organization, Functions, and Authority Delegations: Russell, KS

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Flight service station closure—Russell, Kansas.

SUMMARY: Notice is hereby given that on July 2, 1988, the Flight Service Station at Russell, Kansas, will be closed. Thereafter services to the general public will be provided by the Flight Service Station at Wichita, Kansas. This information will be reflected in the next issue of the FAA Organizational Statement.

(Sec. 313(a), 72 Stat. 752; 49 U.S.C. 1354)

Issued in Kansas City, Missouri, on May 24, 1988.

Paul E. Marchbanks,

Acting Manager, Air Traffic Division.

[FR Doc. 88-12722 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

VETERANS ADMINISTRATION

Agency Form Under OMB Review

AGENCY: Veterans Administration.

ACTION: Notice.

The Veterans Administration has submitted to OMB for review the following proposal for the collection of information under the provisions of the Paperwork Reduction Act (44 U.S.C. chapter 35). This document lists the following information: (1) The department or staff office issuing the form, (2) the title of the form, (3) the agency form number, if applicable, (4) a description of the need and its use, (5) how often the form must be filled out, (6) who will be required or asked to report, (7) an estimate of the number of responses, (8) an estimate of the total number of hours needed to fill out the form, and (9) an indication of whether section 3504(h) of Pub. L. 96-511 applies.

ADDRESSES: Copies of the forms and supporting documents may be obtained from John Turner, Department of Veterans Benefits (203C), Veterans Administration, 810 Vermont Avenue NW., Washington, DC 20420 (202) 233-2744.

Comments and questions about the items on the list should be directed to the VA's OMB Desk Officer, Joseph Lackey, Office of Management and Budget, 726 Jackson Place NW., Washington, DC 20503, (202) 395-7316.

DATE: Comments on the information collection should be directed to the OMB Desk Officer on or before July 7, 1988.

Dated: June 1, 1988.

By direction of the Administrator.

Frank E. Lalley,

Director, Office of Information Management and Statistics.

Extension

1. Department of Veterans Benefits.
2. Interest Rate Reduction Refinancing Loan Worksheet.
3. VA Form 26–8923.
4. This form is used by lenders for completing the funding fee and maximum permissible loan amounts for interest rate reduction refinancing loans to veterans.
5. On occasion.
6. Businesses or other for-profit.
7. 35,000 responses.
8. 5,833 hours.
9. Not applicable.

[FR Doc. 88–12737 Filed 6–6–88; 8:45 am]
BILLING CODE 8320–01–M

Agency Form Under OMB Review

AGENCY: Veterans Administration.

ACTION: Notice.

The Veterans Administration has submitted to OMB for review the following proposal for the collection of information under the provisions of the Paperwork Reduction Act (44 U.S.C. Chapter 35). This document lists the following information: (1) The department or staff office issuing the form, (2) the title of the form, (3) the agency form number, if applicable, (4) a description of the need and its use, (5) how often the form must be filled out, (6) who will be required or asked to report, (7) an estimate of the number of responses, (8) an estimate of the total number of hours needed to fill out the form, and (9) an indication of whether section 3504(h) of Pub. L. 96–511 applies.

ADDRESSES: Copies of the forms and supporting documents may be obained from John Turner, Department of Veterans Benefits (203C), Veterans Administration, 810 Vermont Avenue NW., Washington, DC 20420 (202) 233–2744.

Comments and questions about the items on the list should be directed to the VA's OMB Desk Officer, Joseph Lackey, Office of Management and Budget, 726 Jackson Place NW., Washington, DC 20503, (202) 395–7316.

DATES: Comments on the information collection should be directed to the OMB Desk Officer on or before July 7, 1988.

Dated: May 31, 1988.

By direction of the Administrator.

Frank E. Lalley,

Director, Office of Information Management and Statistics.

Extension

1. Department of Veterans Benefits.
2. Application for Change of Permanent Plan (Nonmedical).
3. VA Form 29–1550.
4. This form is used by insured's to apply for the change of one permanent plan policy to one having a higher reserve value.
5. On occasion.
6. Individuals or households.
7. 468 responses.
8. 156 hours.
9. Not applicable.

[FR Doc. 88–12738 Filed 6–6–88; 8:45 am]
BILLING CODE 8320–01–M

Sunshine Act Meetings

Federal Register
Vol. 53, No. 109
Tuesday, June 7, 1988

This section of the FEDERAL REGISTER contains notices of meetings published under the "Government in the Sunshine Act" (Pub. L. 94-409) 5 U.S.C. 552b(e)(3).

EQUAL EMPLOYMENT OPPORTUNITY COMMISSION

"FEDERAL REGISTER" CITATION OF PREVIOUS ANNOUNCEMENT: 53 FR 20213, Thursday, June 2, 1988.

PREVIOUSLY ANNOUNCED TIME AND DATE OF MEETING: 2:00 p.m. (eastern time) Tuesday, June 7, 1988.

CHANGE IN THE MEETING: An item has been added to the agenda under the Open Session: Request for Approval of a Non-Competitive Requirement for Herman Miller's Vaughan Wall Demountable Wall Systems.

CONTACT PERSON FOR MORE INFORMATION: Hilda D. Rodriquez, Executive Officer (Acting), Executive Secretariat, (202) 634–6748.

Date: June 1, 1988.

Susan Daniel,

Acting Executive Officer Executive Secretariat.

[FR Doc. 88–12898 Filed 6–3–88; 4:03 pm]

BILLING CODE 6750-06-M

EQUAL EMPLOYMENT OPPORTUNITY COMMISSION

DATE AND TIME: 2:00 p.m. (eastern time) Monday, June 13, 1988.

PLACE: Clarence M. Mitchell, Jr., Conference Room, No. 200–C on the Second Floor of the Columbia Plaza Office Building, 2401 "E" Street, NW., Washington, DC 20507.

STATUS: Part of the Meeting will be Open to the Public and Part will be Closed to the Public.

MATTERS TO BE CONSIDERED:

Open Session

1. Announcement of Notation Vote(s)
2. A Report on Commission Operations (Optional)

Closed Session

Litigation Authorization: General Counsel Recommendation

Note.—Any matter not discussed or concluded may be carried over to a later meeting. (In addition to publishing notices on the EEOC Commission meetings in the Federal Register, the Commission also provides a recorded announcement a full week in advance on future Commission sessions. Please telephone (202) 634–6748 at all times for information on these meetings.)

CONTACT PERSON FOR MORE INFORMATION: Hilda D. Rodriguez, Executive Officer (Acting) on (202) 634–6748.

Date: June 2, 1988.

Susan Daniel,

Acting Executive Officer, Executive Secretariat.

[FR Doc. 88–12899 Filed 6–3–88; 4:03 pm]

BILLING CODE 6750-06-M

NUCLEAR REGULATORY COMMISSION

DATE: Weeks of June 6, 13, 20, and 27, 1988.

PLACE: Commissioners' Conference Room, 11555 Rockville Pike, Rockville, Maryland.

STATUS: Open and Closed.

MATTERS TO BE CONSIDERED:

Week of June 6

Thursday, June 9

10:00 a.m.
Briefing on Status of Pilgrim (Public Meeting)
11:30 a.m.
Affirmation/Discussion and Vote (Public Meeting)

Week of June 13—Tentative

Thursday, June 16

2:00 p.m.
Briefing on Advanced Light Water Reactors by EPRI (Public Meeting)
3:30 p.m.
Affirmation/Discussion and Vote (Public Meeting) (if needed)

Week of June 20—Tentative

Monday, June 20

1:00 p.m.
Discussion of Management-Organization and Internal Personnel Matters (Closed—Ex. 4)
2:30 p.m.
Briefing on Technical Specification Revisions (Public Meeting)

Tuesday, June 21

2:00 p.m.
Briefing on Proposed Rule on Fitness for Duty (Public Meeting)

Friday, June 24

11:00 a.m.
Affirmation/Discussion and Vote (Public Meeting) (if needed)

Week of June 27—Tentative

Monday, June 27

10:00 a.m.
Briefing on Proposed Rule on Early Site Permits; Standard Design Certification; and Combined Licenses for Nuclear Power Reactors (Public Meeting)

Wednesday, June 29

10:00 a.m.
Initial Briefing by the Advisory Committee on Nuclear Waste (Public Meeting)
11:30 a.m.
Affirmation/Discussion and Vote (Public Meeting) (if needed)

ADDITIONAL INFORMATION: Briefing on Master Plan for Integrating All Severe Accident Issues (Public Meeting) was held on June 2.

Note.—Affirmation sessions are initially scheduled and announced to the public on a time-reserved basis. Supplementary notice is provided in accordance with the Sunshine Act as specific items are identified and added to the meeting agenda. If there is no specific subject listed for affirmation, this means that no item has as yet been identified as requiring any Commission vote on this date.

TO VERIFY THE STATUS OF MEETINGS CALL (RECORDING): (301) 492–0292.

CONTACT PERSON FOR MORE INFORMATION: William Hill (301) 492–1661.

William M. Hill, Jr.,

Office of the Secretary.

June 2, 1988.

[FR Doc. 88–12900 Filed 6–3–88; 4:02 pm]

BILLING CODE 7590-01-M

SECURITIES AND EXCHANGE COMMISSION

"FEDERAL REGISTER" CITATION OF PREVIOUS ANNOUNCEMENT: (53 FR 19367 May 27, 1988).

STATUS: Closed meeting.

PLACE: 450 5th Street, NW., Washington, DC.

DATE PREVIOUSLY ANNOUNCED: Tuesday, May 24, 1988.

CHANGES IN THE MEETING: Cancellation.

The closed meeting to be held on Wednesday, June 1, 1988, after the 10:00 a.m. open meeting has been cancelled.

Commissioner Peters, as duty officer, determined that Commission business required the above change.

At times changes in Commission priorities require alterations in the scheduling of meeting items. For further information and to ascertain what, if any, matters have been added, deleted

or postponed, please contact: Kevin Fogarty at (202) 272–3195.

Jonathan G. Katz,

Secretary.

June 1, 1988.

[FR Doc. 88–12906 Filed 6–3–88; 4:03 pm]

BILLING CODE 8010–01–M

TENNESSEE VALLEY AUTHORITY

(Meeting No. 1403)

TIME AND DATE: 10 a.m. (E.D.T.), June 8, 1988.

PLACE: A.C. Reynolds High School Auditorium, Reynolds School Road, Asheville, North Carolina.

STATUS: Open.

Agenda

Approval of minutes of meeting held on May 18, 1988.

Action Items

A—Budget and Financing

A1. Modification of the Capital Budget Financed from Power Proceeds and Borrowings for Fiscal Year 1988—Rehabilitation of Precast Concrete Floor Slabs at all Fossil Plants.

B—Purchase Awards

B1. Invitation SA–17354A—Indefinite Quantity Term Agreement for Paper to be used by Office Support Services Branch in Chattanooga, Knoxville, and Muscle Shoals.

B2. Invitation HE–38057B—Instrument and Control Systms for Allen and John Sevier Fossil Plants.

B3. Negotiation GL–06298A—Dry Fly Ash Collection Facility for Colbert Fossil Plant.

C—Power Items

C1. Renewal Power Contract with Knoxville, Tennessee.

D—Personnel Items

*D1. Proposed Increase in Expenditures Under Personal Services Contract with Bishop, Cook, Purcell & Reynolds.

E—Real Property Transactions

E1. Grant of Permanent Easement for a Road Right of Way Affecting Approximately 3.3 Acres of Tims Ford Reservoir Land Located in Franklin County, Tennessee; and Modification of a Deed to a 33-Acre Track of Tims Ford Reservoir Land to Permit Subdivision and Use for Residential Development.

F—Unclassified

F1. Modification of Interagency Agreement Between TVA and the Department of Energy Providing for the Continuation of TVA's Assistance in the Disposal of Residual Materials from Vicinity Properties in Edgemont, South Dakota.

F2. Supplement to Contract No. TV–72077A with U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, Providing for Conduct of Exposure Experiments at Whitetop Mountain to Determine Cause of Red Spruce Decline in High Elevation of Southern Appalachians.

F3. Memorandum of Agreement No. TV–74203A with U.S. Geological Survey (USGS), Department of the Interior, Covering Arrangements for the Coordination of Mapping Activities Within the Tennessee Valley Region and Cooperative Mapping Projects with the USGS.

F4. Supplements to Memorandum of Understanding (TV–71249A) Between TVA and Directorate of Engineering and Housing for TVA Support to the U.S. Army Forces Command, in Connection with Energy Resources Management.

F5. Supplement to Interagency Agreement No. TV–61655A with the U.S. Department of Energy Covering Arrangements for a Southeastern Regional Biomass Energy Program.

*F6. Proposed Changes to the Rules and Regulations of the Retirement System.

*Items approved by individual Board members. This would give formal ratification to the Board's action.

CONTACT PERSON FOR MORE INFORMATION: Alan Carmichael, Director of Information, or a member of his staff can respond to requests for information about this meeting. Call (615) 632–8000, Knoxville, Tennessee. Information is also available at TVA's Washington Office (202) 245–0101.

Dated: June 1, 1988.

W.F. Willis,

General Manager.

[FR Doc. 88–12873 Filed 6–3–88; 1:17 pm]

BILLING CODE 8120–01–M

Corrections

Federal Register
Vol. 53, No. 109
Tuesday, June 7, 1988

This section of the FEDERAL REGISTER contains editorial corrections of previously published Presidential, Rule, Proposed Rule, and Notice documents and volumes of the Code of Federal Regulations. These corrections are prepared by the Office of the Federal Register. Agency prepared corrections are issued as signed documents and appear in the appropriate document categories elsewhere in the issue.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

21 CFR Parts 184 and 186

[Docket No. 79N-0269]

Iron and Iron Salts; Affirmation of GRAS Status as Direct and Indirect Human Food Ingredients

Correction

In rule document 88-10582 beginning on page 16862 in the issue of Thursday, May 12, 1988, make the following corrections:

S 184.1304 [Corrected]

1. On page 16865, in the second column, in S 184.1304(a), in the second line, "H_{20}" should read "H_2O".

2. In the same column, in S 184.1304(d), in the last line, "waived" was misspelled.

S 184.1308 [Corrected]

3. On page 16866, in the second column, in S 184.1308(b), in the ninth line, "1200" should read "1100".

S 186.1300 [Corrected]

4. On page 16867, in the second column, in S 186.1300(b)(2), in the first line, "as" should read "at".

S 186.1374 [Corrected]

5. On the same page, in the second column, in S 168.1374(b)(2), in the first line, "as" should read "at".

BILLING CODE 1505-01-D

NUCLEAR REGULATORY COMMISSION

[Docket No. 50-249]

Commonwealth Edison Co.; Environmental Assessment and Finding of No Significant Impact

Correction

In notice document 88-11463 beginning on page 18361 in the issue of Monday, May 23, 1988, make the following corrections:

1. On page 18362, in the second column, in the first complete paragraph, in the 13th line, after "will" insert "not".

2. On the same page, in the same column, in the fourth complete paragraph, in the second line, "Mary" should read "March".

BILLING CODE 1505-01-D

Federal Register

Tuesday
June 7, 1988

Part II

Department of Labor

Occupational Safety and Health Administration

29 CFR Part 1910
Air Contaminants; Proposed Rule

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Part 1910

[Docket No. H-020]

Air Contaminants

AGENCY: Occupational Safety and Health Administration (OSHA), Department of Labor.

ACTION: Proposed rule.

SUMMARY: The Occupational Safety and Health Administration (OSHA) proposes to amend its existing air contaminant standards § 1910.1000, Tables Z-1, Z-2, Z-3, and add a new Table Z-4. The amendments reduce permissible exposure limits for approximately 100 substances now listed in the "Z-tables," raise the permissible exposure limit for 1 substance, set permissible exposure limits for 205 substances currently not regulated by OSHA, add or change STEL's for 70 substances, and, as appropriate, set skin, short-term or ceiling limits.

OSHA has reviewed health evidence for all these substances and has determined that the new limits substantially reduce a risk of deleterious health effects among American workers, including cancers, central and peripheral neuropathies, lung disease, liver and kidney damage and other systemic effects. The health evidence forms a reasonable basis for proposing revisions to these levels. In the final rule, after review of all the evidence in the record OSHA will establish new levels which it determines will substantially reduce significant risks.

It has also preliminary concluded, based on a review of many data bases and an extensive survey, that the new limits are feasible. To assist in its analysis, OSHA has utilized the National Institute for Occupational Safety and Health-Recommended Exposure Limits (NIOSH-REL's) and the American Conference of Governmental Industrial Hygienists-Threshold Limit Values (ACGIH-TLV) published in 1987-88, as the starting points in its review.

OSHA will continue its practice of rulemaking for individual substances when regulations of that type are necessary and appropriate.

DATES: Written comments on the proposed standard must be postmarked on or before July 8, 1988. Notices of Intention to appear at the informal rulemaking hearings on the proposed standard must be postmarked on or before July 1, 1988. Individuals who wish to comment or appear during the public hearings must see Section VIII of this document for specific requirements.

Parties who request more than 10 minutes for their presentations at the informal public hearing and parties who will submit documentary evidence at the hearing must submit the full text of their testimony and all documentary evidence, postmakred on or before July 8, 1988. The informal rulemaking hearing is scheduled to begin on July 20, 1988.

ADDRESSES: Written comments should be submitted to the Docket Officer, Docket No. H-020, Room N-3670, U.S. Department of Labor 200 Constitution Avenue NW., Washington, DC, 20210, telephone (202) 523-7894.

Notice of intention to appear, testimony and documentary evidence to be submitted at the hearing are to be sent to Mr. Tom Hall, OSHA Division of Consumer Affairs, Docket No. H-020, Room N-3647, U.S. Department of Labor, 200 Constitution Avenue NW, Washington, DC 20210, telephone (202) 523-8615.

The hearing will be held in Washington, DC, in the Auditorium, Frances Perkins Department of Labor Building, Third and Constitution Avenue NW. The informal public hearing will begin at 9:30 a.m.

FOR FURTHER INFORMATION CONTACT: Mr. James F. Foster, Director, Office of Information and Consumer Affairs, OSHA, U.S. Department of Labor, Room N-3649, 200 Constitution Avenue NW., Washington, DC 20210, Telephone (202) 523-8151.

SUPPLEMENTARY INFORMATION:

Organization of this Document

This **Federal Register** notice discusses policy and legal issues, and includes the proposed amendments to 29 CFR 1910.1000 Tables Z-1, Z-2, and Z-3, and the proposed new Table Z-4. It includes a discussion of the generic health effects for 15 individual groupings (e.g., neuropathic, ocular, cardiovascular, etc.) as well as a review of the health effects for all of the individual substances. It also includes a summary of the preliminary regulatory analysis with feasibility determinations organized by industry sector.

The Docket (H-020) includes considerable additional data, including many health studies, the complete preliminary regulatory and feasibility analysis with appendices and additional feasibility information. This includes the final results of a large scale industry survey. Also included are several computerized data tapes and a master tape summarizing the available information. A four-volume printed version of this information, organized by substance, is also in the Docket. All this information is available for inspection and copying at the Docket Office. Copies will be available at the cost of reproduction.

OSHA is continuing to gather additional individual substance information. This includes health effects and feasibility information. A number of site visits reports will be placed in the docket.

The discussion is organized in the following manner:

I. Background

A. Questions Solicited for NPRM

OSHA requests comments on all issues raised by this proposal including health effects, feasibility, risk and policy issues. The following are some specific questions which may assist commenters in their review.

1. Are substances included which should be excluded from this rulemaking?

2. Is additional health and feasibility documentation available relative to the proposed PEL's, beyond that described in the preamble?

3. Are substances included in this rulemaking used in industries other than those described in the preamble?

4. Are substances included in this rulemaking used for purposes other than those described in the preamble?

5. Do alternative unpublished exposure guidelines exist, such as those used in private workplaces, which may be suitable for general usage?

6. Is there information regarding laboratory analytical procedures which may be used in lieu of those suggested by OSHA (See Appendix A) to determine exposure to air contaminants?

7. Are the proposed exposure limits for each substance appropriate?

8. Is additional information available for those substances for which ACGIH proposed a higher TLV which might affect OSHA's decision that such a change was not justified?

9. Should the implementation dates for some substances be delayed because of sampling/analytical limitations or short term feasibility impact considerations?

10. Is there additional information relative to the OSHA plans to adopt some recommended 10 hour TWA REL's as an 8-hour TWA PEL?

11. Does the most current scientific information generally support acceptance of the hypothesis that all C-5-8-Alkanes are *not* equally toxic because a metabolite of n-Hexane exhibits unique neurotoxic properties?

12. OSHA has proposed to use exposure limits from two well-established sets of guidelines as a source of values to update the PEL's. Is information available about alternative sources which OSHA might consider for this purpose?

13. OSHA has outlined its criteria for identifying special situations. Are alternative criteria available which might be used in lieu of these, or in addition to them?

14. OSHA has outlined three alternative procedures for dealing with substances requiring special attention. Are additional approaches available which might be used in lieu of these, or in addition to them?

15. OSHA has performed feasibility analysis for the following substances, based on limited available information:
Acetonitrile
Carbon disulfide
Carbon monoxide
Carbon tetrachloride
Chloroform
Ethylene dichloride
Ethylene glycol dinitrate
Fibrous glass dust
Hydrogen cyanide
Isophorone diisocyanate
Nitrogen dioxide
Nitroglycerin
Trichloroethylene

Is further information available which might be used to supplement the present findings regarding the feasibility of achieving these levels in the workplaces?

16. OSHA has made a preliminary assessment of the proposed rulemakings' impact on large and small establishments. The Act requires OSHA to determine whether a regulation will have a significant impact on a substantial number of small entities, pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. 601 *et seq.* Is there additional information regarding implementation of this rule for small businesses and entities which OSHA should consider?

17. OSHA has proposed PEL's for some substances, where the basis for this proposal also includes a carcinogenicity designation (e.g., TLV with a A1 or A2 designation; REL with a Ca designation). Should OSHA include a similar carcinogen designation in the Z–4 Table in this rulemaking?

18. OSHA has preliminarily decided that for substances where the ACGIH, TLV is a TWA and the NIOSH, REL is a Ceiling Value which is the same or one half of the TWA, OSHA will propose that the TWA be adopted as the PEL. Should this approach be modified in the final rulemaking? What approach should be used when the converse of this situation (TLV, Ceiling-REL, TWA) exists?

19. OSHA preliminarily plans to adopt a phased start-up schedule. This would include an initial start-up requirement permitting the use of alternate control methods for revised PEL's, followed at a later date by the required use of control methods fully consistent with the methods of compliance priorities in effect at that time. OSHA will shortly be requesting comments on the hierarchy of controls. An alternate approach is to set compliance date for engineering controls based on final determinations of that rulemaking. OSHA solicits comments on those approaches and suggestions regarding appropriate times for the two proposed start-up dates.

20. OSHA requests comment on whether the establishment of margins of safety below lowest observed or no effect levels is consistent with the concept of "significant risk," and on whether the specific margins of safety proposed for specific chemicals are appropriate.

21. OSHA has identified sensory irritation, which causes rhinitis, cough, sputum production, chest pain, wheezing and dyspnea as material impairment of health. OSHA invites comments on this understanding.

22. The question also arises of whether odorants present material impairment of health. That issue also might arise in the context of other substances. Based on the evidence in the final record concerning this issue, OSHA will determine if the criteria detailed in section IV–C–16 have been met, and take appropriate action. OSHA requests comment on this issue.

23. Is there exposure information available which can be supplied which will refine OSHA's estimates of employee exposures and overexposures to the substances being regulated?

24. Is there information available which can be supplied to improve or supplement the engineering controls identified as necessary in order to reduce exposure levels? Is there additional cost data which can be

supplied to refine the annual costs associated with these controls?

25. Under what conditions, involving which industrial processes, will respirators be needed during the start up period, for maintenance operations, or where other controls are infeasible in order to protect employees at the proposed exposure levels? Are respirators currently being used under the conditions identified, or would they need to be purchased? Please describe the type of respirator currently in use or needed.

26. As a result of simultaneously regulating many substances, what cost savings will be realized in purchasing new engineering controls? Are alternate engineering controls available to achieve the lower permissible exposure limits being proposed?

27. What is the current state of technology control and financing in firms which would need to comply with reduced exposure limits to wood dust?

B. History and Need for Revision of the PEL's

One of the principal reasons, if not the single most important basis, for Congress passing the Occupational Safety and Health Act of 1970, was Congress' recognition of the need to protect workers from occupational health hazards. In the preamble to the Act, Congress stated one of the purposes was to protect employees by "exploring ways to discover latent diseases, establishing causal connections between diseases and work in environmental conditions, and conduct other research relating to health problems, in recognition of the fact the that *occupations health standards present problems often different from those involved in occupational safety.*" (emphasis added).

The legislative history indicates Congressional concern for reduction in health risk from both the recognized hazards and from the many newly utilized chemicals. Congress stated in 1970,

> In the field of occupational health the view is particularly bleak, and due to the lack of information and records, may well be considerably worse than we currently know. Occupational diseases which first commanded attention at the beginning of the Industrial Revolution are still undermining the health of workers. Substantial numbers, even today, fall victim to to ancient industrial poisons such as lead and mercury. Workers in the dusty trades still contract various respiratory diseases. Other materials in industrial use are only now being discovered to have toxic effects. In addition, technological advances and new processes in American industry have brought numerous new hazards to the workplace. Carcinogenic chemicals, lasers, ultrasonic energy, beryllium metal, epoxy resins, pesticides, among others, all present incipient threats to the health of workers. Indeed, new materials and processes are being introduced into industry at a much faster rate than the present meager resources of occupational health can keep up with. It is estimated that every 20 minutes a new and potentially toxic chemical is introduced into industry. New processes and new resources of energy present occupational health problems of unprecedented complexity. (Senate Report 91–1282, p. 2)

To accomplish the goal of protecting workers from occupationally related disease Congress created a three-pronged approach in the OSH Act.

First, Congress desired that OSHA, as soon as possible after it was established, have in existence a set of basic, minimum health and safety standards. To accomplish this it provided in section 6(a) of the OSH Act that OSHA should adopt within its first two years, without hearing or public comment, established federal standards and national consensus standards.

At that time, under the Walsh-Healey Act, The Department of Labor had adopted for government contractors approximately 400 health standards based on the Threshold Limit Value (TLV) recommendations of the American Conference of Governmental Industrial Hygientists (ACGIH). Those were adopted as established federal standards. In addition about 25 additional exposure limits had been recommended by the American Standards Association (presently called the American National Standards Institute). Those were adopted as national consensus standards. OSHA adopted these initial exposure limits in May 1971. They are for the most part the maximum air contaminant levels set forth in Tables Z–1, Z–2, and Z–3 of 29 CFR 1910.1000.

Congress recognized the need to update these standards. It created two mechanisms for updating health standards: Regular or "6(b)" standards and emergency or "6(c)" standards.

Congress specified the procedures for regular standards in sections 6(b) (1)–(4) and 6(f). They provide that: The public may petition for new standards; OSHA may set up an advisory committee; and, before issuing a standard, OSHA must publish a proposal with an explanatory preamble, request public comments and publish an explanatory preamble with the final standard. In addition to these general requirements of informal rulemaking, Congress specified that OSHA must hold an oral hearing if requested and support its determination with substantial evidence in the rulemaking record.

Congress set forth the criteria for health standards in section 6(b)(5) of its Act. This stated:

> The Secretary, in promulgating standards dealing with toxic materials or harmful physical agents under this subsection, shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposures to the hazard dealt with by such standard for the period of his working life. Development of standards under this subsection shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws. Whenever practicable, the standard promulgated shall be expressed in terms of objective criteria and of the performance desired.

Congress also provided in section 6(c) for the issuance of Emergency Temporary Standards (ETS) to take immediate effect without rulemaking. However, OSHA is to issue a proposal and complete a section 6(b) rulemaking within 6 months. The criteria for issuing an ETS is that "employers are exposed to grave danger from exposure to substances or agents determined to be toxic or physically harmful or from new hazards, and that such emergency standard is necessary to protect employees from that danger." OSHA has found that section 6(c) procedures have not generally accelerated the regulatory process. Most ETS's have been litigated, and judicial stays have been issued either on procedural or substantive grounds.

Since the passage of the Act in 1970, OSHA has made substantial progress improving the occupational health of workers for some priority health hazards. Asbestos and arsenic exposures have been dramatically reduced, substantially reducing cancer risk to employees. Lead exposures have been reduced and we are now seeing a major reduction in employee blood lead levels, and lead related diseases. Cotton dust exposures have been reduced and byssinosis has been nearly eliminated from the textile work force. OSHA has also substantially reduced significant health risk from some of the newer chemicals such as ethylene oxide and vinyl chloride.

Through the hazard communication and access to employee exposure and medical records standards, OSHA has greatly expanded the ability of

employees to learn about and protect themselves from health hazards.

OSHA's standards have proven to be feasible, often costing less than estimated. The vinyl chloride standard cost one-tenth OSHA's contractor's estimate. The cotton dust standard has been credited with improving the industry's competitiveness and productivity while costing one-half OSHA's estimate.

The preambles to OSHA standards have been lengthy, detailed and sophisticated. They have thoroughly analyzed health studies and controversial scientific issues about carcinogencity and risk assessment. Extensive analyses of feasibility have been made.

OSHA has issued only 24 substance-specific health regulations since its creation. It has not been able to review the many thousands of currently unregulated chemicals in the workplace nor to keep up with reviewing the several thousand new chemicals introduced since its creation. It has not been able to fully review the literature to determine if lower limits are needed for many of the approximately 400 substances it now regulates.

Using past approaches and practices, OSHA could continue to regulate a small number of the high priority substances and those of greatest public interest. However, it would take decades to review currently used chemicals and OSHA would never be able to keep up with the many chemicals which will be newly introduced in the future.

OSHA believes it is a major priority to update its existing PEL's and to make a substantial effort to control exposure to chemicals newly used in the workplace for which no exposure limits exist. The existing health literature and expert judgment indicate that such new or lower limits are needed to protect against many types of deleterious health effects. These include kidney and liver diseases, respiratory diseases, reductions in lung function, nerve disorders and reduction in nerve function, carcinogenicity, irritation to the eyes, throat, skin and other organs which prevent working safely and many other disorders and dysfunctions.

As the preliminary regulatory analysis indicates, millions of employees in total are exposed to levels of these chemicals which, the literature or expert opinion indicates, do or may create deleterious health effects. Clearly, it is a most important occupational health priority to reduce or eliminate such disease and material impairments of health.

Congress clearly indicated that it was a major Congressional priority to consider and control, when needed, the many thousands of unregulated chemicals, and update the existing Z-Table chemicals. For example, the previous quotation indicated Congress' concern with the thousands of newly introduced chemicals. Congress also stated.

> Accordingly, it is essential that such standards (Table Z chemicals) be constantly improved and replaced as new knowledge and techniques are developed. In addition there are occupational hazards, particularly those affecting health—which are not covered by any standards at all. (Senate Report 91-1282, p. 6).

Government agencies and professional organizations have also recommended that OSHA lower exposures for many Table-Z substances and add limits for currently unregulated substances. The National Institute for Occupational Safety and Health has recommended new or lower exposure limits for approximately 160 chemicals (REL's) in its Recommendations for Occupational Safety and Health Standards, September 1986.

The American Conference of Governmental Industrial Hygienists (ACGIH) 1987–88 Threshold Limit Values (TLV's) adopted new exposure limits for approximately 200 substances not regulated by OSHA, and lower limits, short-term exposure limits, ceiling or skin limits for approximately 200 substances now regulated by OSHA.

In light of its priority to address the many unregulated health hazards and improve the existing Table Z limits, OSHA commenced a review process to determine the best way to achieve this goal. It has reviewed its past history and set up an internal task force to consider the matter. OSHA requested the Administrative Conference of the United States to study the issue and make recommendations.

In other rulemakings, important factors as discussed below led OSHA to perform detailed analyses, consider all possible issues, write lengthy preambles and have extensive administrative procedures. However, in OSHA's view, to review and regulate many substances in a reasonable period requires some narrowing of the issues, focus of analysis, and reducing the length of the discussions in the preamble.

The factors that led to OSHA's detailed approach to analysis are clear from OSHA's history: when OSHA issued a health standard it would be sued both by industry arguing its health standards were too strict and by unions arguing tis standards were not strict enough. For example, in 1974, OSHA issued standards for 14 carcinogens (39 FR 3756; Jan. 29, 1974). Industry sued, claiming that OSHA's procedures were inadequate and various studies were poorly done. The unions sued arguing that OSHA had not set a no detectable exposure level, had not set up a permit system and had not set detailed enough requirements for medical examinations. See *Synthetic Organic Chemical Mfgs. v. Brennan; Oil Chemical & Atomic Workers* v. *Brennan*, 503 F.2d 1155, 506 F2d 385 (3rd Cir. 1974).

More recently industry challenged the ethylene oxide standard as being too low and the unions challenged the same standard for not including a short term exposure limit (STEL). See *Public Citizen Health Research Group et al v. Tyson; Assoc. of Ethylene Oxide Users v. Tyson*, 796 F. 2d 1479 (D.C. Cir. 1986).

OSHA also found that lengthy discussions of what it perceived were major issues and less detailed discussion of what it perceived to be minor issues or issues which could wait until another day sometimes resulted in a court remand. For example, the preambles to the final lead standard were over 100 **Federal Register** pages (43 FR 52952, Nov. 14, 1978; 43 FR 54354, Nov. 21, 1978) and included extensive health and feasibility discussions. However, the feasibility discussions were brief for those segments of industry which OSHA believed had fewer problems. The court generally upheld the standard but remanded for reconsideration some of those segments. (See OSHA's similar experience for *Asbestos, Building and Construction Trades vs. Brock*, 86–1359 (D.C. Circ., Feb. 2, 1988)) *United States Workers* v. *Marshall* 647 F. 2d 1189 (D.C. Cir. 1980). Energetic industry challenges, difficulties in gathering detailed data and some lengthy agency reviews have resulted in a major commitment of OSHA resources, numerous hearings and several **Federal Register** notices, in attempting to complete this remand. In another example, a court did not accept the agency's decision to intially limit the hazard communication regulation to the manufacturing sector though the standard as issued created major employee protection benefits. *United Steelworkers* v. *Auchter*, 763 F. 2d 728 (3rd Cir. 1985.).

The success of a project to regulate a large backlog of chemicals for which there is a generally recognized need for new or improved employee protection requires some recognition of the need for agency flexibility in several areas. One is in narrowing the scope of the issues to be covered. A second is in less detailed discussion for each substance. Third is in the flexibility not to cover some issues at the present time when

administrative resources are not available to consider them. In the future when resources are available, the Agency will decide whether the issues have priority.

OSHA, in its first 17 years has also had to address difficult scientific, feasibility and policy issues. These include extrapolation from animal data to humans, (ETO supra), epidemiology risk assessment and significant risk analysis (Arsenic, 48 FR 1864, Jan. 14, 1983; Asbestos, 51 FR 22612, June 20, 1986), feasibility for industries with aging facilities (lead, arsenic, supra), lowest feasible level (Benzene, 52 FR 34460, Sept. 11, 1987, for example) and others.

In response to both the court challenges and the need to face difficult issues, OSHA has engaged in detailed and extensive analyses. These have resulted in lengthier preamble discussions and in-depth analyses for all issues. For example, the 1986 asbestos final standard as published in the **Federal Register** had a 100 page explanatory preamble for general industry. The original asbestos Sec. 6(b) standard had a 2 page preamble (37 FR 11318, June 7, 1972).

Now that OSHA has reviewed these issues in depth several times, has experience "gained under this * * * law" (sec. 6(b)(5)) on these issues, and has had its analysis upheld in the Courts, somewhat less detailed chemical-by-chemical analyses should be appropriate. The accumulated judicial guidance and agency experience reduces the need for as extensive a discussion of some of the issues.

Overall, this preamble is lengthy and both the scientific and feasibility analyses are longer than in previous OSHA rulemaking. OSHA is fully meeting the requirements to analyze significant risk and feasibility. However, the analyses for each chemical are briefer than that provided as part of individual rulemaking.

OSHA has also followed the more extensive administrative procedure of what is called hybrid rulemaking rather than the minimum requirements of informal rulemaking. (See the OSHA procedural rules in 29 CFR Part 1911.) This includes oral hearings, questioning by the public in hearings, extensive right to comment, decision based on an identified record and an Administrative Law Judge presiding at hearings.

As discussed above, in part this is a requirement of the OSHA Act. However, it also reflects relevant legal doctrine. See *International Harvester v. Ruckleshouse.* 478F 2d 615 (D.C. Cir. 1973). This approach has served OSHA well by increasing the Agency's knowledge, and gaining commendation from the courts. See *Industrial Union Dept. v. Hodgson,* 499 F. 2d 467 (D.C. Circ. 1974). It has also been commended in the academic community.

OSHA is not short-cutting its administrative procedures in this matter. However, it is, of course, covering more territory in a single proposal for exposure limits than it has previously. (OSHA's hazard communication regulation, which also has very wide scope, was covered in a single proceeding and was upheld.) This method seems reasonable to OSHA in light of the nature of its proposal and its past experience. Also the Supreme Court in *Vermont Yankee* v. *N.R.D.C.,* 435, U.S. 519, 543.44 (1798) has indicated that agencies have broad flexibility in devising appropriate administrative procedures. It stated that: "administrative agencies should be free to fashion their own rules of procedure, and to pursue methods of inquiry capable of permitting them to discharge their multitudinous duties.

Additional factors which have affected the number of health standards issued by OSHA include various policies of Congress and the President. OSHA develops Environmental Impact Statements as required by the National Environmental Policy Act, conducts Regulatory Flexibility Analyses as required by the Regulatory Flexibility Act and conducts detailed analysis required by the Paperwork Reduction Act. All of the Presidents during OSHA's existence have stressed the need to reduce inflation and improve the cost effectiveness of regulations. Under various Executive Orders (E.O. 12044, 12291) OSHA has been required to perform extensive economic analyses. OSHA, of course, must continue to carry out these important goals of Congress and the President.

As mentioned, OSHA consulted with the Administrative Conference of the United States on appropriate procedures to face the issue of the large number of chemicals which needed new exposure limits. The Conference issued two lengthy reports of a study by two professors of administrative law. After extensive consideration, it made two sets of recommendations to OSHA, Recommendation 87–1, 52 FR 23629 (1987) and 87–10, 92 FR 40147 (Dec. 30, 1987).

The Administrative Conference specifically recommended:

1. Updating the 1971 Consensus Standards. The Occupational Safety and Health Administration, as an interim step should continue to update the Table Z national consensus standards adopted in 1971 if updating can be accomplished by expedited rulemaking procedure (e.g., including more concise preambles) appropriate to the nature of the revised Table. OSHA should update the 1971 standards on a generic basis (i.e., include multiple standards in one proceeding) when consensus recommendations are available, which are generally accepted by employers and workers in the affected industries, and when the new standards can be evaluated on the basis of risk and feasibility information reasonably available to the Agency. This interim step should not interfere with OSHA's continuing responsibility to promulgate and modify safety and health standards.

As this discussion indicates there is clear and generally recognized need to improve occupational health protection of workers from a substantial number of chemicals which are present in the workplace. Clearly an improved approach to regulation is needed to solve this problem in a reasonable time period. OSHA has reviewed the law, Congressional intent, its history, and the recommendations of experts. Based on this review, OSHA has adopted the approach reflected in this proposal and described in greater detail in the approach section below.

OSHA believes that the proposal will lead to a major improvement in occupational health, probably the greatest improvement it can achieve in a short period of time. Consequently, it believes it is justified to make, as one of its first priorities, reducing exposure to approximately 400 substances. It believes it is appropriate to leave for later standards and a second stage, of somewhat lower priority, more detailed analyses of some substances, where lower limits may be appropriate, and review of the need for medical, monitoring and industrial hygiene provisions is required.

C. Approach

This proposed rulemaking represents a different OSHA approach to the problem of setting permissible exposure limits for the wide variety of potentially hazardous substances present in the work place. Under typical section 6(b) rulemaking, OSHA has developed detailed standards for individual substances based on an extensive review of all available information. This is an extremely time and resource-intensive process. In the proposed rulemaking, OSHA will rely to a large extent on the evaluation of other existing exposure limits which have been developed and widely accepted as health protection guidelines, recommendations, or regulations together with an evaluation of the more important studies for each substance. These sources have been developed by

various organizations within and outside the United States.

Analysis of all these guidelines clearly documented the inadequacies of the existing Permissible Exposure Limits (PEL), defined in the § 1910.1000 Z-Tables, which were all developed prior to 1968. Further analysis identified two sources, the American Conference of Governmental Industrial Hygienists, Threshold Limit Values (ACGIH/TLV) and the National Institute for Occupational Safety and Health, Recommended Exposure Limits (NIOSH/REL's), which could be used in this rulemaking. The TLV's were used to identify those substances to be considered in this rulemaking. Both the REL's and TLV's were used to permit OSHA to determine which limits provide a more appropriate permissible exposure limit in light of the evidence and the statutory requirements OSHA must follow. A detailed explanation of this analysis is provided in a separate section of this preamble. The justifications for limiting this proposed rulemaking to the question of allowable air concentrations, without considering ancillary requirements, such as control methods, personal protective equipment, training, etc., are described in a separate section of this preamble.

While OSHA has relied extensively on the guidance provided by the documentation for the ACGIH TLV's and NIOSH REL's, OSHA has also reviewed other health effects data to determine, as the OSHA Act requires, if significant risks exist; if the new exposure limits would substantially reduce that risk; and if technological and economic feasibility exists for the proposed PEL's. OSHA has concentrated its efforts on reviewing summaries of the major studies, with emphasis on the literature used to support the exposure limits proposed by NIOSH and ACGIH for the several hundred substances being considered in this proposed rulemaking. With this approach, it is not necessary to analyze in depth all available studies for each substance. When the studies support the recommended level within the context of OSHA's legal requirements, OSHA is proposing to adopt either the TLV or REL, rather than attempt a detailed analysis. The details of the approach used to resolve differences between individual permissible exposure limits are provided in another section of the preamble. This preamble will discuss the health effects and risk for each substance being considered.

OSHA is also engaging in an extensive analysis of technological and economic feasibility. OSHA is utilizing: A review of the literature; expert professional judgement by a selected group of certified industrial hygienists and professional engineers; a large scale survey of past experiences in the work place; and input from several computer-processable data bases to determine whether the proposed levels are technologically and economically feasible. The survey will be focused by using existing exposure sampling data which indicate usage and the level of compliance already achieved. OSHA is not attempting to analyze the feasibility of alternative proposed exposure levels except where the TLV and REL differ significantly. In those instances only the REL and TLV are considered. However, the absence of adequate feasibility information for a given TLV or REL will eliminate that exposure level from consideration as a possible OSHA PEL.

To attain the objectives of the proposed rulemaking, it has been necessary to limit the discussion of health effects for each individual substance. To use this approach, and satisfy the technical and legal requirements for section 6(b) rulemaking, OSHA has identified 15 health effect categories to include all the substances considered in the rulemaking. While some substances have health effects which fall into more than one category, for purposes of organization, OSHA has grouped the substances according to the ACGIH rationale for identifying the primary health effect. For each of these groups there is a generic discussion of the general health effects considerations which lead to the development of permissible air concentrations for those substances falling within that category. This is then supplemented by a limited discussion of: health effects, significance of risk, and risk reduction for each substance, primarily based on the TLV and REL documentation. In each instance, OSHA reaches its own conclusion regarding which (if either) of these limits are appropriate. OSHA is also considering other relevant guidelines for allowable air concentrations to identify any specific substances which require special attention.

This preamble will include the generic discussions for all 15 health effects groups, and an evaluation of the specific substances.

OSHA anticipates that there are three possible outcomes for the proposed PEL's in this proposal. These are:

(1) The final rule adopts the proposed limits.

(2) The final rule adopts limits different from the existing or proposed limits.

(3) The final rule adopts no changes to the existing limits.

To make a decision between these three alternatives, OSHA will consider three types of information.

(a) Facts, objectively defined on the basis of information now available.

(b) Policy judgment consistent with the statutory requirements the Agency must follow.

(c) Assessment of the record presented during or as a result of the public hearing scheduled for this rulemaking. This assessment of the record will consider both factual and policy information.

Specific evidence which OSHA will consider includes the following:

Number of exposed employees at various exposure levels, number of manufacturing processes involved, quantity of material involved, cost of compliance, type of effect (e.g., acute, chronic), severity of health effects, absence of an existing PEL, magnitude of proposed change to PEL, general acceptance of proposed PEL, and quality of the evidence.

OSHA will use all these criteria in reaching its final decisions based on statutory requirements for each of the substances currently included in the proposal.

In most previous health rulemakings subsequent to the benzene decision OSHA has regulated health hazards which have posed risks above 1 in a thousand over a working lifetime. These are clearly in the range of risks which the agency generally considers "significant." These risks have been quantified through risk assessments using accepted statistical techniques. In most of these rulemakings, the limits of the agency's action have been determined by the constraint of feasibility, meaning that significant risks were likely to remain at the new levels, according to the quantitative risk assessments, but that further reductions in exposures were feasible. In the formaldehyde final rulemaking OSHA stated that regarding the question of significant risk, it "believes that figures of 0.6 per 100,000 (i.e., 6 in one million) predicted by the lower end of the range may be approaching a level that can be viewed as safe in the context of the workplace environment.

Most of OSHA's prior standards have involved chronic health hazards where studies have identified risks at relatively high levels of exposure. OSHA utilized standard risk assessment models to estimate risks at lower levels of

exposure. It used these estimates as the basis for significant risk determinations at existing and proposed levels.

Many of the substances OSHA is regulating in this proposed rulemaking are acute hazards. Studies indicate that workers may suffer health effect at a level close to the current exposure limit, or if not exposure limit exists, at a specific level. With data close to the level of interest, extensive extrapolation is not necessary and the primary question is what level will substantially reduce or eliminate the significant risk identified.

OSHA is relying on guidelines already available in the literature, which use a variety of adjustments to account for the uncertainties inherent in translating animal or human health studies to the actual work situation. Adjustments are required due to inter-species and intra-species variations, sex and age differences, and the limited statistical power of typical studies. Statistical power is frequently limited because of the small number of test subjects, and the time constraints regarding single or repeated exposures. For the same reason the available studies may not support precise quantitative estimates of the probability of adverse health effects. In these situations, even where the presence of risk is well-established at the current level, it may not be possible to reach a conclusion concerning the precise point at which that risk ceases to be significant, in other words, how far exposure limits should be reduced. However, the evidence may be sufficient to justify a specific level as substantially reducing or eliminating significant risk.

The Supreme Court has indicated that the decision about whether a particular level of risk is significant will be based on largely on policy considerations. OSHA will include in the final rule only those limits which the record supports as being consistent with the statutory requirement that OSHA must follow. In carrying out this responsibility OSHA will consider the quality of the evidence, the type of risk, the reasonableness of the risk assessment or evidence of risk, the substantial reduction or elimination of significant risk, and the appropriateness of the final limit, taking into account statutory requirements, the cost and compliance factors, and policy considerations. Where more information is required to support a new final rule, the agency will collect it before revising existing limits or establishing new limits. Policy discretion is particularly appropriate where risk appears to be in the range where the question of its insignificance is presented.

OSHA is proposing to regulate 428 chemicals in this proceeding. In developing new PELs for some of these chemicals, questions may arise about the point at which the risks associated with them become insignificant. (See the discussion about formaldehyde quoted above.) EPA and FDA have recently considered analogous issues under other statutory authorities, specifically, what levels of risk are sufficiently low so that no further regulatory action is necessary or where there is more discretion whether to take action or not.

The FDA has indicated that in its view, risks of less than one in one-million from a lifetime of exposure are *de minimus*. See 51 FR 28344 at 362 August 7, 1986 and *Public Citizen* v. *Young*, 831 F. 2d 1108 (D.C. Cir., 1987). "FDA's proposed one-in-one million dividing point has been used by EPA to distinguish acceptable and unacceptable risks. 119 FR 46294 (1984) (general guideline); 51 FR 1602, 1635 (1986) (hazardous wastes). FDA has used the same break point to determine whether the general safety clause of the Act applies. 47 FR 14 138 (1982) "*Public Citizen*, Note 4 ibid. Public comment is invited on how OSHA should, as a matter of policy, address these issues.

Policy discretion concerning the appropriate extent of regulation if any may be particularly appropriate where risk appears to be in the range between clearly significant and *de minimus*, when the question of its insignificance is presented. One area of such discretion may be whether ancillary provisions are appropriate when risk is in this middle range. For example, medical screening tests may not be as effective, or the side effects may outweigh their value when the predicted risk is relatively low, and it is of value to focus medical resources where these have greater value. See, for example, discussion of medical surveillance for OSHA's arsenic standard, 43 FR 19620–1 (May 5, 1978) and benzene standard, 52 FR 34547–54 (September 11, 1987).

On the other hand, the Supreme Court stated in the benzene decision about medical surveillance that, "It should also be noted that, in setting a permissible exposure level in reliance on less-than-perfect methods, OSHA would have the benefit of a backstop in the form of monitoring the medical testing.

Thus, if OSHA properly determined that the permissible exposure limit should be set at 5 ppm, it could still require monitoring and medical testing for employees exposed to lower levels. By doing so, it could keep a constant check on the validity of the assumptions made in developing the permissible exposure limit, giving it a sound evidentiary basis for decreasing the limit if it was initially set too high. Moreover, in this way it could ensure that workers who were unusually susceptible to benzene could be removed from exposure before they had suffered any permanent damage.

* * * This is precisely the type of information-gathering function that Congress had in mind when in enacted section (6)(b)(7), which empowers the Secretary to require medical examinations to be furnished to employees exposed to certain hazards and potential hazards in order to most effectively determine whether the health of such employees is adversely affected by such exposure. See Legis. Hist., p. 147 (Emphasis added)" (448 U.S. 658). *Accord, National Cottonseed Prods. Assoc.* v. *Brock*, 829 F. 2d 482 (D.C. Cir. 1987), Cert. denied 56 U.S.L.W. 3733 (4/26/88).

OSHA is not raising the issue of the appropriateness of ancillary provisions in this rulemaking for reasons discussed above. However, this question may be of relevance to any comments on the issue of insignificant risk and regulatory discretion.

D. Basis for Identifying Replacement PEL's

OSHA's PEL's were based originally on established Federal standards and consensus standards, as provided by the Occupational Safety and Health Act. Those standards, in turn, were based largely upon air contaminant standards (Threshold Limit Values or TLV's) promulgated by the American Conference of Governmental Industrial Hygienists (ACGIH). Originally, ACGIH–TLV's were adopted for employees of government contractors, pursuant to the Walsh-Healey Act. At the time, they represented the most comprehensive set of workplace exposure guidelines available. They were then adopted under the OSHAct as established federal standards.

ACGIH updates its TLV's annually, adjusting exposure limits and adding new substances to its list as evidence of health effects is accumulated. During the past 20 years, a gap has developed between the OSHA PEL's and the more current ACGIH–TLV's because OSHA has approached standards-setting on an item-by-item basis and has not re-evaluated the PEL's listed in the 1910.1000 Z Tables as a group.

In the present rulemaking, OSHA had many more sources of standards from which to consider exposure limits, and a comparison of several of these sources was made early in the review process. In the review it became clear that two sorts of decisions, based on alternative

sources of standards, would be made. First, it was necessary to determine which substances would be included in the updating, since the health effects of many more substances are now known. Second, it was necessary to propose new limits for each substance which will provide protection to exposed workers.

OSHA examined lists of recommended exposure limits compiled by a variety of professional organizations, international bodies, governments and government agencies, using these criteria:

1. Comprehensiveness: What is the breadth (number of substances covered) and depth (inclusion of STEL's and ceilings as well as 8-hour TWA's) of the guidelines as a whole?
2. Currentness: How recent are the limits and how often are they updated?
3. Review Process: What procedures does he limit-setting body use to update its list?
4. Feasibility: To what extent is feasibility considered when limits are decided upon?
5. Documentation: What reasons are provided when limits are set and how well-documented are those decisions?
6. Applicability: Are the limits suitable for application in U.S. workplaces?

OSHA considered exposure limits set by professional organizations. (The American National Standards Institute, ANSI; The American Industrial Hygiene Association, AIHA; The American Conference of Governmental Industrial Hygienists, ACGIH), by NIOSH, by several countries (United Kingdom, Sweden, Federal Republic of Germany, and Japan), and three international bodies (European Economic Community, EEC; International Labor Organization, ILO; and the World Health Organization, WHO).

Not all of these limits could be evaluated against all of the criteria, since information was unavailable in some cases. Some organizations do not explain their reasons for setting guidelines, and others do not publish descriptions of their limit-setting and review procedures. OSHA nonetheless identified a group of exposure limit lists that warranted additional study, including the NIOSH Recommended Exposure Limits (REL's), WHO limits, British and West German limits and the TLV's established by ACGIH.

For the purpose of determining which substance would be included in the rulemaking, OSHA determined that the 1987–88 ACGIH–TLV list was most suitable. This TLV list included all of the substances in the present Z-tables, plus some two hundred more recently enrolled common substances. None of the other lists had equal depth and breadth. The number of hazardous substances included in other lists ranged from three (the EEC) to about 400 (United Kingdom), compared to over 600 substances in the ACGIH list. The NIOSH REL's covered a total of approximately 160 substances with numerical values.

OSHA then began its analysis of the particular exposure limits on the ACGIH list, comparing them with values suggested by other sources. All of the sources cited above indicated the need for updating, but inconsistencies in documentation of the recommended limits reduced the utility of most sources. For example, while the United Kingdom has many recommended limits, documentation by means of specific studies and description of methodology is often missing or inadequate for OSHA's purposes. In many instances, West German limits were based on the same 1968 documentation used by OSHA. Although West Germany has amended more than one hundred of the standards, documentation of feasibility and of risk has not been available to support the limits. OSHA believes that such documentation of feasibility would be especially necessary if German standards were to be adopted for application in U.S. workplaces, given the differing social, economic and political environments in the two countries.

NIOSH's recommended exposure limits (REL's) are well-documented and they are set with U.S. workplaces in mind. NIOSH explains the basis for its limits in criteria documents or in Current Intelligence Bulletins. OSHA has considered each of the available REL's in preparing this proposal, and has used the NIOSH-recommended exposure limit wherever it is shown to be both feasible and more appropriate than the corresponding ACGIH TLV. In each instance where there is a "significant difference" between a TLV and REL for an individual substance, OSHA has independently evaluated which value should be adopted as the PEL. In those few instances where REL's indicated limits for substances which were not on the ACGIH list, no new limit was proposed, because it was necessary to set a boundary on the number of substances to be evaluated. It was considered a higher priority to devote time to completing the regulation of 428 substances, rather than attempting to determine if additional substances, in other listings, should be considered. Where the REL and TLV differed in matters such as minor variations in TWA, lack of a STEL or ceiling, or use of a ceiling in lieu of a STEL, simplified procedures (described elsewhere) were adopted. These procedures considered the availability of feasibility data, practical sampling considerations, and the time available to complete this rulemaking. The criteria for defining significant differences between REL's and TLV's is discussed in section I–F.

Thus, the proposed modifications of OSHA's permissible exposure limits are based on the best information available to the agency at this time, regarding both health effects and feasibility, making use of the guidelines and recommendations developed by other organizations, primarily those of NIOSH and ACGIH. OSHA requests that the public provide any further relevant information regarding both health effects and feasibility which will supplement the information upon which this proposal is based.

E. Substances Included in the Update of § 1910.1000 Z Tables

Table I–E lists those 420 substances which are addressed by this proposal. This includes substances listed by the ACGIH in its publication "Threshold Limit Values and Biological Exposure Indices for 1987–88", excluding: (a) 24 substances for which comprehensive OSHA standards exist; (b) 9 substances for which OSHA standard development is in active progress; (c) and 160 substances from the existing Z-Tables where there is no difference between the OSHA PEL and the adopted 1987–88 ACGIH-TLV. This rulemaking therefore includes all substances which have been changed or added to the ACGIH TLV list since 1968. Changes or additions are considered to exist when: (1) A TWA or STEL has been modified; (2) a STEL or ceiling has been added (where none existed before); (3) where skin notation has been added; or (4) where some type of exposure limit (TWA, STEL or ceiling) exists where no OSHA limit existed in the § 1910.1000 Z-Tables.

Use of the TLV list as a reference point to define the bounds of this rulemaking is necessary to limit the number of substances under consideration to manageable size. Since the TLV list is the most extensive available source, and is the basis for the existing OSHA PEL's in the § 1910.1000 Z-Tables, it represents the best choice to serve this limited purpose.

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TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard

H.S. Number/Chemical Name		CAS Number
1001	ACETALDEHYDE	75-07-0
1002	ACETIC ACID	64-19-7
1003	ACETIC ANHYDRIDE	108-24-7
1004	ACETONE	67-64-1
1005	ACETONITRILE	75-05-8
1006	ACETYLSALICYLIC ACID (ASPIRIN)	50-78-2
1007	ACROLEIN	107-02-8
1008	ACRYLAMIDE	79-06-1
1009	ACRYLIC ACID	79-10-7
1010	ALLYL ALCOHOL	107-18-6
1011	ALLYL CHLORIDE	107-05-1
1012	ALLYL GLYCIDYL ETHER (AGE)	106-92-3
1013	ALLYL PROPYL DISULFIDE	2179-59-1
1014	ALPHA-ALUMINA	1344-28-1
1015	ALUMINUM (ALKYLS)	7429-90-5
1016	ALUMINUM (METAL)	7429-90-5
1017	ALUMINUM (PYRO POWDERS)	7429-90-5
1018	ALUMINUM (SOLUBLE SALTS)	7429-90-5
1019	ALUMINUM (WELDING FUMES)	7429-90-5
1020	AMITROLE (3-AMINO-1,2,4-TRIAZOLE)	61-82-5
1021	AMMONIA	7664-41-7
1022	AMMONIUM CHLORIDE (FUME)	12125-02-9
1024	AMMONIUM SULFAMATE (AMMATE)	7773-06-0
1025	ANILINE	62-53-3
1028	ASPHALT FUMES	8052-42-4
1029	ATRAZINE	1912-24-9

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name		CAS Number
1031	BARIUM SULFATE	7727-43-7
1032	BENOMYL	17804-35-2
1033	BERYLLIUM & COMPOUNDS	7440-41-7
1034	BISMUTH TELLURIDE (SE-DOPED)	1304-82-1
1035	BISMUTH TELLURIDE (UNDOPED)	1304-82-1
1036	BORATES, TETRA, SODIUM (ANHYDROUS)	1303-96-4
1037	BORATES, TETRA, SODIUM (DECAHYDRATE)	1303-96-4
1038	BORATES, TETRA, SODIUM (PENTAHYDRATE)	1303-96-4
1039	BORON OXIDE	1303-86-2
1040	BORON TRIBROMIDE	10294-33-4
1041	BROMACIL	314-40-9
1042	BROMINE	7726-95-6
1043	BROMINE PENTAFLUORIDE	7789-30-2
1044	BUTANE	106-97-8
1045	2-BUTANONE (MEK)	78-93-3
1046	2-BUTOXY ETHANOL	111-76-2
1047	N-BUTYL ACETATE	123-86-4
1048	BUTYL ACRYLATE	141-32-2
1049	SEC-BUTYL ALCOHOL	78-92-2
1050	TERT-BUTYL ALCOHOL	75-65-0
1051	N-BUTYL ALCOHOL	71-36-3
1052	N-BUTYL GLYCIDYL ETHER	2426-08-6
1053	N-BUTYL LACTATE	138-22-7
1054	BUTYL MERCAPTAN	109-79-5
1055	O SEC-BUTYL PHENOL	89-72-5
1056	P-TERT-BUTYLTOLUENE	98-51-1

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1057 CALCIUM CARBONATE	1317-65-3
1058 CALCIUM CYANAMIDE	156-62-7
1059 CALCIUM HYDROXIDE	1305-62-0
1060 CALCIUM OXIDE	1305-78-8
1061 CALCIUM SILICATE, TOTAL DUST	NONE
1062 CALCIUM SULFATE	7778-18-9
1063 CAMPHOR (SYNTHETIC)	76-22-2
1064 CAPROLACTAM (DUST)	105-60-2
1065 CAPROLACTAM (VAPOR)	105-60-2
1066 CAPTAFOL (DIFOLATAN)	2425-06-1
1067 CAPTAN	133-06-2
1068 CARBOFURAN (FURADAN)	1563-66-2
1069 CARBON DIOXIDE	124-38-9
1070 CARBON DISULFIDE	75-15-0
1071 CARBON MONOXIDE	630-08-0
1072 CARBON TETRABROMIDE	558-13-4
1073 CARBON TETRACHLORIDE	56-23-5
1074 CARBONYL FLUORIDE	353-50-4
1075 CATECHOL (PYROCATECHOL)	120-80-9
1076 CELLULOSE	9004-34-6
1077 CESIUM HYDROXIDE	21351-79-1
1078 CHLORINATED CAMPHENE	8001-35-2
1079 CHLORINE	7782-50-5
1080 CHLORINE DIOXIDE	10049-04-4
1081 1 CHLORO-1 NITROPROPANE	600-25-9
1082 2 CHLORO-6-TRICHLOROMETHYL PYRIDINE (NITRAPYRIN)	1929-82-4

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1083 CHLOROACETYL CHLORIDE	79-04-9
1084 O-CHLOROBENZYLIDENE MALONONITRILE	2698-41-1
1085 CHLORODIFLUOROMETHANE	75-45-6
1086 CHLOROFORM	67-66-3
1087 CHLOROPENTAFLUOROETHANE	76-15-3
1088 CHLOROPRENE	126-99-8
1089 O-CHLOROSTYRENE	1331-28-8
1090 O-CHLOROTOLUENE	95-49-8
1091 CHLORPYRIFOS	2921-88-2
1092 CHROMIC ACID & CHROMATES	7440-47-3
1093 CHROMIUM, METAL	7440-47-3
1094 CHROMYL CHLORIDE	14977-61-8
1095 CLOPIDOL(COYDEN)	2971-90-6
1096 COAL DUST, < 5% QUARTZ	NONE
1097 COAL DUST, > 5% QUARTZ	NONE
1098 COBALT CARBONYL	10210-68-1
1099 COBALT HYDROCARBONYL	16842-03-8
1100 COBALT, METAL, FUME, DUST	7440-48-4
1101 COPPER (FUME)	7440-50-8
1102 CRAG HERBICIDE (SESONE)	136-78-7
1103 CRUFOMATE	299-86-5
1104 CYANAMIDE	420-04-2
1105 CYANOGEN	460-19-5
1106 CYANOGEN CHLORIDE	506-77-4
1107 CYCLOHEXANOL	108-93-0
1108 CYCLOHEXANONE	108-94-1

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number	Chemical Name	CAS Number
1109	CYCLOHEXYLAMINE	108-91-8
1110	CYCLONITE	121-82-4
1111	CYCLOPENTANE	287-92-3
1112	CYHEXATIN	13121-70-5
1113	DDT	50-29-3
1114	DECABORANE	17702-41-9
1116	DI-SEC-OCTYL-PHTHALATE	117-81-7
1117	2,6-DI-TERT-BUTYL-P-CRESOL	128-37-0
1118	DIAZINON	333-41-5
1119	DIBUTYL PHOSPHATE	107-66-4
1120	2-N-DIBUTYLAMINOETHANOL	102-81-8
1121	1,1-DICHLORO-1-NITROETHANE	594-72-9
1122	1,3-DICHLORO-5,5-DIMETHYLHYDANTOIN	118-52-5
1123	DICHLOROACETYLENE	7572-29-4
1125	P-DICHLOROBENZENE	106-46-7
1126	1,1-DICHLOROETHANE	75-34-3
1127	DICHLOROETHYL ETHER	111-44-4
1128	DICHLOROMONOFLUOROMETHANE	75-43-4
1129	1,3-DICHLOROPROPENE	542-75-6
1130	2,2-DICHLOROPROPIONIC ACID	75-99-0
1131	DICROTOPHOS (BIDRIN)	141-66-2
1132	DICYCLOPENTADIENE	77-73-6
1133	DICYCLOPENTADIENYL IRON	102-54-5
1134	DIETHANOLAMINE	111-42-2
1135	DIETHYL KETONE	96-22-0
1136	DIETHYL PHTHALATE	84-66-2

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number	Chemical Name	CAS Number
1137	DIETHYLAMINE	109-89-7
1138	DIETHYLENE TRIAMINE	111-40-0
1139	DIGLYCIDYL ETHER (DGE)	2238-07-5
1140	DIISOBUTYL KETONE	108-83-8
1141	DIMETHYL 1,2-DIBROMO-2,2-DICHLOROETHYL PHOSPHATE	300-76-5
1142	DIMETHYL SULFATE	77-78-1
1143	DIMETHYLANILINE	121-69-7
1144	DINITOLMIDE (3,5-DINITRO-O-TOLUAMIDE)	148-01-6
1145	DIOXANE (DIETHYLENE DIOXIDE)	123-91-1
1146	DIOXATHION (DELNAV)	78-34-2
1147	DIPHENYLAMINE	122-39-4
1148	DIPROPYL KETONE	123-19-3
1149	DIPROPYLENE GLYCOL METHYL ETHER	34590-94-8
1150	DIQUAT	85-00-7
1151	DISULFIRAM	97-77-8
1152	DISULFOTON	298-04-4
1153	DIURON	330-54-1
1154	DIVINYL BENZENE	108-57-6
1155	EMERY	112-62-9
1156	ENDOSULFAN	115-29-7
1158	EPICHLOROHYDRIN	106-89-8
1159	ETHANOLAMINE	141-43-5
1160	ETHION (NIALATE)	563-12-2
1161	ETHYL ACRYLATE	140-88-5
1162	ETHYL BENZENE	100-41-4
1163	ETHYL BROMIDE	74-96-4

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name		CAS Number
1164	ETHYL ETHER	60-29-7
1165	ETHYL MERCAPTAN	75-08-1
1166	ETHYL SILICATE	78-10-4
1167	ETHYLENE CHLOROHYDRIN	107-07-3
1168	ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE)	107-06-2
1169	ETHYLENE GLYCOL	107-21-1
1170	ETHYLENE GLYCOL DINITRATE	628-96-6
1171	ETHYLIDENE NORBORNENE	16219-75-3
1172	N-ETHYLMORPHOLINE	100-74-3
1173	FENAMIPHOS	22224-92-6
1174	FENSULFOTHION (DASANIT)	115-90-2
1175	FENTHION	55-38-9
1176	FERBAM	14484-64-1
1177	FERROVANADIUM DUST	12604-58-9
1178	FIBROUS GLASS DUST	NONE
1179	FLUORINE	7782-41-4
1180	FLUOROTRICHLOROMETHANE	75-69-4
1181	FONOFOS	944-22-9
1182	FORMAMIDE	75-12-7
1183	FURFURAL	98-01-1
1184	FURFURYL ALCOHOL	98-00-0
1185	GASOLINE	8006-61-9
1186	GERMANIUM TETRAHYDRIDE	7782-65-2
1187	GLUTARALDEHYDE	111-30-8
1188	GLYCERIN (MIST)	56-81-5
1189	GLYCIDOL (2,3-EPOXY-1-PROPANOL)	556-52-5

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name		CAS Number
1190	GRAIN DUST	NONE
1191	GRAPHITE, NATURAL, RESPIRABLE	7782-42-5
1191A	GRAPHITE, SYNTHETIC	NONE
1192	GYPSUM, TOTAL DUST	NONE
1194	N-HEPTANE	142-82-5
1195	HEXACHLOROBUTADIENE	87-68-3
1196	HEXACHLOROCYCLOPENTADIENE	77-47-4
1197	HEXACHLOROETHANE	67-72-1
1198	HEXAFLUOROACETONE	684-16-2
1200	N-HEXANE	110-54-3
1201	HEXANE ISOMERS	NONE
1202	2-HEXANONE	591-78-6
1203	HEXONE (METHYL ISOBUTYL KETONE)	108-10-1
1204	HEXYLENE GLYCOL	107-41-5
1205	HYDRAZINE	302-01-1
1206	HYDROGEN BROMIDE	10035-10-6
1207	HYDROGEN CYANIDE	74-90-8
1208	HYDROGEN FLUORIDE	7664-39-3
1209	HYDROGEN SULFIDE	7783-06-4
1210	HYDROGENATED TERPHENYLS	61788-32-7
1211	2-HYDROXYPROPYL ACRYLATE	999-61-1
1212	INDENE	95-13-6
1213	INDIUM & COMPOUNDS	7440-74-6
1214	IODOFORM	75-47-8
1215	IRON OXIDE (DUST AND FUME)	1309-37-1
1216	IRON PENTACARBONYL	13463-40-6

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1243 MESITYL OXIDE	141-79-7
1244 METHACRYLIC ACID	79-41-4
1245 METHOMYL (LANNATE)	16752-77-5
1246 METHOXYCHLOR	72-43-5
1247 4-METHOXYPHENOL	150-76-5
1248 METHYL 2-CYANOACRYLATE	137-05-3
1249 METHYL ACETATE	79-20-9
1250 METHYL ACETYLENE/PROPADIENE MIXTURE	74-99-7
1251 METHYL ACRYLONITRILE	126-98-7
1252 METHYL ALCOHOL	67-56-1
1253 METHYL BROMIDE	74-83-9
1254 METHYL CHLORIDE	74-87-3
1255 METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE)	71-55-6
1256 METHYL DEMETON	8022-00-2
1257 METHYL ETHYL KETONE PEROXIDE	1338-23-4
1258 METHYL FORMATE	107-31-3
1259 METHYL IODIDE	74-88-4
1260 METHYL ISOAMYL KETONE	110-12-3
1261 METHYL ISOBUTYL CARBINOL	105-30-6
1262 METHYL ISOPROPYL KETONE	563-80-4
1263 METHYL MERCAPTAN	74-93-1
1264 METHYL N-AMYL KETONE	110-43-0
1265 METHYL PARATHION	298-00-0
1266 METHYL SILICATE	681-84-5
1267 ALPHA METHYL STYRENE	98-83 9
1268 METHYLCYCLOHEXANE	108-87-2

TABLE I-F. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1217 IRON SALTS (SOLUBLE)	NONE
1218 ISOAMYL ALCOHOL	123-51-3
1219 ISOBUTYL ALCOHOL	78-83-1
1220 ISOOCTYL ALCOHOL	26952-21-6
1221 ISOPHORONE	78-59-1
1222 ISOPHORONE DIISOCYANATE	4098-71-9
1223 2-ISOPROPOXYETHANOL	109-59-1
1224 ISOPROPYL ACETATE	108-21-4
1225 ISOPROPYL ALCOHOL	67-63-0
1226 ISOPROPYL ETHER	108-20-3
1227 ISOPROPYL GLYCIDYL ETHER	4016-14-2
1228 ISOPROPYLAMINE	75-31-0
1229 N-ISOPROPYLANILINE	643-28-7
1230 KAOLIN, TOTAL DUST	NONE
1231 KETENE	463-51-4
1232 LIMESTONE, TOTAL DUST	NONE
1233 MAGNESITE, TOTAL DUST	NONE
1234 MAGNESIUM OXIDE FUME	1309-48-4
1235 MALATHION	121-75-5
1236A MANGANESE, FUME	7439-96-5
1237 MANGANESE CYCLOPENTADIENYL TRICARBONYL	12079-65-1
1238 MANGANESE TETROXIDE	1317-35-7
1239 MARBLE, TOTAL DUST	1317-65-3
1240 MERCURY (ARYL AND INORGANIC COMPOUNDS)	7439-97-6
1241 MERCURY (VAPOR)	7439 97 6
1242 MERCURY, (ORGANO) ALKYL COMPOUNDS	7439-97-6

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name		CAS Number
1269	METHYLCYCLOHEXANOL	25639-42-3
1270	O-METHYLCYCLOHEXANONE	583-60-8
1271	METHYLCYCLOPENTADIENYL MN TRICARBONYL	12108-13-3
1272	METHYLENE BIS (4-CYCLOHEXYLISOCYANATE)	5124-30-1
1273	4,4'-METHYLENE BIS(2-CHLOROANILINE)	101-14-4
1275	METRIBUZIN	21087-64-9
1276	MICA	12003-38-2
1277	MINERAL WOOL FIBER	NONE
1278	MOLYBDENUM (INSOLUBLE COMPOUNDS)	7439-98-7
1279	MONOCROTOPHOS (AZODRIN)	6923-22-4
1280	MONOMETHYL ANILINE	100-61-8
1281	MORPHOLINE	110-91-8
1282	NAPHTHALENE	91-20-3
1283	NICKEL (SOLUBLE COMPOUNDS)	7440-02-0
1284	NICKEL CARBONYL	13463-39-3
1286	NITRIC ACID	7697-37-2
1287	P-NITROANILINE	100-01-6
1288	P-NITROCHLOROBENZENE	100-00-5
1289	NITROGEN DIOXIDE	10102-44-0
1290	NITROGLYCERIN	55-63-0
1291	2-NITROPROPANE	79-46-9
1292	NITROTOLUENE	1321-12-6
1293	NONANE	111-84-2
1294	NUISANCE PARTICULATES, TOTAL DUST	NONE
1295	OCTACHLORONAPHTHALENE	2234-13-1
1296	OCTANE	111-65-9

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name		CAS Number
1297	OIL MIST (MINERAL)	8012-95-1
1298	OSMIUM TETROXIDE	20816-12-0
1299	OXALIC ACID	144-62-7
1300	OXYGEN DIFLUORIDE	7783-41-7
1301	OZONE	10028-15-6
1302	PARAFFIN WAX FUME	8002-74-2
1303	PARAQUAT, RESPIRABLE DUST	4685-14-7
1304	PENTABORANE	19624-22-7
1305	PENTAERYTHRITOL, TOTAL DUST	115-77-5
1306	PENTANE	109-66-0
1307	2-PENTANONE (METHYL PROPYL KETONE)	107-87-9
1308	PERCHLOROETHYLENE	127-18-4
1309	PERCHLORYL FLUORIDE	7616-94-6
1310	PERLITE	NONE
1312	PETROLEUM DISTILLATES (NAPHTHA)	8002-05-9
1313	PHENOTHIAZINE	92-84-2
1314	PHENYL ETHER (VAPOR)	101-84-8
1315	PHENYL GLYCIDYL ETHER	122-60-1
1316	PHENYL MERCAPTAN	108-98-5
1317	PHENYLHYDRAZINE	100-63-0
1318	PHENYLPHOSPHINE	638-21-1
1319	PHORATE (THIMET)	298-02-2
1320	PHOSDRIN (MEVINPHOS)	7786-34-7
1321	PHOSPHINE	7803-51-2
1322	PHOSPHORIC ACID	7664-38-2
1323	PHOSPHORUS OXYCHLORIDE	10025-87-3

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1324 PHOSPHORUS PENTASULFIDE	1314-80-3
1325 PHOSPHORUS TRICHLORIDE	7719-12-1
1326 PHTHALIC ANHYDRIDE	85-44-9
1327 M-PHTHALODINITRILE	626-17 5
1328 PICLORAM (TORDOM)	1918-02-1
1329 PICRIC ACID	88-89 1
1330 PIPERAZINE DIHYDROCHLORIDE	142-64-3
1331 PLASTER OF PARIS, TOTAL DUST	NONE
1332 PLATINUM, METAL	7440-06-4
1333 PORTLAND CEMENT	65997-15-1
1334 POTASSIUM HYDROXIDE	1310-58-3
1335 PROPARGYL ALCOHOL	107-19-7
1336 PROPIONIC ACID	79-09-4
1337 PROPOXUR (BAYGON)	114-26-1
1338 N-PROPYL ACETATE	109-60-4
1339 PROPYL ALCOHOL	71-23-8
1340 N-PROPYL NITRATE	627-13-4
1341 PROPYLENE DICHLORIDE	78-87-5
1342 1,2-PROPYLENE GLYCOL DINITRATE	6423-43-4
1343 PROPYLENE GLYCOL MONOMETHYL ETHER	107-98-2
1344 PROPYLENE OXIDE	75-56-9
1346 RESORCINOL	108-43-3
1347 RHODIUM (METAL FUME & INSOLUBLE COMPOUNDS)	7440-16 6
1348 RHODIUM (SOLUBLE SALTS)	7440-16-6
1349 RONNEL	299 84 3
1350 ROSIN CORE SOLDER PYROLYSIS PRODUCT (AS HCHO)	NONE

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1351 ROUGE, TOTAL DUST	NONE
1352 SILICA, AMORPHOUS, DIATOMACEOUS EARTH	68855-54-9
1353 SILICA, AMORPHOUS, PRECIPITATED OR GEL	NONE
1354 SILICA, CRYSTALLINE-CRISTOBALITE	14464-46-1
1355 SILICA, CRYSTALLINE QUARTZ, RESPIRABLE	14808-60-7
1356 SILICA, CRYSTALLINE TRIDYMITE	15468-32-3
1357 SILICA, CRYSTALLINE TRIPOLI (AS QUARTZ DUST)	1317-95-9
1358 SILICA, FUSED	60676-86-0
1359 SILICON	7440-21-3
1360 SILICON CARBIDE	409-21-2
1361 SILICON TETRAHYDRIDE	7803-62-5
1362 SILVER, METAL, DUST, AND FUME	7440-22-4
1363 SOAPSTONE, TOTAL DUST	NONE
1363A SOAPSTONE, RESPIRABLE DUST	NONE
1364 SODIUM AZIDE	26628-22-8
1365 SODIUM BISULFITE	7631-90-5
1366 SODIUM FLUOROACETATE	62-74-8
1367 SODIUM HYDROXIDE	1310-73-2
1368 SODIUM METABISULFITE	7681-57-4
1369 STARCH, TOTAL DUST	NONE
1371 STODDARD SOLVENT	8052-41-3
1372 STYRENE (PHENYLETHYLENE)	100-42-5
1373 SUBTILISINS (PROTEOLYTIC ENZYMES)	9014-01-1
1374 SUCROSE, TOTAL DUST	57-50-1
1375 SULFUR DIOXIDE	7446 09 5
1376 SULFUR MONOCHLORIDE	10025-67 9

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S Number/Chemical Name		CAS Number
1377	SULFUR PENTAFLUORIDE	5714-22-7
1378	SULFUR TETRAFLUORIDE	7783-60-0
1379	SULFURYL FLUORIDE	2699-79-8
1380	SULPROFOS	35400-43-2
1381	TALC (NON-ASBESTIFORM)	14807-96-6
1382	TANTALUM	7440-25-7
1383	TEMEPHOS	3383-96-8
1384	TERPHENYLS	26140-60-3
1385	1,1,2,2-TETRACHLOROETHANE	79-34-5
1386	TETRAETHYL LEAD	78-00-2
1387	TETRAHYDROFURAN	109-99-9
1388	TETRAMETHYL LEAD	75-74-1
1389	TETRASODIUM PYROPHOSPHATE	7722-88-5
1391	4,4'-THIOBIS (6-TERT-BUTYL-M-CRESOL)	96-69-5
1392	THIOGLYCOLIC ACID	68-11-1
1393	THIONYL CHLORIDE	7719-09-7
1394	TIN (ORGANIC COMPOUNDS)	7440-31-5
1395	TIN OXIDE	18282-10-5
1396	TITANIUM DIOXIDE	13463-67-7
1397	TOLUENE	108-88-3
1398	TOLUENE-2,4-DIISOCYANATE	584-84-9
1399	O-TOLUIDINE	95-53-4
1400	P-TOLUIDINE	106-49-0
1401	M-TOLUIDINE	108-44-1
1402	TRIBUTYL PHOSPHATE	126-73-8
1403	1,1,2 TRICHLORO-1,2,2 TRIFLUOROETHANE	76-13-1

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name		CAS Number
1404	TRICHLOROACETIC ACID	76-03-9
1405	1,2,4-TRICHLOROBENZENE	120-82-1
1406	TRICHLOROETHYLENE	79-01-6
1407	1,2,3-TRICHLOROPROPANE	96-18-4
1408	TRIETHYLAMINE	121-44-8
1409	TRIMELLITIC ANHYDRIDE	552-30-7
1410	TRIMETHYL PHOSPHITE	121-45-9
1411	TRIMETHYLAMINE	75-50-3
1412	TRIMETHYLBENZENE	25551-13-7
1413	2,4,6-TRINITROTOLUENE (TNT)	118-96-7
1414	TRIORTHOCRESYL PHOSPHATE	78-30-8
1415	TRIPHENYL AMINE	603-34-9
1416	TUNGSTEN & COMPOUNDS (INSOLUBLE)	7440-33-7
1417	TUNGSTEN & COMPOUNDS (SOLUBLE)	7440-33-7
1418	URANIUM (INSOLUBLE COMPOUNDS)	7440-61-1
1419	URANIUM (SOLUBLE COMPOUNDS)	7440-61-1
1420	N-VALERALDEHYDE	110-62-3
1421	VANADIUM (V_2O_5, DUST)	7440-62-2
1422	VANADIUM (V_2O_5, FUME)	7440-62-2
1423	VEGETABLE OIL MIST	NONE
1424	VINYL ACETATE	108-05-4
1425	VINYL BROMIDE	593-60-2
1426	VINYL CYCLOHEXENE DIOXIDE	106-87-6
1427	VINYL TOLUENE	25013-15-4
1428	VINYLIDENE CHLORIDE	75-35-4
1429	VM & P NAPHTHA	8032-32-4

TABLE I-E. List of Substances for Which ACGIH Recommendation Differs From OSHA's Current Standard (continued)

H.S. Number/Chemical Name	CAS Number
1430 WELDING FUMES (TOTAL PARTICULATE)	NONE
1430a WOOD DUST, HARD WOOD	NONE
1430b WOOD DUST, SOFT WOOD	NONE
1431 XYLENE (O,M,P-ISOMERS)	1330-20-7
1432 M-XYLENE-ALPHA,ALPHA'-DIAMINE	1477-55-0
1433 XYLIDINE	1300-73 8
1434 ZINC STEARATE	557-05-1
1435 ZINC CHLORIDE FUME	7646-85-7
1436 ZINC CHROMATES (CrVI)	13530-65-9
1437 ZINC OXIDE (FUME)	1314-13-2
1438 ZINC OXIDE, TOTAL DUST	1314-13-2
1439 ZIRCONIUM COMPOUNDS	7440-67-7

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F. Identification of Substances Requiring Special Attention

As previously noted, the substances to be considered in this proposed rulemaking are defined by the aodpted 1987–88 ACGIH TLV's. The use of some boundary for this rulemaking is necessary to avoid the impossible task of considering over 100,000 chemicals which exist in U.S. workplaces. Use of a single source to identify such a boundary is necessary to provide a clearly defined reference point for additional analyses. Since the 1968 ACGIH TLV's were used (through the Walsh-Healey Act) as the primary basis for the existing Z-Tables adopted in 1971, and since the 1987–88 TLV's represent the most extensive data base available (as described in a previous section of the preamble), selection of the TLV's to satisfy the objective of setting a boundary, is appropriate.

While the adopted 1987–88 ACGIH TLV's define the boundaries for this proposed rulemaking, the OSHA analysis (previously described) will consider both the 1987–88 ACGIH TLV's and NIOSH REL's as the potential alternatives for selecting replacements for the existing OSHA PEL's noted in the § 1910.1000 Z-Tables, or expansion of these Z-Tables.

Twenty or more years have elapsed since the TLV's forming the basis for OSHA's PEL values were set. During the interim, a great deal of knowledge has been gained regarding the hazards of these and other substances generally found in the workplace. Control technologies have evolved during this same time, altering previous standards of feasibility for workplace exposures.

OSHA realizes that while this proposal represents a major improvement in health protection, it is also necessary that OSHA evaluate the appropriateness of the individual TLV's or REL's OSHA should also identify any individual substances which will require: (1) Special attention as part of this rulemaking, or (2) follow-up rulemaking activities.

Of the 428 substances considered in this proposed rulemaking, approximately 75 involved changes to the existing OSHA TWA; approximately 70 involve the addition of, or changes to, a STEL in conjunction with an existing PEL; approximately 25 involve changes to both the TWA and STEL; and 205 involve establishment of some allowable exposure limit where none existed before. These four categories cover most of the 428 substances to be covered by this proposal.

In most instances, proposed new PELs establish lower permissible exposure limits or establish exposure limits where none existed before. In a very limited number of instances, however, the permissible exposure limits could be increased in keeping with the best current judgment regarding toxicity, hazard, and risk for the specific substance in question. In those instances, OSHA will ascertain that the legal requirements for increasing an established PEL are satisfied. The details of this requirement are noted in that part of section IV of this preamble dealing with substances falling within this category.

Since two independent sources will be used to develop new PEL's it is necessary to indicate what criteria will be used to identify substances where the TLV and REL "differ significantly." These substances will undergo additional analyses to resolve the different recommendations. For this rulemaking a "significant difference" is presumed *NOT* to exist when:

(a) The TLV and REL values are the same.

(b) TLV and REL values differ by less than 10%.

(c) The TLV and REL Time Weighted Averages (TWA) are the same, but there are differences in the Short Term Exposure Limit (STEL) or Ceiling (C).

(d) The TWA in one data base is the same, or one-half, the STEL/C in the other data base.

OSHA realizes that (c) and (d) represent simplification of the standard setting analysis. For both (b) and (c) situations, the TLV values will be used since they represent a logical extension of the existing Z-Tables, which are based on the 1968 TLV's. This approach is intended to facilitate the proposed changes for a large number of substances. Evidence may be introduced into the record which will permit further analysis of these situations. OSHA will consider comments on this procedure prior to final rulemaking. Based on comments, priorities and administrative resources, OSHA will consider if proposing further refinements in the future is appropriate.

For situation (d), the data base providing a TWA value will be used, since this type of limit represents a more typical exposure monitoring situation. This will result in the adoption of PEL's based either on a TLV or REL.

On the basis of these criteria, Table I–F–A lists 35 substances where there is a "significant difference" between the TLV and the REL, and the REL is lower than the TLV. Table I–F–B lists 9 substances for which there is a "significant difference", and the REL is higher than the TLV. Individual evaluations will be performed by OSHA for each of the substances listed in these Tables.

The approach of using primarily exposure limits from two well-established sets of guidelines carries with it the responsibility for OSHA to determine also which of these limits is appropriate in light of the statutory and legal requirements that OSHA must satisfy. OSHA describes in the following text these circumstances where consideration of other factors may be appropriate. OSHA requests comments on these proposed circumstances and/or the alternate procedures for handling these situations (described in section I–G).

To satisfy these requirements, and complete the objectives of revision and expansion for a large number of exposure limits in a reasonable time period, OSHA will identify two special situations by comparing the ACGIH TLV's with exposure limit guidelines developed by: (1) United Kingdom 1987 Occupational Exposure Limits (OEL); (2) West German—1985 Maximum Allowable Concentrations (MAK); (3) Japanese Permissible Exposure Limits—1983; (4) Swedish-Allowable Workplace Air Concentrations—1984. OSHA will consider the significance of differences among these sources, and take appropriate action in each case. Use of the TLV's as a reference point for this comparison is dictated by the fact that the TLV's define the boundary for the substances to be considered in this proposed rulemaking, and any significant differences between the TLV's and REL's are considered in the evaluation previously noted for substances listed in Tables I–F–A and I–F–B.

OSHA proposes to identify these two special situations as follows:

(a) At least three of the four alternate data bases recommend allowable exposure limits that are less than the 1987–88 ACGIH-TVL's. Five substances fall into this category, and are identified in Table I–F–C. This criterion avoids undue consideration of any single low proposed exposure limit, and identifies those instances where there is reasonable uncertainty regarding the proper levels which will improve worker protection. One of these substances noted in Table I–F–C is also identified in Table I–F–B.

(b) At least three of the four alternate data bases recommend allowable exposure limits which are *greater* than the 1987–88 ACGIH-TLV's. Ten substances fall into this category, and these are identified in Table I–F–D. Two of the substances noted in Table I–F–D are also noted in Table I–F–B. and four

of these substances are listed in Table I–F–A.

Special situations are also indicated for the following three circumstances:

(c) The 1987–88 TLV exceeds the existing PEL. When considering these substances, OSHA will ascertain that the legal requirements detailed in the cotton dust preamble (50 FR 511 32–3, Dec. 13, 1985) for increasing or eliminating an existing PEL are satisfied. Analyses of these situations are detailed in that part of section IV which discusses substances for which current ACGIH TLV's are less stringent than current OSHA limits.

(d) The available analytical and sampling methods are not adequate to measure the air concentrations of a specific chemical. OSHA has reviewed this concern and has identified 7 substances for which adequate sampling and analytical methods are not available. These are listed in Table I-F-E and details regarding analytical procedures are provided in Appendix A. OSHA will consider if rulemaking can proceed for such substances, with final implementation being deferred until OSHA or others develop the necessary sampling and analytical procedures.

(e) Substances for which recent information suggests that the 1987–88 TLVs or REL's may not be appropriate. OSHA will consider this aspect prior to final rulemaking if the hearing record provides relevant additional information. This category may include substances such as carcinogens, which have implicit or explicit recommendations to maintain exposures to levels which are: As low as feasible; as low as detectable; minimal; as low as practical; etc. Clearly, the use of detection limits as a PEL does not fully consider the feasibility issue. OSHA preliminarily believes that such substances cannot be considered in this rulemaking without greatly extending the decision process, and inordinately delaying changing the PEL's for 428 substances. Therefore, it would be more appropriate to proceed only on the basis of available, quantitative information provided by the TLV's or REL's. OSHA intends future consideration, using individual rulemaking, for such substances.

OSHA invites public comments on the five special situations identified. OSHA also is interested in learning of any chemicals which should be added to, or deleted from the listing in Tables I-F-A through I-F-E. Such suggestions should clearly indicate the basis and supporting data for any requested changes.

Table I-F-A

Significant Difference between REL and TLV REL lower than TLV

1. Acetone
2. Acretonitrile
3. Beryllium and its compounds
4. n-Butyl glycidyl ether
5. Carbon disulfide
6. Carbon monoxide
7. Carbon tetrachloride
8. Chlorine
9. Chloroform
10. Chloroprene
11. Chromic acid and chromates, non-carcinogenic
12. Dioxane
13. Ethylene dichloride
14. Ethylene glycol dinitrate
15. Fibrous glass dust
16. n-Heptane
17. Hexane Isomers
18. 2-Hexanone (methyl n-butyl ketone)
19. Hydrazine
20. Hydrogen cyanide
21. Mercury (aryl and inorganic compounds)
22. Mesityl oxide
23. Methyl propyl ketone
24. Nickel (soluble compounds)
25. Nitroglycerin
26. Nitrogen dioxide
27. Octane
28. Pentane
29. Petroleum distillates (naphtha)
30. Phenylhydrazine
31. Silica, crystalline quartz, respirable
32. Sulfur dioxide
33. Trichloroethylene
34. Vinyl acetate
35. Zinc chromate

Table I–F–B

Significant Difference Between REL and TLV REL Higher than TLV

1. Acrylamide
2. Ammonia
3. Carbon dioxide
4. Furfuryl alcohol
5. n–Hexane
6. Isophorone diisocyanate
7. Malathion
8. Methyl n-amyl ketone
9. Stoddard solvent

Table I–F–C

Substances Requiring Special Attention

At least three data base exposure limits are less than the ACGIH TLV's.

1. Furfuryl alcohol
2. Methyl chloroform
3. Selenium
4. Tetraethyl lead
5. Tetramethyl lead

Table I–F–D

Substances Requiring Special Attention

At least three data base exposure limits are greater than the ACGIH TLV's.

1. Acrylamide
2. Carbon tetrachloride
3. Cobalt
4. Ethylene glycol dinitrate
5. Furfural
6. n–Hexane
7. Methylene chloride
8. Nitroglycerin
9. Toluene di-isocyanate
10. Zinc chromate

Table I–F–E

Substances Requiring Special Attention

Inadequate Analytical or Sampling Methods

1. Aluminum alkyls
2. Cyanamide
3. Ethylidene norbornene
4. Hexafluoracetone
5. Mercury (alkyl compounds)
6. Subtilisins
7. Sulfur pentafluoride

G. Alternate Procedures for Dealing with Substances Requiring Special Attention

In previous sections of this preamble, OSHA has indicated an approach where different recommendations exist for an individual TLV or REL. For these substances an extended analysis of the health and feasibility data was performed to determine which level will be proposed. Evaluation of feasibility and significance of risk are statutory requirements which OSHA must follow. The absence of any evidence indicating these requirements are satisfied would preclude OSHA from adopting a PEL. Therefore, permissible exposure levels cannot be adopted if they are primarily based on limits of detection, or similar concepts, unless OSHA's legal requirements are satisfied.

OSHA is also considering three possible alternative procedures for the substances categorized according to the criteria previously described, as requiring special attention (Tables I–F–C, and I–F–D). Any additional substances which may be identified during the rulemaking process as requiring special attention may receive similar treatment.

The first alternative would be to review in depth all the available health effects data for each of these substances, the data and reasoning which lead to the different allowable exposure limits, the criteria of the organization providing each

recommendation, relative dates of adoption, and the applicability of supporting data to typical workplaces in the United States. Based on this analysis, OSHA could adopt either the REL, TLV or some other recommended or other allowable exposure limit. This would require preparation of numerous mini-standards, a major time commitment by OSHA, and would probably result in a significant delay in the adoption of 428 new or revised permissible exposure limits proposed in this rulemaking.

A second approach would be to identify the substances noted in Section I–F–, Tables C, and D, (plus any additional substances identified during the rulemaking process) as requiring possible individual follow-up evaluation and possible separate rulemaking but adopt the proposed PEL or another level if clear evidence is presented to the record. This approach would: permit prompt updating and expansion of all the PEL's noted in the Z–Tables on the basis of either the TLV or REL; use the current rulemaking analyses to identify chemicals requiring priority consideration regarding their PEL; and reduce conflicts among the several allowable exposure guidelines which currently face many industrial health protection organizations. Future rulemaking based on OSHA priorities could consider the necessary and appropriate refinements based on all the available evidence.

A third approach would be to maintain the current OSHA PEL's for the substances noted in Section I–F, Tables C, and D (plus any additional substances identified during the rulemaking process), while revising the remaining substances on the basis of TLV or REL guidance. These unchanged substances would then be identified for future follow-up evaluations and possible separate rulemaking under 6(b) provisions. This is similar to the second approach but without benefit of the updating process.

OSHA invites comments on these three options and others, so they can be considered in the final rulemaking. OSHA initially believes that the second approach is the best option since it promptly provides health protection for over 400 substances of concern, when the evidence indicates it is needed.

The substances identified in Table I–F–E, where OSHA is not aware of an adequate analytical method, present a different situation. OSHA is considering issuing the proposed new PEL's if supported by the record on health and feasibility grounds. OSHA would also consider staying these PEL's until an analytical procedure becomes available. OSHA requests comments on this, or alternate approaches.

H. Construction, Maritime and Agriculture Segments

Currently the exposure limits which apply to construction are the ACGIH Threshold Limit Values of Air Contaminants for 1970 and certain substance specific section 6(b) standards. See 29 CFR 1926.55, 58 and 29 CFR 1910.19. OSHA is to consult with the Advisory Committee on Construction Safety and Health prior to proposing new standards that have a major impact on construction. See 29 CFR 1911.10(a). OSHA is in the process of consulting with the Construction Advisory Committee. After receiving their recommendations, OSHA intends to propose amendments covering exposures to toxic substances in construction reflecting the facts in this proposal and the views of the Construction Advisory Committee.

Parts 1916, 1917 and 1918 of 29 CFR cover, respectively, employment in shipyards, marine terminals and longshoring. Part 1916 for shipyards references the 1970 TLV's of the ACGIH. See 29 CFR 1915.5 and 1915.12 (b)(3). Part 1917 for marine terminals references the current Z–Tables. See 29 CFR 1917.2(p), and 1917.23. Part 1918 for longshoring refers to "dangerous gaseous contaminants not immediately dangerous to life" and "heavy concentrations of dusts." See 29 CFR 1918.93 (e) and (f). Certain substance specific section 6(b) standards also cover these industries. See 29 CFR 1910.19.

OSHA, as part of the rulemaking covering construction, intends to consider applying this proposal to the maritime sectors.

Subpart Z of 29 CFR Part 1910, and the included Z–Tables specifically do not apply to Agriculture. See 29 CFR 1928.21(b). In addition, many of the chemicals which affect agriculture are pesticides regulated by the EPA over which OSHA may not have jurisdiction, pursuant to section 4(b)(1) of the OSHA Act. In the future OSHA will consider based on relevance, priorities and administrative resources if it is appropriate to consider coverage for agriculture.

II. Pertinent Legal Authority

The publication of a final standard is authorized by sections 6 and 8 of the Occupational Safety and Health Act of 1970 (the Act), 29 U.S.C. 655 and 657. Section 6(b)(5) governs the issuance of occupational safety and health standards dealing with toxic materials or harmful physical agents. It states:

> The Secretary in promulgating standards dealing with toxic materials or harmful physical agents under this subsection shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life. Development of standards under this subsection shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the feasibility of standards, and experience gained under this and other health and safety laws. Whenever practicable, the standard promulgated shall be expressed in terms of objective criteria and of the performance desired.

Section 3 (8) defines an occupational safety and health standard as "a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment."

The Supreme Court has held under the Act that the Secretary, before issuing any new standard, must determine that it is reasonably necessary and appropriate to remedy a significant risk of material health impairment. *Industrial Union Department* v. *American Petroleum Institute*, 448 U.S. 607 (1980). The Court stated that "* * * before he can promulgate any permanent health or safety standard, the Secretary is required to make a threshold finding that a place of employment is unsafe in the sense that significant risks are present and can be eliminated or lessened by a change in practices" (448 U.S. at 642). The Court also stated "that the Act does limit the Secretary's power to require the elimination of significant risk" (448 U.S. 644, n. 19).

The Court indicated, however, that the significant risk determination is "not a mathematical straitjacket," and that "OSHA is not required to support its finding that a significant risk exists with anything approaching scientific certainty." The Court ruled that "a reviewing court [is] to give OSHA some leeway where its findings must be made on the frontiers of scientific knowledge (and that) * * * the Agency is free to use conservative assumptions in interpreting the data with respect to carcinogens, risking error on the side of over protection rather than under protection" (448 U.S. at 655, 655).

The Court also stated that "while the Agency must support its finding that a certain level of risk exists with substantial evidence, we recognize that its determination that a particular level of risk is 'significant' will be based largely on policy considerations." (488 U.S. at 655, n. 62).

After OSHA determines that a significant risk exists and that such risk can be reduced or eliminated by the proposed standard, it must set a standard which is technologically and economically feasible. In *American Textile Manufacturers Institute* v. *Donovan*, 452 U.S. 490 (1981) the Supreme Court held that "cost-benefit analysis is not required by statute because feasibility analysis is" (452 U.S. 531, n. 32). For non-threshold toxic substances, the aim is to set the lowest feasible level necessary to eliminate significant risk.

As stated above in the history and approach sections of the preamble, OSHA has concluded that updating the Z-tables to reflect recent information is the highest priority for the Agency. This will reduce exposure limits for approximately 200 substances regulated currently by the Z-tables and add exposure limits for approximately 200 substances. The health; literature indicates this must be accomplished to improve worker health: it is one of Congress's concurrent goals and will greatly increase occupational health protection for a very large number of workers.

In order to accomplish this high priority task in a reasonable time in the light of limited administrative resources, it is necessary to narrow somewhat the issues to be faced by the agency in this proceeding. Consequently, it is necessary to delay other worthwhile goals and concurrent Congressional purposes to a later stage.

This approach is consistent with general principles of administrative law. An agency may set priorities within the framework of its statutory authority. Secondly, an Agency may take substantial steps towards its statutory goals without having to achieve them completely at the first stage, when agency resources are not sufficient to complete all aspects initially.

Section 6(g) of the OSHA Act clearly indicates that OSHA has authority to set priorities among competing occupational health and safety goals. It states:

> In determining the priority for establishing standards under this section, the Secretary shall give due regard to the urgency of the need for mandatory safety and health standards for particular industries, trades, crafts occupations, businesses, workplaces or work environments. The Secretary shall also give due regard to the recommendations of the Secretary of Health, Education, and Welfare regarding the need for mandatory standards in determining the priority for establishing such standards.

Several Court decisions recognize that OSHA has some discretion in setting priorities. For example, the District of Columbia Circuit Court stated,

> The Act has built in flexibilities that the Secretary may use, such as his right to initially determine whether or not there will be a standard; what the standard will be; the priorities between the various occupations that may require standards; the altering and changing of those priorities even though once set; the forgiving of inaction where the Secretary makes a contemporaneous statement of reasons; the right to delay hearings; to process higher priority standards more quickly than initiated ones . . . Since the Congress left such open-ended discretion in the Secretary at many key points in the Act, including Section 6(g) we find implicit acknowledgement that traditional agency discretion to alter priorities and defer action due to legitimate statutory considerations was preserved. *National Congress of Hispanic Cit.* v. *Usery* 554 F. 2d 1196, 1199–1200, (1977). See also *National Cong.* v., *Marshall*, 626 F. 2d 882, 889 (1979).

Similarly, the Court stated, in regard to delaying a relevant decision to a later stage, in *Natural Resources Defense Council* v. *S.E.C.*, 606 F. 2d 1031 (1979) that,

> Deference to the SEC's decision to consider environmental disclosure in another proceeding is in our view, appropriate. Our discussion of the scope of review of agency rulemaking shows that the quasi-legislative nature of rulemaking requires even greater agency freedom to manage and structure decisionmaking than is required in licensing or adjudication. (1056)

It also stated.

> the Agency alone is cognizant of the many demands on its, its limited resources, and the most effective structuring and timing of proceedings to resolve those competing demands. An agency is allowed to be master of its own house, lest effective agency decisionmaking not occur in any proceeding; and judicial review awaits the agency's conclusion of its proceedings. See Myers v. Bethlehem Shipbuilding Corp., 303 U.LS. 41, 58 S.CT 459, 82L.ED. 638 (1938). (p. 1056)

Within this context the ACGIH's Threshold Limit Values and NIOSH Recommended Exposures Limits have been used in determining the substances to give priority to in this proceeding. They have also been used as a starting point for OSHA's significant risk and feasibility analysis. See also the other criteria used which are discussed in the "History" and "Additional Factors" sections.

Secondly, OHSA has concluded that setting exposure limits for these chemicals has priority at this stage over exploring the need for accompanying medical surveillance, monitoring and industrial hygiene provisions. Section 6(b)(7) of the Act, of course, indicates that "where appropriate" such provisions are to be included. That was a concurrent goal of Congress as was Congress' goal to lower exposure for the many unregulated or inadequately regulated substances when scientific data indicates lower exposures are needed.

OSHA has inadequate time to accomplish both goals at this time. Lowering exposures is a higher priority because it is more effective in reducing diseases and material impairments of health.

OSHA has already addressed some of section 6(b)(7)'s goals, labels and warnings, in the Hazard Communication Regulation, 29 CFR 1910.1200 for all substances. It is working on a standard to improve respirator use for all chemicals (47 FR 20803). It is considering generic regulation for monitoring and medical surveillance. OSHA does not have the resources to conclude this rulemaking in any reasonable time, and also consider these issues.

OSHA will meet its statutory requirements to determine whether the proposed new levels substantially reduce significant risk and are feasible. OSHA's risk assessments are briefer than has been the case for rulemakings limited to single sustances. Elaborate and detailed risk assessments for these 428 substances which are generally recognized as needing new limits, would make it impossible for OSHA to address these hazards in any reasonable time period.

Many of the exposure limits are based on moderate safety factors below levels which human or animal studies report "no observed effect" (sometimes called a "threshold"). Incorporation of a moderate safety factor does not result in setting a limit below which significant risk is eliminated. Many of the studies are of small scale and do not have the scientific quality (statistical power) to demonstrate that a "no observed effect level" has been shown. In many instances interpretation of health effects studies must account for inter-species and intra-species variability, and the lack of statistical power.

Finally, when the reported no-effect level is based on animal date, consideration must be given to the fact that humans may be more or less sensitive than the animals. All experts in this situation recommend setting an exposure limit which includes a safety factor from the reported no observed effect level in animals. Therefore, a

moderate safety factor below the level which is hypothesized, or reported as demonstrating no observed effect, does not put OSHA in the position of proposing a limit below the level where there is insignificant risk.

In this rulemaking, OSHA is also proposing new exposure limits for some possible carcinogens and some other chemicals for which there may be a remaining significant risk. It is possible that much more detailed analysis or new data might find that a lower limit than OSHA proposed would both reduce remaining significant risk and be feasible.

However, OSHA preliminarily believes that to address those questions in this rulemaking would significantly delay completion of this rulemaking which substantially improves health protection for many millions of workers.

OSHA's experience in ethylene oxide, benzene, formaldehyde, asbestos and other such substances, indicates that these issues take a large amount of administrative and scientific resources for each substance. Consequently, OSHA preliminarily concludes that it is appropriate to complete this action as first priority. In the future, based on priorities, OSHA will explore the issue that for some substances lower limits might be determined to be appropriate after more extensive analysis.

III. Glossary

The following terms and acronyms appear in the proposed standard and the preamble supporting it. This glossary is provided as a convenience to the reader.

ACGIH—American Conference of Governmental Industrial Hygienists.

CHRIS—Chemical Hazard Response Information System, a data base developed for use by the U.S. Coast Guard.

HSDB—Hazardous Substances Data Bank, a data base developed by the National Library of Medicine.

IARC—International Agency for Research on Cancer.

ILO—The International Labor Organization, and agency of the United Nations.

IMIS—The Integrated Management Information System, a source of enforcement data developed by and for OSHA.

MSDS—Material Safety Data Sheet, a means of disseminating risk information and safe handling information to workers; it is required by OSHA's Hazard Communication Standard (29 CFR 1910.1200).

NIOSH—The National Institute for Occupational Safety and Health, a research agency located within the Department of Health and Human Services.

NOES—National Occupational Exposure Survey, a compilation of data about the prevalence of certain chemicals in workplaces based on a survey of some 4000 workplaces.

OCIS—OSHA Computerized Information System, a data base containing records of laboratory analyses of air contaminant samples, gathered during OSHA inspections.

OSHA HS Number—OSHA has identified each substance considered in their rulemaking with a unique 4-digit number, referred to as the "Health Standard (HS) number." This step was taken for ease of reference and convenience of readers.

PEL—Permissible Exposure Limit, the exposure limits contained in OSHA's air contaminant standard. (See "Z-Tables")

REL—Recommended Exposure Limit, produced by NIOSH and publicized through Criteria Documents and Current Intelligence Bulletins.

RTECS—Registry of Toxic Effects of Chemical Substances, a NIOSH publication.

TLV—Threshold Limit Value, a recommended exposure limit produced by the ACGIH.

TSCA—Toxic Substances Control Act, administered by the Environmental Protection Agency, EPA.

WHO—World Health Organization, an agency of the United Nations.

IV. Substances to be Regulated

A. General Principles of Toxicology and Dose-Response

As long ago as the 16th century, people recognized that there is no such thing as an absolutely safe chemical. The Swiss physician Paracelsus, who live from 1493 to 1541, said:

> All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy.

On the other hand, methods have been devised to permit any chemical, no matter how poisonous, to be handled safely; this is done either by limiting the dose or controlling the exposure. However, before the necessary degree of control can be determined for a particular exposure or situation, the toxicity of the substance in question must be known. The paragraphs that follow describe the methods used by scientists to measure the relative toxicity of substances and to select exposure limits that will prevent exposed individuals from suffering adverse effects from such exposures. As this discussion demonstrates, methods of choosing exposure limits must, because of the lack or inadequacy of dose-response information for most chemicals, rely heavily on experience in the use of these substances and on scientific and professional judgment.[1]

Chemicals range in inherent toxicity from those that are relatively harmless even after large doses have been administered to others that cause death if encountered even in small quantities. Toxicologists rank chemicals by categories that range from practically non-toxic (an adult human would have to consume a quart) to supertoxic (fewer than 7 drops would be lethal for most people).

In the occupational setting, it is the risk associated with a particular use of a chemical rather than its inherent toxicity that is important. *Risk* can be defined as the probability that a substance will produce harm under certain conditions of use. The converse of risk is *safety*, which is the probability that no harm will occur under specific circumstances.

The degree of hazard associated with exposure to a specific substance depends on the manner in which it is handled in a particular situation: A supertoxic chemical that is processed in a closed, isolated system may be less hazardous in actual use than a relatively low-toxicity compound handled in an open batch process. Another factor affecting the ability of a chemical to elicit a toxic response is the susceptibility of the biological system or individual. For the relative degree of hazard to be known in a particular instance, this requires knowledge about the chemical agent, the exposure situation, and the exposed subject. In addition, the route of administration and the duration and frequency of exposure must be known.

Route of Exposure

There are four principal routes of exposure by which toxic substances can invade humans or animals. These are inhalation, ingestion, dermal absorption, and parenteral administration (i.e., administration through routes other than the intestinal canal). The route of administration of a toxin also affects the relative toxicity of the agent. For example, a chemical that can be detoxified in the liver will be less toxic if it is administered orally than if it is given systemically (i.e., inhaled). Studies that provide information about the relative toxicity of an agent via different routes of exposure can provide a considerable amount of information

[1] The material in this section derives principally from the following sources: Klaasen, Amdur, and Doull, 1986; National Research Council, 1956; and Cohen, 1986a, b.

about the absorbability of the agent. For example, if exposure to a certain dose of a chemical via all routes of administration causes death within the same time period, it can be assumed that the substance in question is easily and rapidly absorbed. On the other hand, if the dermal dose of a chemical that is required to kill a subject is much higher than the dose required to produce the same effect when the chemical is ingested, one can deduce that the skin provides, to some degree, a barrier against that agent's toxicity. Other, less important elements affecting the response to a toxic substance include the relative concentration of the substance, the volume of the vehicle used to administer the chemical, the chemical and physical properties of the vehicle, and the dose rate, i.e., the period of time over which the dose is administered.

Duration and Frequency of Exposure

Scientists conduct animal experiments that involve four different types of exposure: acute, subacute, chronic, and subchronic. Acute exposures are limited to periods of less than 24 hours and can involve either single or repeated exposures within that period. Subacute exposures are repeated exposures that last for one month or less, while subchronic exposures have a duration of one to three months. When a research project having a chronic regimen is conducted, the test animals are dosed repeatedly for a period lasting more than three months. Animals exposed acutely can have both immediate and delayed-onset responses. Similarly, chronic exposures can cause immediate reactions as well as long-term effects.

The frequency of dosing also has an important influence on the magnitude of the toxic effect: A large single dose of an acute toxin will usually have more than three times the effect of one-third the dose given at three different times, and the same dose administered in 10 or 15 applications might have no effect whatsoever. The pattern of dosing is important because it is possible for some of the substance to be excreted between successive administrations or because the lesion caused by the toxin has a chance to be partially or completely repaired between applications. Thus a chronic effect is said to occur: (1) If a toxic substance accumulates in the system of an exposed person or animal because the dose absorbed is greater than the body's ability to transform or eliminate the substance; (2) if it produces adverse effects that are not reversible; or (3) if it is administered in a manner that permits inadequate time for repair or recovery.

Variation in Response

Responses to toxic insults vary in a number of ways. For example, some toxicants have immediate effects, while other are associated with delayed symptom onset. The latency period for carcinogenic agents may be as long as 40 years for some types of cancer, and even some acute agents, such as some chemicals that have adverse ocular effects, may not cause overt symptoms until hours after exposure.

Another difference in type of response concerns the reversibility or irreversibility of the effect. Reversibility depends on the site of action as well as the magnitude of the insult. That is, some tissues of the body, such as the liver, have considerable ability to regenerate; others, like the kidney or central nervous system, do not.

The site of action associated with toxic substances also varies widely. Local effects are those lesions caused at the site of first contact between the agent and the organisms. Examples of localized effects are skin burns caused by contact with a caustic substance and site-of-contact tumors that develop at the locus of the injection of the carcinogen.

In contrast to localized effects, systemic effects involve the absorption and distribution of the toxic agent from the point of entry to a distant site; the toxic response is manifested at this distant point. An example of a systemic poison is mercury, which produces its toxic effect on the central nervous system. Often, the site of deposition for a chemical is not the organ system most affected by the toxin. For example, although lead is deposited and concentrated in the bone, it affects the central nervous system. Any sites that are adversely affected by the toxic effects of exposure to a substance, whether they are sites of contact or distal sites, are called the target organs of toxicity.

In cases of systemic poisoning, the system most often affected is the central nervous system (CNS); it is common for the CNS to be involved even when another target, such as the liver, is the primary target organ of toxicity. In descending order of frequency, the systems or organs most often involved in cases of systemic poisoning are the central nervous system, the circulatory system, the blood and hematopoietic system, the visceral organs (liver, kidney, lung), and the skin.

Dose-Response

The relationship that associates the dose of a chemical with the effects it causes is called the dose-response relationship. A single data point relating a dose to a response is sufficient to establish a dose-response relationship. As additional data become available, it is possible to expand our understanding of the dose-response relationship to cover a range of doses or exposures. Dose-response is the most important single principle in toxicology, and an understanding of dose-response is important in establishing occupational or other exposure limits. Knowing how toxic substances act makes it easier to predict the potential effects of exposure. (It is, of course, generally true that lowering dose reduces response, and data are often available to demonstrate that lower doses reduce responses, at least on the grossly observable level. However, data showing that more subtle responses, e.g., those at the subcellular level, have been reduced are rarely available.)

To apply dose-response relationships, it is helpful if several types of data are available. First, it must be possible to relate a response to a particular chemical. Although basic data pointing toward causality may be available, it is often difficult to refine the dose-response relationship further. For example, epidemiological studies often identify an association between a disease and one or more causative agents. However, since information on the precise identity of the etiologic agent, the actual dose received, and the true site of the response is usually not available, it is often impossible to use data from epidemiological studies to establish a precise dose-response relation between a specific dose of a toxin and an effect.

The second condition to be met before dose-response can be established is that is must be possible to relate the response to the dose. It is relatively easy to determine that a large dose causes an obvious response. Refining the relationship, however, involves three other requirements: (1) That there be a receptor site; (2) that the response and the intensity of the response be related to the concentration of the toxin at the receptor site; and (3) that the concentration of the toxin at the site be related to the dose given.

The third principle underlying the concept of dose-response is that there be a quantifiable means of measuring the toxicity of a substance and a precise method of expressing this measured toxicity. Although lethality in test animals is often used to measure toxicity, the best form of measurement would involve quantification of the sequence of molecular events occurring during the toxic response. In the

absence of such endpoints, other good methods are available. For example, it is common to measure an effect believed to be related to the substance in question. The level of activity of an enzyme in the blood is often used as a measure of effect, e.g., serum glutamic-oxaloacetic transaminase (SGOT) levels are used to measure liver damage. Many different endpoints can be used to measure toxic effects, such as changes in muscle tone, heart rate, blood pressure, electrical activity of the brain, motor functioning, and behavior.

The most widely used endpoint, especially when a new substance is involved, is lethality in an animal test system. Lethality studies allow scientists to make comparative assessments of a chemical's toxicity as it relates to that of many other substances. Research of this type also permits the gathering of essential information on dose, duration, route of administration, site of action, and the target organ of toxicity.

Form of the Response

The classic form of dose-response is sigmoidal (Figure 1). This form characterizes the relationship between the amount of a toxin administered and the degree of response to that dose. The response is measured on the ordinate, and the dose is represented on the abscissa.

Dose-response can be thought of in two ways:

- As exposure increases, the proportion of the population that manifests the response increases;
- As exposure increases, the intensity of the response increases.

A relatively flat dose-response curve means that a large change in dose is required before there is a significant change in response. A step curve, on the other hand, means that a small change in dose will elicit a large increase in response. Although it is sometimes possible to generate a curve of the type shown in Figure 1, it is not necessary to do so to demonstrate that exposure at a given level is associated with a particular response. That is, it is not necessary to have sufficient data to define, in mathematical terms, the dose-response relationship to know that exposure at a given level is associated with adverse consequences.

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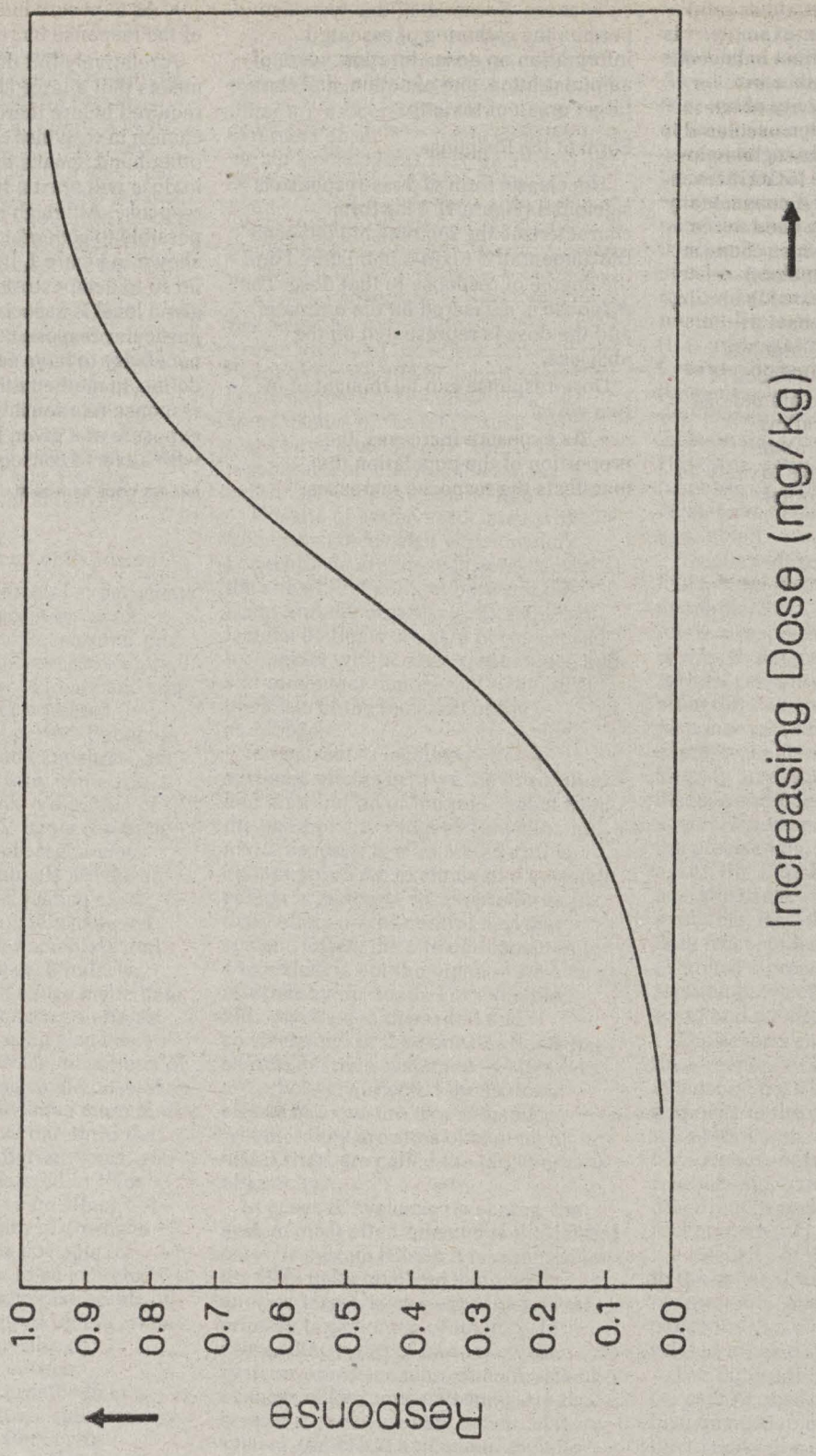
Figure 1

Diagram of dose-response relationship



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In the regulatory context, it is most common to express dose-response relations in terms of the percentage of the population responding. However, this information alone is meaningless unless the endpoint being considered is known. For every substance, there are several dose-response relationships, depending on endpoint: A substance that produces irritation at low doses may cause more severe symptoms or even death at high doses and in other conditions. For example, many substances that are mucosal irritants at low doses will produce pulmonary edema and nervous system effects at high doses.

Plotting the cumulative percentage of individuals responding against dose produces the typical sigmoid curve. Such a curve reflects the fact that at the lowest dose, zero percent of the population responds, while 100 percent of the population will respond at the highest dose. However, if the percentage responding is plotted against incremental rather than total dose, the curve produced is abnormal distribution (Figure 2). This curve says that a relatively small percentage of the population will manifest the response at the lowest dose and that a similarly small percentage of the population will exhibit the effect at the highest dose. What this normal distribution of response reflects is individual and species variation in exposed populations. A wide degree of variation occurs even in inbred, homogeneous laboratory animals, and such variability increases dramatically when a heterogeneous population, such as workers, is involved. Individuals responding at the left end of the curve shown in Figure 2 are hypersusceptible, while those at the right end could be termed resistant.

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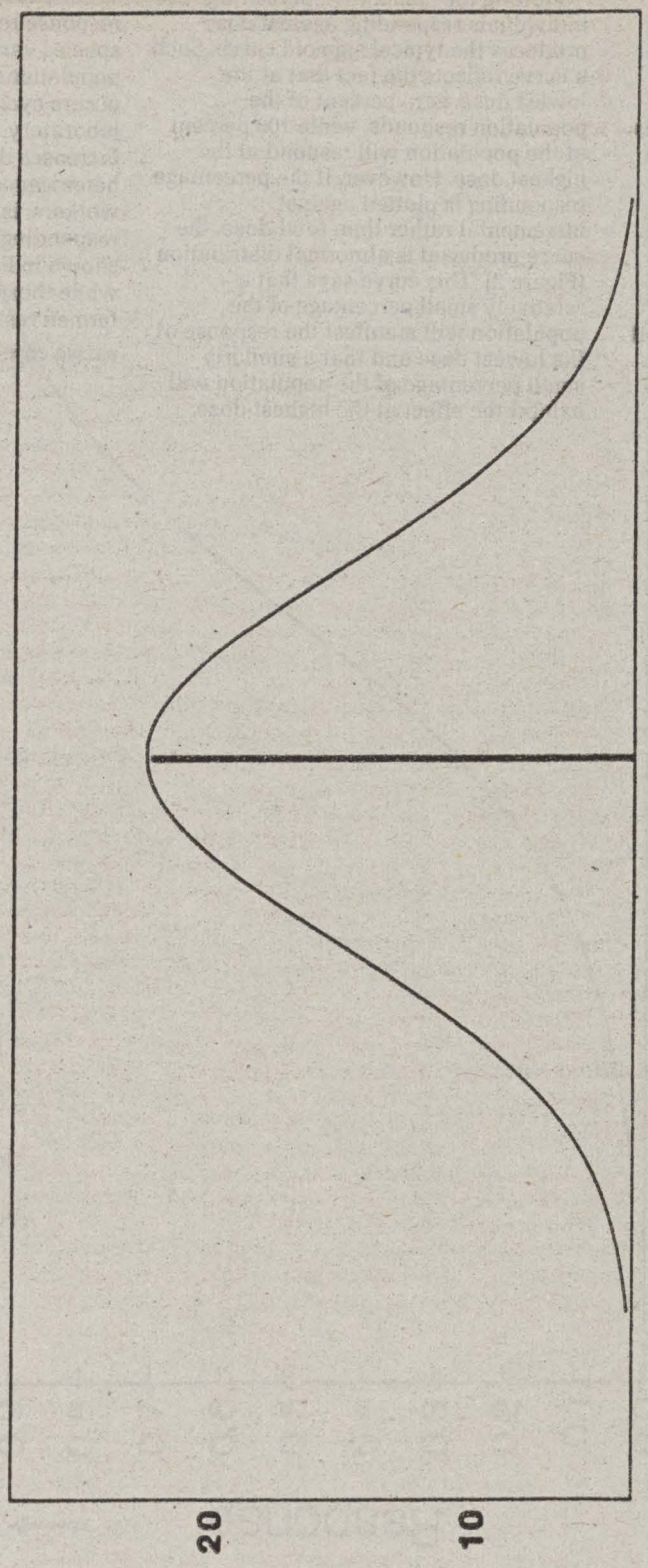
Figure 2
Diagram of quantal dose-response relationship



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Because the relationship between dose and response is sigmoidal, response approaches zero as dose approaches zero. However, because of the mathematical form used to express this relationship, a true zero response can never be achieved. In the strictest sense, therefore, a true threshold dose level (i.e., the dose with which a zero response is associated) can never be established on the basis of experimental research. Instead, scientists attempt to define the minimum dose associated with a specific endpoint, which is customarily termed the "threshold" dose for that particular endpoint. However, unless a specific endpoint, such as respiratory irritation, cholinesterase inhibition, the development of a tumor, or death, is specified, the concept of a threshold is essentially meaningless. In fact, a separate threshold could be said to exist for each of these endpoints.

The extent to which an experimentally derived "threshold" actually reflects the true threshold for a substance (i.e., the level above which a response will occur and below which no response will occur) depends on several factors, such as the number of animals used to determine the experimental threshold, the number of dose levels tested, and the degree of variation represented in the test subjects. For example, to determine an LD_{50} (the lethal dose that will kill 50 percent of the animals tested) with a high degree of precision requires the use of a minimum of 50 test animals and 5 dose groups (10 animals in each group). Other factors that can influence the magnitude of the median lethal dose include the sources involved, the sex and age of the animals, the environmental conditions prevailing during the test conditions, diet, the health status of the subjects being tested, and their past exposure to other toxic substances.

In toxicological research, the experimentally observed "threshold" dose is called the low observed effect level (LOEL) or the low observed adverse effect level (LOAEL). Alternatively, the threshold may be expressed as the highest no observed effect level (NOEL), i.e., the highest dose administered and found not to produce a given response. Determination of an accurate NOEL requires both a careful interpretation of the toxicological data and the use of an adequate number of test animals. The National Academy of Sciences (1985) has concluded that the chance of finding a no adverse effect level (that is, of missing an adverse effect) at a given dose is statistically greater in experiments having a small number of animals than in studies involving a large number of animals. Thus, the degree of confidence one has that NOEL actually represents a "safe" dose, rather than a research design artifact, increases with the number of animals tested. The greatest degree of confidence is associated with studies involving a large number of animals that were tested at several doses that were administered at close intervals.

Safety Factors

Because of the uncertainties surrounding the use of NOELs and LOELs, the difficulties of extrapolating from animals to humans, and the problems involved in trying to account for biological variability (both across species and within the same species), regulators and others have used safety factors to aid them in setting permissible exposure limits. Safety factors are margins applied to the NOEL or LOEL to determine a level believed to be "safe." Safety margins are necessary because studies designed to establish NOELs and LOELs do not generally pick up other-than-gross-organ responses or include hypersusceptible individuals. Regulatory agencies and limit-setting organizations have traditionally used safety factors ranging from 2 to 1,000.

These factors are designed to account for:

- Sensitive members of a population;
- Extrapolation from animals to human; and
- Administration of a substance via a different route.

Additional safety factors may be applied if the toxicological endpoint assessed by the NOEL or LOEL is an insensitive one, e.g., lethality. This is necessary because the dose that is "safe" for an insensitive endpoint will not really be safe in terms of any adverse effects occurring before that endpoint is reached. That is, the LOEL associated with convulsions caused by a neuropathic agent will not be safe or protective against the decrement in mental capacity observed in animals or people long before convulsions occur; to give another example, a dose that is "safe" in terms of lethality is often sufficient to cause serious damage to various organ systems.

Types of Toxicological Evidence

The evidence available to scientists wishing to evaluate the toxicity of a substance can be derived from studies in laboratory animals, in-vitro studies in cell or tissue systems, reports of clinical observations, studies of exposed human populations, or from intervention studies conducted with human volunteers. The preceding paragraphs have described animal studies (or "bioassays"). The following section discusses the two most common types of human evidence: Data derived from clinical observations and information from epidemiological studies.

Clinical observations. Much of the data on the toxic effects associated with human exposures have come from industrial accidents, fatal poisonings, or other such tragedies. This information is generally more useful in delineating broad categories of pathological effects than in refining a specific dose-response relationship, because the exposure levels causing the accident are known to be high but cannot be quantified with precision.

Epidemiological studies. Studies conducted by epidemiologists are designed to reveal the patterns of disease or mortality prevailing in certain groups of people (usually workers) exposed to a single toxin or to a group of substances. One of the advantages of epidemiological studies is that they involve humans and their responses to actual situations. The interpretation of the results of epidemiological studies is complicated by the inevitable presence of confounding variables that occur whenever human populations are involved. Ideally, the populations being studies (i.e., the study population and the control population) should be fully comparable with regard to every variable except the single characteristic under study. Because it is rarely possible to achieve this degree of comparability, statistical techniques are often used to attempt to adjust for this lack of comparability. In addition, if the measured effect is relatively large, it is unlikely that confounding factors will obscure the true picture.

Broadly speaking, epidemiological studies can have two possible outcomes: They can report an effect or they can report no effect; in the former case, the study is termed a positive study, and in the latter, a negative one. Within each of these categories, it is possible for the study to be correct (that is, to give a true-positive or true-negative result) or to be incorrect (that is, to give a false-positive or a false-negative result). A false-positive result reports that there is an increased risk when in fact there is not, and a false-negative study reports that there is no increased risk when in fact there is.

The probability that a study will detect a statistically significant effect if that effect is actually present is called the power of the study. As the power of a study increases, the likelihood of producing a false-negative error decreases. Power is dependent on two factors: The level of relative risk being

evaluated and the number of cases of the effect (i.e., disease) that are expected in the population being studied. The number of expected cases depends both on the sample size and the expected disease frequency in the comparison population. For example, a study involving a small population and a common disease can have the same power as a study of a rare disease in a large population. Consequently, studies of larger samples have sufficient power to detect smaller increases in risk, and studies of smaller samples will be able only to detect large increases in relative risk.

Because epidemiological studies have limitations, it is essential that the power of such studies, particularly of negative studies, be examined to ensure that their sample sizes are adequate to detect the absence of increased risk with validity. When the power of a study is not adequate, negative studies cannot be said either to contradict or to support the conclusion that increased risk exists. However, a study with a positive result may indicate a relationship if the excess risk is high, even if the study's sample size is small and the effects of some factors are not controlled for.

Quality of Evidence

Dose-response models have often been used in the quantitative assessment of the risks associated with exposures to carcinogenic substances. However, less scientific effort has been devoted to models to be used with non-carcinogenic substances. Mathematically precise methods to establish the true no-effect level or to define the dose-response curves have not been developed for most of the more than 400 substances involved in this rulemaking.

Most of the scientific work that has been done was designed to identify lowest observed effect or no-effect levels for a variety of acute effects. As described above, experts in industrial hygiene and occupational health have developed factors to be used to offset, at least to some extent, the insensitivity of NOELs and LOELs to such factors as subcellular effects, sensitive individuals, and chronic effects. It is possible to use these data, combined with professional judgment and OSHA's expertise and experience, to determine that significant risk exists at current levels of exposure and that a reduction in these levels will substantially reduce that risk. OSHA is also confident that it is not attempting in this rulemaking to reduce exposures to insignificant levels. However, additional analysis may well reveal that the levels being proposed at this interim stage can be refined further in the future.

B. Historical Development of Occupational Exposure Limits

Early Limits

Until the development of occupational health standards, the occurrence of adverse health effects resulting from exposures to hazardous substances or conditions in the workplace could only be determined *ex post facto*—after impairment had already occurred to the health and welfare of exposed employees. In her 1910 studies of lead poisoning, Dr. Alice Hamilton was forced to rely on "personal observations of working conditions and the illness and deaths of workers to demonstrate the existence of harmful exposures" (Paull 1984). The concept of occupational exposure limits thus represents a dramatic breakthrough in the battle against occupational disease and remains "one of the most useful and indispensable tools yet devised for safeguarding the health and well-being of industrial workers" (Thomas 1979).

Occupational exposure limits are air quality values that apply in workplaces, and they are derived by studying the correlation between the amount of a toxic substance absorbed by the body and its effects on health. Within the context of occupational exposure, knowledge of this relationship permits quantification of the etiology "of a large number of occupational health impairments, [evaluation of] the risk of such impairments and, if necessary, [consideration of] the effectiveness of preventive meaures" (Parmeggiani 1983). More specifically, an understanding of the levels at which disease or other health effects occur can be used to establish limits of occupational exposure below which health hazards are unlikely to occur in most workers.

The historical development of occupational exposure limits began with the published reports of a German scientist whose investigations in 1883 into the effects of experimental animals (and on himself) of carbon monoxide in known air concentrations caused him to conclude that "the boundary of injurious action of carbon monoxide lies at a concentration in all probability of 500 parts per million, but certainly [not less than] 200 parts per million" (Cook 1987). Shortly after the appearance of this first documented dose-response value, another German researcher, K. N. Lehmann, published a series of reports on a number of chemical substances under the title "Experimental Studies on the Effect of Technically and Hygienically Important Gases and Vapors on the Organism." This series culminated in 1936 with a comprehensive paper on chlorinated hydrocarbons, published as Volume 116 of *Archiv fuer Hygiene*.

In 1912, Rudolf Kobert published a table of exposure limits, based on animal studies, for 20 compounds. One of the first tables of hazardous air concentrations to originate in the United States was a technical paper published in 1921 by the U.S. Bureau of Mines. The 33 substances included in this table were those frequently encountered in the workplace. In addition to limits based on acute toxic effects, this table provided some information on the least detectable odor concentration and the lowest airborne concentration required to cause irritation (Paull 1984; Cook 1987).

Throughout the 1920s and 1930s, data became available that correlated concentrations of harmful substances with observed effects on worker health for such materials as lead and mercury compounds, benzene, and granite dusts. These early occupational health studies, which were based on animal experiments and on findings in exposed workers, provided the kind of data needed to link human exposures "to concentrations that were capable of producing not only acute, but chronic health effects" (Paull 1984).

After 1935, the emphasis of researchers had shifted, for the most part, from the reporting of a series of values for a range of acute effects to results that yielded a single limit based on studies of repeated exposures. Over the years, a sizable amount of data about the levels of exposure that would not produce injurious effects had been amassed for a considerable number of substances. "By the early 1940s, control of the occupational environment to prevent the harmful absorption of toxic materials was becoming an accepted principle, and the practical problem of defining what was 'harmful' was beginning to be met by employing maximum allowable concentrations" (Paull 1984). In 1943, Sterner explained the meaning of the term maximum allowable concentrations as "the upper limit of concentration of an atmospheric contaminant which will not cause injury to an individual exposed continuously during his working day and for indefinite periods of time" (Paull 1984).

The first lists of maximum allowable concentrations of airborne toxic substances were issued between 1933 and 1938. The Union of Soviet Socialist Republics (U.S.S.R.) was the first country to make occupational exposure limits a statutory obligation; in 1933 it published a list that included 14 substances (although health standards for some air pollutants apparently were

used in the Soviet Union during the 1920s). The first American list was published four years later by the State of Massachusetts, and in 1938 Germany issued occupational health standards for a number of organic solvents (Holmberg and Winell 1977). Additionally, the United States "imposed limited occupational safety and health requirements on certain contractors with the Federal government" when the Walsh-Healey Act was passed in 1936 (Mintz 1984).

Standards Developed by Professional Organizations

During the 1940s, American organizations led in the development of occupational health standards, beginning with the American Standards Association (now the American National Standards Institute, or ANSI) list of "maximum acceptable concentrations" (MACs), which appeared in 1941. This list represented a consensus of opinion by the ASA and a number of industrial hygienists who had formed the American Conference of Governmental Industrial Hygienists (ACGIH) in 1938 (Baetjer 1980). Originally conceived of as a time-weighted concentration to be maintained as an average over the working shift, the MAC was redefined in 1957 to mean an upper level (ceiling level) that should never be exceeded (Turner 1976).

An important contribution to occupational health standard-setting was made in 1945 by Warren Cook, who published a list of maximum allowable concentrations for 132 industrial atmospheric contaminants. These limits had been developed by six states, the U.S. Public Health Service, and the American Standards Association, and included Cook's own list of "accepted or tentative values" based on industrial experience, animal experimentation, human sensory response, or a combination of these factors. This table was followed by:

> documentation supported by 187 specific references, indicating the basis and reliability of each value. Cook was the first investigator to codify all of the available data on MAC's and present it in one publication. His list of recommended values was incorporated, practically without changes, by the ACGIH in establishing the TLVs. In support of Cook's inferences, it should be noted that 50 of the * * * values that he recommended in 1945 were subsequently adopted as federal standards, and are still in use today (Paull 1984).

The American Conference of Governmental Industrial Hygienists Subcommittee on Threshold Limits presented its second report at the Eighth Annual Meeting of the ACGIH in 1946. The report included values for 131 gases, vapors, dusts, fumes, mists, and 13 mineral dusts "compiled from the list reported by this subcommittee * * * in 1942, from the list published by Warren Cook in * * * 1945, and from published values of the Z-37 Committee of the American Standards Association" (Cook 1987). The Committee's report noted that:

> Considerable difficulty attends the fixing of satisfactory values for maximal allowable concentrations of chemicals in respirable atmospheres because of the lack of a uniform definition of the maximum allowable concentration concept. One concept is that the M.A.C. value should represent as accurately as possible that concentration at which a worker exposed for a sufficient period of time will just escape physiological or organic injury and occupational disease. A second concept is that the M.A.C. should represent some fraction of that concentration which will injure the worker in order to allow a margin of safety in the design of protective equipment and guard against possible synergistic effects in the case of multiple exposures. A third concept is that the M.A.C. should perform the functions of the former concepts and in addition provide a work environment free of objectionable but non-injurious concentrations of smokes, dusts, irritants and odors. Obviously all of these concepts cannot be fulfilled with the establishment of a single value. M.A.C. values in use at the present time represent examples of all of these concepts.
>
> The committee feels that the establishment of dual lists or a single definition is not possible at the present time.

The report concluded by stressing that the 1946 list of M.A.C. values was presented "with the definite understanding that it be subject to annual revision" (Report of the Sub-committee on Threshold Limits 1946).

Papers presented at both the Ninth International Congress on Industrial Medicine in London (1948) and at the Fifteenth International Congress of Occupational Health in Vienna (1966) also dealt with maximum acceptable concentrations. The first of these proposed that zones of toxicity be set up to facilitate an understanding of the relative hazards of substances, "since the boundarties of MAC values were not sharp lines of demarcation" (Cook 1987). At the 1966 meeting, discussion took place on the advantages of the concept of a "peak level" of exposure—an extension of the "ceiling level" notion inherent in the definition of a MAC since 1957. A "peak level" was defined as one "that can be applied to certain substances for brief designated periods and for a strictly limited number of times during the work shift, with a designated time interval between peaks. The 'peak' concept places a limit on the intermittent higher exposures that occur in many industrial operations. The time-weighted average exposure limit is of course to be observed [even when a peak has also been assigned to a substance]" (Cook, 1987).

Terminology and definitions throughout this early period were ambiguous and imprecise, reflecting uncertainty as to exactly what needed to be and could be done in the realm of occupational health standard setting. Initially, the ACGIH designated its recommended limits as "maximum allowable concentrations," although this term was often used interchangeably with "threshold limit values." Confusion about the meaning, interpretation, and relative significance of the terms being employed during this embryonic period was common. After 1953, the ACGIH defined the concept of threshold limit values in the preface to its annual published list of occupational health standards as "maximum average atmospheric concentrations * * * for an eight-hour day." This definition of the TLVs as average concentrations differed from the general understanding of the original term "maximum allowable concentrations," which were essentially ceiling values (Stokinger 1962).

By 1955, the ACGIH's philosophy of establishing threshold limits had begun to shift from concern solely with the prevention of acute stress and illness to consideration also of "more subtle effects on health, such as the effects of annoying or irritating agents * * *. Thus, whereas a threshold limit value of 3 or 4 ppm for chlorine would insure no impairment to workers' health, this value is reduced to 1 ppm in the interest of greater freedom from irritant effects" (Stokinger 1956). It should be noted that such analyses often did not take into account chronic effects or responses among sensitive workers.

Documentation for the 238 substances included in the TLV list for 1956 was provided by Smyth in a separate paper in which the author

> recommended that the TLV's include references to the underlying data, and that the concepts represented by the values be restated in more realistic toxicological terms. In his analysis of the TLVs, he [Smyth] concluded that nine categories of objectionable action were guarded against: chronic toxicity, acute toxicity, narcosis, irritation, asphyxiation, fume fever, eye pigmentation, allergic response, and cancer. (Paull 1984)

At about the same time, Stokinger stated that in his opinion, the Threshold Limits Committee had avoided grappling with the issue of developing a method for establishing limits for industrial

carcinogens and noted that, with the exception of nickel carbonyl, limits had not been assigned for potential carcinogens (Paull 1984). In 1962, however, the TLV Committee included three carcinogens as additions to the TLV list, although these were listed separately in an appendix and did not have assigned TLVs.

Despite the fact that the ACGIH had stressed early on that TLVs were intended as guides and not as rigidly enforceable limits, the American Standards Association's MAC values (or, where none was available, the TLV) were included as mandatory limits in the Safety and Health Standards for Federal Supply Contracts, which were published in 1960 under the Walsh-Healey Act. Following this action, the ACGIH issued a statement on the definitions and interpretations of TLVs and MACs (Stokinger 1962). At the same time, the ACGIH announced the production of the first edition of the *Documentation for Threshold Limit Values* (ACGIH 1962); this was followed by another paper in which the work and intentions of the Threshold Limits Committee were reviewed. Turner states that:

> [a]t this time the concept of ceiling values and excursion factors around the time-weighted average values was introduced in order to reduce conflict or confusion with the 'maximal' values in the American [ANSI] Standards. A 'C' (ceiling value) listing was to be given to those fast-acting substances thought likely to be injurious if the concentration exceeded the limit value by more than a designated factor for a relatively short period (about 15 min.). The factor varied between 3 and 1.25, depending inversely upon the magnitude of the TLV. A corollary was that the factor would also indicate the limit of permissive excursion of the concentration above the TLV for a substance not given a 'C' listing, always provided that the time-weighted average concentration did not exceed the TLV. This rule of thumb approach to limiting exposure is no doubt appropriate to certain substances when they are used routinely throughout the working day. It seems to have little relevance in other instances where exposure is irregular or where the basis for fixing the TLV is on grounds other than toxicity. (Turner 1976)

Limits in the Era of OSHA

The enactment of the Occupational Safety and Health Act of 1970 marked the first "comprehensive and serious attempt * * * to protect the health and safety of American workers" (Mintz 1984); it also greatly extended the use of MACs and TLVs by authorizing the newly established Occupational Safety and Health Administration (OSHA) to adopt as its own standards "national consensus standards" and established federal standards (29 U.S.C. 655(a)). Mintz notes that "in addition to the safety standards adopted under section 6(a), OSHA also adopted permissible exposure limits for approximately 400 toxic substances. These [start-up] health standards, now appearing in 29 CFR 1910.1000, * * * were derived from both national consensus and established federal standards. The national consensus standards had been issued by ANSI, while the established federal standards had been adopted under the Walsh-Healey Act from the TLVs * * * recommended by the * * * ACGIH" (Mintz 1984).

Since OSHA's large-scale adoption of the ANSI consensus standards and the 1968 ACGIH TLVs, the Agency has promulgated standards under section 6(b) of the OSH Act to regulate the industrial use of 24 substances, most of which have been identified as occupational carcinogens, but the ANSI and ACGIH start-up standards continue to comprise the major part of the Agency's occupational health and safety program.

In the interval since the establishment of OSHA and the adoption of the ACGIH and ANSI limits by the Agency, the ACGIH has continued to revise, update, and document the recommended limits that appear in its annual list of TLVs. Since 1968, annual revisions have been made to these limits by the ACGIH. During this time, the TLVs have been "accepted on an international basis as the best available guides for providing healthful occupational environments, and at least 18 countries, including the United States, have either adopted them as legal standards or as guides to legal action, thus verifying their efficacy in accomplishing this purpose" (Paull 1984).

The action OSHA takes today initiates the process of updating the Agency's Z table permissible exposure limits. That these limits are seriously out of date is attested to by the fact that the ACGIH has found it necessary to revise or add nearly 200 limits to its list in the 20 years since the limits that were later adopted by OSHA were initially published. Recognition that OSHA's Z table limits need updating to reflect recent developments in toxicology and new data on the health effects associated with exposure to these substances is widespread throughout industry: For example, OSHA requires and it is standard practice for organizations that develop Material Safety Data Sheets (MSDSs) to include on these MSDSs the ACGIH's current TLV values, as well as the OSHA limit.

The following section describes the methodology used by OSHA in selecting the limits it is proposing today. The Agency believes that promulgation of these limits will address a broad range of significant risks now prevalent in industry. As many industrial hygienists and occupational safety and health professionals have noted, the use of permissible exposure limits continues to be the single most efficacious way of protecting the health, functional capacity, and well-being of the American worker.

C. Description of the Substances For Which Limits Are Being Proposed

In this rulemaking, OSHA considered revising 428 substances and is proposing to revise existing or add new limits for several hundred (a total of 406) toxic substances currently being manufactured, used, or handled in workplaces throughout general industry. This section of the preamble identifies the proposed PELs, describes the available toxicological data for many of these substances, and explains the Agency's rationale for selecting the proposed limits for several of these substances.

The universe of substances included in this rulemaking is bounded by the substances for which the American Conference of Governmental Industrial Hygienists (ACGIH) has established a Threshold Limit Value (TLV) for exposures in the work environment. That is, OSHA is not proposing at this time to establish exposure limits for any hazardous substance that is not included in the ACGIH's 1987–88 List of TLVs. In addition, where the limit included in the current ACGIH list is identical to OSHA's existing Z-table limit for the same substance, OSHA is not proposing a change. OSHA has determined that the ACGIH's TLV is clearly the most comprehensive list for this purpose.

Although limits are not being proposed for chemicals excluded from the ACGIH's 1987–88 list, OSHA has not limited its consideration of appropriate limits to those levels established by the ACGIH. The Agency has also carefully evaluated the exposure limits recommended by the National Institute for Occupational Safety and Health, OSHA's sister agency. In instances where both NIOSH and the ACGIH have recommended substantially different limits for the same substance, OSHA has thoroughly analyzed the evidence presented by each organization before determining which of the two limits to propose. The proposed limits thus represent, in the Agency's professional judgment, those levels found to be most consistent with OSHA's mandate and the case law that

has subsequently developed to interpret that mandate. (For a discussion of the relevent legislative and judicial principles, see the section elsewhere in this preamble entitled History and Need for Revision of the PELs.

For ease of analysis and presentation, the substances included in the scope of this rulemaking have been grouped into 18 separate sub-sections. In general, these groupings reflect the principal mechanisms of action or target organ systems involved in the toxic responses that occur when workers are exposed to these substances.

In addition to target organs or effect groupings, separate sections dealing with limits set on the basis of no-effect levels or by analogy are included. Three additional sections cover substances for which the ACGIH has increased its limits, substances for which OSHA is proposing to add short-term limits, and those for which the Agency proposes to add skin notations.

The following sections are included:

1. Substances for Which Proposed Limits Are Based on Avoidance of Neuropathic Effects.
2. Substances for Which Proposed Limits Are Based on Avoidance of Narcotic Effects.
3. Substances for Which Proposed Limits Are Based on Avoidance of Sensory Irritation.
4. Substances for Which Proposed Limits Are Based on Avoidance of Liver or Kidney Effects.
5. Substances for Which Proposed Limits Are Based on Avoidance of Ocular Effects.
6. Substances for Which Proposed Limits Are Based on Avoidance of Respiratory Effects.
7. Substances for Which Proposed Limits Are Based on Avoidance of Cardiovascular Effects.
8. Substances for Which Proposed Limits Are Based on Avoidance of Systemic Effects.
9. Substances for Which Proposed Limits Are Based on Observed No-Effect Levels.
10. Substances for Which Proposed Limits Are Based on Avoidance of Adverse Nuisance Effects.
11. Substances for Which Proposed Limits Are Based on Avoidance of Taste and Odor Effects.
12. Substances for Which Proposed Limits Are Based on Avoidance of Adverse Health Effects Caused by Exposure to Analogous Substances.
13. Substances for Which Proposed Limits Are Based on Avoidance of Biochemical/Metabolic Effects.
14. Substances for Which Proposed Limits Are Based on Avoidance of Sensitization Effects.
15. Substances for Which Proposed Limits Are Based on Avoidance of Cancer.
16. Substances for Which Current ACGIH TLVs Are Less Stringent than Existing OSHA PELs.
17. Substances for Which OSHA Is Proposing Short-Term Exposure Limits.
18. Substances for Which OSHA Is Proposing To Add Skin Notations.

A list of the references that OSHA relied on in evaluating the toxicological evidence pertaining to these chemicals appears at the end of Section IV.

1. Substances for Which Proposed Limits Are Based on Avoidance of Neuropathic Effects

Introduction

Many industrial chemicals have been shown to cause severe neurological effects in exposed workers, and in many cases these effects are irreversible. There are 20 chemicals for which limits have been set on the basis of avoidance of neuropathic effects. Table C1–1 lists the current PEL, ACGIH TLV, NIOSH REL, CAS number, and OSHA identification number for each of these chemicals. The table shows time-weighted averages (TWAs), ceiling limits, and short-term exposure limits (STELs). For this group of 20 compounds, OSHA is proposing to lower its current TWA-PEL for two substances; add a STEL to an existing TWA for five substances; change an existing ceiling to a TWA and STEL for one substance; change an existing TWA-PEL to a ceiling value for one substance; amend existing short-term or ceiling limits for four substances; and establish new exposure limits for seven substances not currently regulated by OSHA. As Table C1–1 shows, most of the proposed limits are revisions of existing OSHA limits, rather than new additions to Table Z. In only five instances is there a difference between the quantitative limits set by the ACGIH and NIOSH for the same substance.

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TABLE C1-1. Substances for Which Limits Are Based on Avoidance of Neuropathic Effects

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1051 n-Butyl alcohol	71-36-3	100 ppm TWA	50 ppm Ceiling, Skin	—
1078 Chlorinated camphene	8001-35-2	0.5 mg/m^3 TWA	0.5 mg/m^3 TWA, Skin 1 mg/m^3 STEL	—
1114 Decaborane	17702-41-9	0.05 ppm TWA, Skin	0.05 ppm TWA, Skin 0.15 ppm STEL	— —
1116 di-sec-octyl-Phthalate	117-81-7	5 mg/m^3 TWA	5 mg/m^3 TWA 10 mg/m^3 STEL	— —
1123 Dichloroacetylene	7572-29-4	—	0.1 ppm Ceiling	—
1149 Dipropylene glycol methyl ether	34590-94-8	100 ppm TWA, Skin	100 ppm TWA, Skin 150 ppm STEL	—
1200 n-Hexane	110-54-3	500 ppm TWA	50 ppm TWA	100 ppm TWA 510 ppm Ceiling (15 min)
1202 2-Hexanone	591-78-6	100 ppm TWA	5 ppm TWA	1 ppm TWA

TABLE C1-1. Substances for Which Limits Are Based on Avoidance of Neuropathic Effects (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1216 Iron pentacarbonyl	13463-40-6	--	0.1 ppm TWA 0.2 ppm STEL	--
1236A Manganese, fume	7439-96-5	5 mg/m^3 Ceiling	1 mg/m^3 TWA 3 mg/m^3 STEL	--
1237 Manganese cyclopentadienyl tricarbonyl	12079-65-1	--	0.1 mg/m^3 TWA, Skin	--
1238 Manganese tetroxide	1317-35-7	--	1 mg/m^3 TWA	--
1240 Mercury (aryl and inorganic compounds)+	7439-97-6	0.1 mg/m^3 Ceiling	0.1 mg/m^3 TWA, Skin	0.05 mg/m^3 TWA (8-hr)
1241 Mercury, vapor	7439-97-6	0.1 mg/m^3 Ceiling	0.05 mg/m^3 TWA, Skin	--
1242 Mercury, (organo) alkyl compounds	7439-97-6	0.01 mg/m^3 TWA 0.04 mg/m^3 Ceiling	0.01 mg/m^3 TWA, Skin 0.03 mg/m^3 STEL	-- --
1251 Methylacrylonitrile	126-98-7	--	1 ppm TWA, Skin	--
1253 Methyl bromide	74-83-9	20 ppm Ceiling, Skin	5 ppm TWA, Skin	Lowest feasible level

TABLE C1-1. Substances for Which Limits Are Based on Avoidance of Neuropathic Effects (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1304 Pentaborane	19624-22-7	0.005 ppm TWA	0.005 ppm TWA 0.015 ppm STEL	-- --
1316 Phenyl mercaptan	108-98-5	--	0.5 ppm TWA+	0.1 ppm Ceiling (15 min)
1342 1,2-Propylene glycol dinitrate	6423-43-4	--	0.05 ppm TWA, Skin	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

\+ OSHA's current limit is retained.

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Description of the Health Effects

The human nervous system comprises the central nervous system (CNS) and peripheral nervous system (PNS). The CNS is made up of the brain and spinal cord, while the PNS consists of a network throughout the body of nerves that communicate with the CNS via connections to the spinal cord. The brain and spinal cord are bathed in cerebrospinal fluid, which supplies nutrients to the CNS and also acts as a barrier against some foreign substances. This barrier protects the central nervous system. In general, fat-soluble substances readily diffuse across this barrier and water-soluble substances do not.

Chemicals that affect the central nervous system may manifest their toxic effects peripherally. An example of this is the tremor associated with elemental and organic mercury poisoning. Exposure to some chemicals, such as n-hexane, is associated with axonal degeneration of the nerves in both the central and peripheral nervous systems. Baker (1983) refers to this dual-system effect as central-peripheral distal axonopathy.

Nervous system toxicants can affect motor function, sensory function, or integrative processes, and they can also cause changes in the behavior of exposed persons. Substances that cause demyelination or neuronal damage can produce motor dysfunction that is expressed as muscular weakness or unsteadiness of gait, while exposures to chemicals that are associated with loss of sensory function may result in alterations in touch, pain, or temperature sensation or damage to sight or hearing. Other neuropathic chemicals affect the way in which information is processed in the brain and can interfere with learning and memory.

Although mature neurons cannot divide and be replaced, the nervous system has considerable ability to restore function lost as a result of exposure to toxic chemicals. This capability to restore function even after neurons have been killed is achieved by two mechanisms: Plasticity of organization and redundancy of function. That is, when some neurons die, other cells that perform the same function may be able to maintain an adequate level of functioning, or other neurons may be able to "learn" how to perform the lost function. However, even when one of these mechanisms comes into play to compensate for neuronal damage, the overall reserve capacity of the nervous system will have been diminished. The loss of this reserve could be critical in a situation in which additional demands are placed on the nervous system. Thus, even so-called reversible neuropathic effects should be seen as toxic effects causing alterations in an impairment of the normal functioning of the nervous system.

The neurological effects potentially associated with chemical exposures are numerous, and it is not always easy to identify the precise target site. However, recent medical advances have made tests available that can detect neurological damage that was not detectable several years ago. For example, electrophysiological methods have been developed to measure damage to the visual pathway caused by such exposures. Because of the variation in individual responses to chemical exposures, exposure limits should be set with a view toward this range of susceptibility and the avoidance of any neuropathic effects.

Peripheral Nervous System Effects

The pathological mechanisms associated with peripheral neuropathies result from segmental demyelination or axonal degeneration. Segmental demyelination destroys the myelin sheath but leaves the axon intact; this causes a slowing in nerve conduction velocity. Muscle weakness is often the first sign of such segmental demyelination, and this effect can progress to a decline in motor function or paralysis. Although remyelination may occur within weeks after injury, even a temporary loss in motor or sensory function places the affected worker or others at risk of injury.

Axonal degeneration is a more serious effect in that recovery is often slow or incomplete. It causes demyelination secondary to the degeneration of the distal portion of the nerve. This effect occurs when a chemical interferes with the physiologic dynamics of the nerve, e.g., when it decreases the transport of nutrients to the nerve. The axon will degenerate (die-back) sufficiently to accommodate the cell's capacity to supply it with nutrients. Axonal degeneration can also occur as a result of biochemical or metabolic derangement of the central nervous system. Alkyl mercury and elemental mercury are examples of chemicals causing this type of effect (Cavanaugh 1985).

Central Nervous System Effects

The mechanism of action of central nervous system toxins is not well understood but is believed to be associated with neurochemical alteration in the brain. Seizures, Parkinsonism, intellectual impairment, narcosis, dementia, cranial neuropathy, and visual disturbances are all examples of effects that can occur after overexposures to neuropathic chemicals. The more serious CNS effects, such as Parkinsonism, dementia, intellectual impairment, and cranial neuropathy, are generally irreversible (Baker 1983). Before these effects are manifested, subtle changes in behavior may occur; if these subtle signs are interpreted correctly, exposure can be stopped before irreversible damage occurs.

Dose-Response Relationships and Neuropathic Effects

The development of chemically induced neurological effects is believed to follow a dose-response pattern. At an exposure intensity or duration below the no-effect level, detectable effects are unlikely to be evident. As exposure intensity/duration increases to and beyond this level, the toxin begins to interfere with the normal cellular processes of the neurological system. At this early stage, transient signs and symptoms may appear. Overt effects become more severe as exposure continues and finally progress to serious loss of neurological function and possible permanent damage to neural tissue. Increases in our ability to detect neurological changes at lower levels of exposure have shown that neurobehavioral changes or impairment may occur at levels previously thought to be innocuous. These early effects can be important indicators of potential functional impairment at exposure levels below those that produce either transient or permanent damage. Heavy metals, solvents, and pesticides are examples of chemicals that can cause symptoms that include nausea, sensory and motor function impairments, depression, sleep disturbances, cognitive impairment, and sexual dysfunction. Limits for substances in this group are generally designed to maintain worker exposures below the level associated with such symptoms. This approach ensures that employees will not be likely to suffer these adverse symptoms and provides a margin of safety against the risk of more severe or permanent neurological impairment.

The following discussions describe OSHA's preliminary findings for all of the substances in this group and illustrate the serious nature of the risk faced by workers exposed to these toxicants.

n-BUTYL ALCOHOL

CAS: 71-36-3; Chemical Formula: $CH_3CH_2CH_2CH_2OH$

H.S. No. 1051

OSHA's current PEL for n-butyl-alcohol is a 100 ppm 8-hour TWA; the ACGIH-recommended limit is a 50 ppm ceiling, with a skin notation.

n-Butyl alcohol is a colorless, highly refractive liquid with a mild vinous odor that has long been known to cause irritation of the eyes and headaches in occupational settings. Systemic exposure effects in the form of vestibular and auditory nerve injury have only been reported in workers in France and Mexico (Seitz 1972; Velasquez 1964; Velasquez et al. 1969).

The current OSHA limit of 100 ppm (TWA) is based on the studies of Tabershaw, Fahy, and Skinner (1944) and of Smyth (1956). These studies indicated that workers experienced no narcotic or systemic effects at levels lower than 100 ppm. Mild irritation was reported in humans exposed to 24 ppm; this irritation became uncomfortable and was followed by headaches at 50 ppm (Nelson, Ege, Ross et al. 1943).

More recent data reported by Seitz (1972), Velasquez (1964), and Velasquez et al. (1969) indicate serious long-term systemic effects on the auditory nerve and hearing loss (hypoacusia), the magnitude of hearing loss was related to length of exposure. Nine of 11 workers exposed without hearing protection to 80 ppm for periods of from 3 to 11 years displayed impaired hearing. This phenomenon was particularly evident in younger workers (Velasquez 1964; Velasquez et al. 1969).

OSHA believes that the current PEL of 100 ppm is not protective against the risk of hearing loss and vestibular injury associated with exposure to n-butyl alcohol, because these types of systemic injuries have been observed at levels below 100 ppm. A skin notation is also being proposed because of n-butyl alcohol's potential to cause skin irritation. The Agency preliminarily concludes that the proposed 50 ppm ceiling will reduce this risk substantially. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-butyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

CHLORINATED CAMPHENE (60 Percent)
CAS: 8001-35-2; Chemical Formula: $C_{10}H_{10}Cl_8$
H.S. No. 1078

OSHA currently has a limit of 0.5 mg/m³, with a skin notation, for chlorinated camphene. The ACGIH recommends a limit of TLV-TWA 0.5 mg/m³ and a TLV-STEL of 1 mg/m³ for chlorinated camphene (60 percent), with a skin notation. This substance is an amber waxy solid with a pleasant, pine-like odor.

Chlorinated camphene has demonstrated a moderately high acute toxicity in animal studies (ACGIH 1986, p. 114). Toxic doses cause varied central nervous system effects, including nausea, muscle spasms, confusion, and convulsions (Hayes 1963). Data indicate that rats and guinea pigs show no significant effects at dietary levels of 800 ppm daily for a 6-month period (Alderson Reporting Co. 1972). Monkeys tolerate 10 ppm daily but show toxic symptoms after 2 weeks' feeding at the 60-ppm level (Sosinerz 1972). Although chlorinated camphene may accumulate in fatty tissues, it clears quickly when ingestion is terminated (Sosinerz 1972).

In humans, the acute lethal dose of chlorinated camphene is between 2 and 7 grams, and a dose of 10 mg/kg causes nonfatal convulsions in some exposed individuals. The ACGIH (1986, p. 115) concludes that the acute toxicity of chlorinated camphene is equivalent to that of chlordane, for which the fatal human dose is estimated to be around 6 grams; the ACGIH TLV-TWA for chlordane is 0.5 mg/m³. One study of 25 human volunteers failed to reveal toxic responses to a daily 30-minute exposure to 500 mg/m³ for 10 consecutive days, followed by similar exposures for 3 consecutive days 3 weeks later (Shelansky 1947, as cited in ACGIH 1986, p. 115). There are no reports of occupational poisonings, and a review of the medical records of employees engaged in the manufacture and handling of chlorinated camphene showed no ill effects in workers exposed for an average of 3.7 years (Hercules 1972).

OSHA is proposing a PEL of 0.5 mg/m³ TWA and a 15-minute STEL of 1.0 mg/m³ for this insecticide, with a skin notation. The Agency preliminarily concludes that both a TWA and a STEL are required to protect exposed workers against the risk of neuropathic and systemic effects. The health evidence forms a reasonable basis for proposing a new limit for chlorinated camphene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DECABORANE
CAS: 17702-41-9; Chemical Formula: $B_{10}H_{14}$
H.S. No. 1114

OSHA currently has an 8-hour TWA limit of 0.05 ppm TWA and a skin notation for decaborane. The ACGIH recommends a TLV-TWA of 0.05 ppm and a TLV-STEL of 0.15 ppm, also with a skin notation. Decaborane forms colorless crystals, which are stable at ordinary temperatures and have a pungent odor.

The acute toxicity of decaborane is extremely high for small laboratory animals. The 40-hour LC_{50}s for rats and mice are 46 and 12 ppm, respectively (Schecter 1958). Dermal LD_{50}s for rabbits and rats are 71 and 740 ppm, respectively (Svirbely 1955). Acute exposures to decaborane cause loss of coordination, convulsions, weakness, tremors, and hyperexcitability. Its primary effects are on the kidneys and liver. Studies of repeated exposures to this substance suggest that the toxicity of decaborane is intermediate between that of pentaborane and diborane. The ability of decaborane to penetrate the skin is particularly notable, as is its toxicity to the central nervous system in some species, e.g., rats and rabbits (Svirbely 1954 and 1955). Monkeys showed decreased ability for certain operant behaviors when injected with doses of 3 to 6 mg/kg decaborane (Reynolds et al. 1964). Central nervous system toxicity has been observed in humans exposed occupationally (Krackow 1953).

OSHA is proposing an 8-hour TWA PEL of 0.05 ppm TWA, a 15-minute STEL of 0.15 ppm, and a skin notation for decaborane. The Agency preliminarily concludes that this level will provide protection against the risk of neuropathies, kidney and liver damage, and percutaneous absorption possible in the absence of a short-term limit for decaborane. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for decaborane if the Agency determines that this limit will substantially reduce significant risk.

di-sec-OCTYL PHTHALATE
CAS: 117-81-7; Chemical formula: $C_{24}H_{38}O_4$
H.S. No. 1116

OSHA currently has a limit of 5 mg/m³ TWA for di-sec-octyl phthalate. The ACGIH recommends a TLV-TWA of 5 mg/m³ and a TLV-STEL of 10 mg/m³ for this light-colored, viscous, odorless, and combustible liquid.

Di-sec-octyl phthalate (DEHP) has an extremely low acute oral toxicity in small laboratory animals. The oral LD_{50} reported for the mouse is 26.3 g/kg; for the rat, it is 33.8 g/kg (Krauskopf et al. 1973). No skin irritation or sensitization potential has been demonstrated in either animals or humans, and the lethal dermal dose in rabbits is about 25 ml/kg (Singh, Lawrence, and Autian 1972). Shaffer, Carpenter and Smyth (1945) and Lawrence (unpublished data) have reported deaths in exposed rats as well

as chronic diffuse inflammation of the lung, resembling burn responses, after DEHP exposures in mice at unspecified levels.

Long-term dietary toxicity studies in rats, guinea pigs, and dogs have established a no-effect dose level of about 60 mg/kg/day, and no carcinogenic or histologic abnormalities were observed at this level (Gesler 1973). Higher doses were associated with growth retardation and increased liver and kidney weights but not histologic abnormalities. Metabolic studies have demonstrated that laboratory animals do not appreciably metabolize DEHP (Dillingham and Autian 1983). Teratogenicity studies in pregnant rats indicated that fertility is unaffected at doses of 0.1, 0.2, or 0.33 percent of the acute intraperitoneal LD_{50} dose for rats, although slight effects on embryonic and fetal development were observed in these animals; skeletal deformities were the most common teratogenic effects observed (Dillingham and Autian 1973). Mutagenic effects were observed at intravenous doses of one-third, one-half, and two-thirds of the acute LD_{50}; these effects were consistent with DEHP's ability to produce dominant lethal mutations (Dillingham and Autian 1973).

A study of exposures to a mixture of the vapors of diethyl phthalate, dibutyl phthalate, and di-2-ethylhexyl phthalate reported that exposures to 1 to 6 ppm caused no phthalates in the blood and no peripheral polyneuritis (Raleigh, as cited in ACGIH, p. 223). However, Russian investigators examined male and female workers exposed to between 1.7 and 66 mg/m^3 of various combinations of airborne phthalates and noted complaints of pain, numbness, and spasms in the upper and lower extremities after 6 to 7 years' exposure. Polyneuritis was observed in 32 percent of the workers studied, and 78 percent of these workers showed depression of vestibular receptors (Milkov et al. 1973).

OSHA proposes an 8-hour PEL of 5 mg/m^3 and a 15-minute STEL of 10 mg/m^3 for di-sec-octyl phthalate. The Agency preliminarily concludes that these limits together will protect workers from the risk of pain, numbness, spasms of the extremities, and polyneuritis possible at excursions above the existing 8-hour TWA PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for di-sec-octyl phthalate if the Agency determines that this limit will substantially reduce significant risk.

DICHLOROACETYLENE

CAS: 7572-29-4; Chemical Formula: C1C≡CC1
H.S. No. 1123

OSHA currently has no limit for dichloroacetylene. The ACGIH recommends a TLV-ceiling of 0.1 ppm for this liquid, which explodes on boiling.

In preliminary inhalation exposure studies, guinea pigs demonstrated a 4-hour LC_{50} of 20 ppm; death occurred 2 or 3 days after exposure and was caused by pulmonary edema. In rats, similar exposures to dichloroacetylene in the presence of 330 ppm of trichloroethylene indicated an LC_{50} of 55 ppm (Siegel, as cited in ACGIH 1986, p. 177). When dichloroacetylene was mixed with 9 parts of ether, the 4-hour LC_{50} in rats was 219 ppm; in combination with 7 parts of trichloroethylene, the 4-hour LC_{50} in rats was 55 ppm; and exposure to dichloroacetylene with 10 parts trichloroethylene caused a 4-hour LC_{50} in guinea pigs of 15 ppm (Siegel et al. 1971).

In humans, dichloroacetylene exposure causes headache, loss of appetite, extreme nausea, and vomiting; it affects the trigeminal nerve and facial muscles and exacerbates facial herpes. Disabling nausea was experienced by approximately 85 percent of individuals exposed for prolonged periods of time (not further specified) at concentrations from 0.5 to 1 ppm (Saunders 1967). A number of occupational fatalities have been attributed to exposure to dichloroacetylene (Humphrey ad McClelland 1944; Firth and Stuckey 1945). Humphrey and McClelland (1944) reported on 13 instances of cranial nerve palsy, nine of which had labial herpes, following exposure to dichloroacetylene. These patients also had symptoms of nausea, headache, jaw pain, and vomiting. Autopsies of two of these fatalities revealed edema at the base of the brain (Humphrey and McClelland 1944).

OSHA is proposing a ceiling limit of 0.1 ppm for dichloroacetylene. The Agency preliminarily concludes that exposure to dichloroacetylene poses a risk of disabling nausea and serious systemic effects to workers exposed to the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for dichloroacetylene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIPROPYLENE GLYCOL METHYL ETHER

CAS: 34590-94-8; Chemical Formula: $CH_3OC_3H_6OC_3H_6OH$
H.S. No. 1149

OSHA currently has an 8-hour TWA limit of 100 ppm for dipropylene glycol methyl ether (DPGME), with a skin notation. The ACGIH recommends a TLV-TWA of 100 ppm and a TLV-STEL of 150 ppm for this colorless liquid with a mild, pleasant, ethereal odor and a bitter taste.

DPGME is a central nervous system and cardiac depressant. Dogs receiving intravenous injections of DPGME exhibited auricular fibrillation caused by auricular anoxia, depressed conduction, and heart block. Ventricular asystole accompanied increased intra-auricular pressure. Irritation and local pain preceded death from respiratory depression (Shideman and Procita 1951). Rowe and associates (1954) reported a single acute oral LD_{50} for rats of 5.4 ml/kg. Even at the highest levels tested (not further specified), no single application of DPGME to the skin of rabbits was lethal, although some narcosis and transient weight loss did occur. However, a significant number of deaths occurred in a group of rabbits treated with 65 repeated dermal applications of 3 ml/kg and higher during a 90-day period. Four animal species, including the monkey, were exposed repeatedly to 7-hour daily inhalation exposures of between 300 and 400 ppm DPGME; the animals exhibited narcosis and changes in the lung and liver (Rowe, McCollister, Spencer et al. 1954).

Humans inhaling levels of 300 to 400 ppm found them very disagreeable, but 100 ppm was tolerable and, in the opinion of the authors, was not likely to produce organic injury (Rowe, McCollister, Spencer et al. 1954). Patch tests on the skin of 250 human subjects produced neither irritation nor sensitization (ACGIH 1986, p. 221). Humans exposed to DPGME vapor concentrations at levels between 50 to 2000 ppm experienced eye, nose, and throat irritation before the onset of CNS impairment, which occurred at 1000 ppm in one of two subjects (Stewart, Baretta, Dodd, and Terkelson 1970).

OSHA is proposing a PEL of 100 ppm TWA and a STEL of 150 ppm for dipropylene glycol methyl ether. The Agency believes this combined limit will reduce the risk of central nervous system effects and irritation that may exist when workers are exposed for short periods above the 100 ppm PEL. In addition, OSHA is proposing a skin notation because of evidence in experimental animals that DPGME can be percutaneously absorbed. The health evidence forms a reasonable basis for proposing a revision of this level. At the time of the final rule, OSHA will establish a new limit for dipropylene

glycol methyl ether if the Agency determines that this limit will substantially reduce significant risk.

n-HEXANE
CAS: 110-54-3; Chemical Formula: $CH_3(CH_2)_4CH_3$
H.S. No. 1200

n-Hexane has been shown to produce distal axonopathy in both experimental animals and humans; it is metabolized to 2,5-hexanedione (2,5-HD), which is thought to be the causative agent of most of the adverse neurological effects observed after exposure to hexane (Schaumburg et al. 1983). OSHA's current PEL for n-hexane is 500 ppm. The ACGIH arrived at a TLV at 50 ppm for this substance, based primarily on studies (Miyagaki 1967; Inoue et al. 1970) showing peripheral neuropathies at exposure levels as low as 210 ppm. The REL for n-hexane recommended by NIOSH is 100 ppm (10-hour TWA). NIOSH based its recommendation on the same studies as those cited by the ACGIH (Miyagaki 1967; Inoue et al. 1970). NIOSH reasoned as follows:

> The absence of definitive epidemiologic or toxicologic evidence makes it difficult to determine how much lower the environmental limit should be. Professional judgment suggests a TWA concentration of 350 mg/m³ (100 ppm) offers a sufficient margin of safety to protect against the development of chronic nerve disorders in workers (NIOSH 1977a, p. 74).

The adverse neurological effects of hexane exposure are manifested as both sensory and motor dysfunction. Initially, there is a symmetric sensory numbness of the hands and feet, with loss of pain, touch, and heat sensation. Motor weakness of the toes and fingers is often present; as the neuropathy becomes more severe, weakness of the muscles of the arms and legs may also be observed (Schaumburg et al. 1983). There are no known conditions that predispose an individual to hexane neurotoxicity (Schaumburg et al. 1983). The onset of neurological symptoms may not be evident for several months to a year after the beginning of exposure. Recovery may be complete, but severely exposed individuals often retain some degree of sensorimotor deficit.

The dose-response relationship for n-hexane exposure in humans is not well defined, although it is clear that the severity of the resulting neuropathy increases as the exposure level of n-hexane increases. A number of studies have shown a consistent relationship between exposure levels of 500 ppm (OSHA's current exposure limit) to 2000 ppm and the development of characteristic peripheral neuropathies (Yamamura 1969; Yamada 1967). Neuropathic effects have also been shown to occur at levels between 210 and 500 ppm (Takeuchi et al. 1975).

Reports of effects occurring at levels of 210 to 500 ppm indicate that the current OSHA PEL of 500 ppm is not adequate to protect exposed workers from adverse sensorimotor neuropathic effects, and exposure at this level thus represents a risk to workers. The decreased sensitivity to pain, touch, and temperature associated with n-hexane exposure can also make a worker more susceptible to injuries and accidents. Further, the delayed onset of a clinical response, which is typical of hexane exposure, increases the probability that exposure will continue until irreversible effects occur.

The NIOSH REL is 100 ppm. However, both the presence of peripheral neurophathies at 210 ppm and the delay in onset of neurological symptoms indicate the need to adopt the 50 ppm TLV to prevent development of these symptoms. Sampling data from the IMIS data base show that 75 percent of the samples are below the 50 ppm level, and additional information confirms that attaining this level is feasible. OSHA therefore proposes a PEL of 50 ppm TWA. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-hexane if the Agency determines that this limit will substantially reduce significant risk.

2-HEXANONE (METHYL n-BUTYL KETONE)
CAS: 591-78-6; Chemical Formula: $CH_3CO-CH_2CH_2CH_2CH_3$
H.S. No. 1202

OSHA's current PEL for 2-hexanone is 100 ppm TWA; the NIOSH REL is 1 ppm (10-hour) TWA; and the ACGIH recommends a TLV-TWA of 5 ppm. Industrial exposure to 2-hexanone causes distal neuropathy manifesting as interference with motor and sensory function; even in cases characterized by minimal intensity, electrodiagnostic abnormalities were seen (ACGIH 1987). In animals, exposure to 2-hexanone causes axonal swelling and thinning of the myelin sheath. A metabolite of 2-hexanone, 2,5-hexanedione, appears to be responsible for the neural damage; this same metabolite is formed when n-hexane (discussed above) is metabolized.

The limit of 5 ppm TWA for 2-hexanone recommended by the ACGIH is based on the results of several different studies. These include a study showing decreases in sciatic-tibial nerve conduction in animals exposed to levels of 75 ppm for 9 months (Johnson et at. 1979); another study reporting neuropathy in animals after 6 months of exposure to 50 ppm (Streletz, Duckett, and Chambers 1976); and a study identifying 2,5-hexanedione in the serum of humans after a 1-day exposure to 50 ppm (diVincenzo, Kaplan, and Dedinas 1976).

The NIOSH REL for 2-hexanone of 1 ppm (10-hour TWA) is based on an epidemiologic study describing an outbreak of neurologic disease among workers in a plant that manufactures printed fabrics (Allen et al. 1975, as cited in NIOSH 1978). This study reported that a screening of 1,157 exposed workers revealed 86 verified cases of distal neuropathy. 2-Hexanone was suspected of being the neurotoxicant because it had only recently been introduced into the process (Allen et al. 1975). When recommending its limit, NIOSH relied on an industrial hygiene survey of the plant conducted by Billmaier et al. in 1974, which showed that 2-hexanone concentrations near the textile printing machines ranged from 1 to 156 ppm (10-minute area samples). After reviewing this evidence, NIOSH concluded that the 1 ppm level could not a considered a no-effect level for 2-hexanone-induced neuropathy.

The ACGIH (1987) stated that interpretation of the results of the Billmaier study was complicated because the exposure measurements reported in the study had been taken after the outbreak of neuropathic effects had occurred. In addition, the ACGIH pointed out that Billmaier et al. found poor work practices at the plant (gloves were rarely used, employees washed their hands with solvent, etc.), and thus dermal exposure may have contributed substantially to the outbreak.

Both human and animal studies show the development of disease at exposure levels below the existing 100 ppm PEL, clearly indicating the need to reduce this risk. There is disagreement regarding the interpretation of the reported epidemiology study to substantiate the 1 ppm REL. At this time OSHA has inadequate data to support feasibility at the 1 ppm level, while feasibility at 5 ppm has been demonstrated. OSHA therefore proposes adoption of a 5-ppm (TWA) PEL. The health evidence forms a reasonable basis for proposing a revision in this level. At the time of the final rule, OSHA will establish a new limit for 2-hexanone if the Agency determines that this limit will substantially reduce significant risk.

IRON PENTACARBONYL
CAS: 13463-40-6; Chemical Formula: $Fe(CO)_5$
H.S. No. 1216

OSHA currently has no limit for iron pentacarbonyl. The ACGIH recommends a TLV-TWA of 0.1 ppm with a TLV-STEL of 0.2 ppm, as iron, for this highly flammable, oily, colorless-to-yellow liquid.

In studies of rats, iron pentacarbonyl has been reported to have approximately one-third the acute toxicity of nickel carbonyl (for which ACGIH has recommended a TLV of 0.05 ppm TWA) (Sunderman, West, and Kincaid 1959). In 1970, Gage found that a 5.5-hour exposure at 33 ppm caused fatalities in three of eight rats; four of eight animals died after two 5.5-hour exposures at 18 ppm. At 7 ppm, no ill effects were observed in rats exposed 18 times for 5.5 hours (Gage 1970). There are no reports of long-term dose-response exposure studies in laboratory animals, and no evidence exists that iron pentacarbonyl is carcinogenic in either man or animals (ACGIH 1986, p. 327).

Immediate symptoms of acute exposure to high concentrations of iron pentacarbonyl include headache and dizziness, followed in 12 to 36 hours by fever, cyanosis, cough, and shortness of breath. The primary clinical effect is lung injury, although degenerative changes in the central nervous system have also been reported (ACGIH 1986, p. 327).

OSHA proposes a permissible exposure limit of 0.1 ppm TWA and a STEL of 0.2 ppm for iron pentacarbonyl. OSHA preliminarily concludes that these limits will protect exposed workers from the risk of headache, dizziness, fever, dyspnea, cyanosis, pulmonary injury, and central nervous system effects potentially associated with exposures at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for iron pentacarbonyl. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MERCURY (ARYL AND INORGANIC COMPOUNDS)
CAS: 7439-97-6: Chemical Formula: Hg
H.S. No. 1240

The current OSHA limit for all inorganic forms of mercury is 0.1 mg/m^3 Hg as a ceiling limit; this limit was adopted from ANSI standard Z37.8 (1943). ACGIH currently recommends a 0.1 mg/m^3 TLV-TWA for aryl and inorganic mercury compounds. NIOSH (1973b) has recommended a 0.05 mg/m^3 limit as an 8-hour TWA.

In 1971, the ACGIH recommended a 0.05 mg/m^3 TLV-TWA for all forms of mercury, including inorganic compounds. ANSI also reduced its standard to 0.05 mg/m^3 in 1972, and NIOSH recommended the same limit in 1973. The 0.05 mg/m^3 limit was based largely on the study of Smith et al. (1970) on workers exposed to mercury levels ranging from less than 0.1 to 0.27 mg/m^3 in chlor-alkali plants. The authors reported a significant dose-related increase in the incidence of weight loss, tremors, abnormal reflexes, nervousness, and insomnia among workers exposed to 0.1 mg/m^3 or more. There were slight increases in the incidence of insomnia and loss of appetite among workers exposed to 0.1 mg/m^3 or less. Smith et al. (1970) concluded that a limit of 0.1 mg/m^3 contained little or no margin of safety. Other studies (Bidstrup et al. 1951; Turrian et al. 1956) have also reported symptoms of mercury poisoning among workers exposed below 0.1 mg/m^3. The 0.05 mg/m^3 limit established by ACGIH, ANSI, and NIOSH also follows the 1968 recommendation of an international committee (Permanent Commission & International Association on Occupational Health 1968).

In 1980, the ACGIH revised its recommended TLV for aryl and inorganic mercury compounds to 0.1 mg/m^3 Hg. In revising this limit, the ACGIH cited discrepancies in the literature regarding the ratio of blood and urinary mercury levels to airborne concentrations of mercury (Bell et al. 1973; Stopford et al. 1978). These studies reported lower ratios of mercury body burden to airborne concentration when personal sampling is used rather than area sampling. According to Bell et al. (1973), the lower ratio results because mercury exposure measurements are generally found to be higher when personal sampling is conducted, presumably as a consequence of contamination of clothing. The ACGIH argued that the 0.05 mg/m^3 limit may be too stringent to apply when personal sampling is conducted. The ACGIH also stated that, unlike elemental or alkyl mercury, little mercury is deposited in the brain following exposure to aryl or inorganic mercury compounds. Based on this reasoning, the ACGIH adopted the higher 0.1 mg/m^3 TLV-TWA for aryl and inorganic compounds of mercury. However, the ACGIH (1986) also noted that, although central nervous system effects are less likely to occur from exposure to mercury salts than from other forms of mercury, the risk of renal and oral effects would "presumably be just as great." Therefore, they cautioned that the higher limit for mercury salts "may be subject to debate" (ACGIH 1986). The 0.05 mg/m^3 REL for the aryl and inorganic forms of mercury was established in 1973 and has been superseded by the 1980 ACGIH TLV of 0.1 mg/m^3 TWA, which is based on more recent studies. However, adopting the TLV would constitute a deregulation of OSHA's current standard for mercury. Because the health effects data available do not satisfy the requirements for deregulation, OSHA proposes to maintain its current 0.1 mg/m^3 ceiling PEL.

METHYLACRYLONITRILE
CAS: 126-98-7: Chemical Formula: $CH_2=C(CH_3)C=N$
H.S. No. 1251

There is no current OSHA standard for methylacrylonitrile, and NIOSH has no REL for this substance. The ACGIH recommends a 1-ppm TLV-TWA with a skin notation to protect workers who are occupationally exposed to methylacrylonitrile.

Methylacrylonitrile has been shown to be extremely toxic in animals, both by inhalation and dermal absorption. Beagles exposed for 90 days to 13.5 ppm convulsed and lost motor control in their hind limbs. Microscopic brain lesions were detected in one of the dogs. The level at which no effects were detected was determined to be between 3.2 ppm and 8.8 ppm (ACGIH 1986).

Neuropathic effects in dogs at levels of exposure below 8.8 ppm indicate that, in the absence of an exposure limit, occupational exposure to methyl acrylonitrile may be associated with a risk of neurological impairment. OSHA believes that establishing a 1 ppm PEL (which provides for a margin of safety below the observed no-effect level in dogs) and a skin notation will reduce the risk of neurological impairment that currently exists in the absence of an OSHA limit for this substance. The health evidence forms a reasonable basis for proposing a new limit for methylacrylonitrile. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce a significant risk.

METHYL BROMIDE
CAS: 74-83-9; Chemical Formula: CH_3Br
H.S. No. 1253

OSHA's current PEL for methyl bromide is a 20 ppm ceiling, while the ACGIH limit is 5 ppm as an 8-hour TWA, with a skin notation. NIOSH recommends that the REL for this substance be set at the lowest feasible level. Acute poisoning from methyl bromide is characterized by lung irritation, pulmonary edema, convulsions, and coma. Chronic exposure to low concentrations of methyl bromide generally produces

central nervous system effects, including muscle weakness and pain, incoordination, inability to focus one's eyes, and behavioral changes (ACGIH 1986; Craft 1983). The onset of neurological signs and symptoms is delayed for several hours to a few days after exposure.

Methyl bromide is a gas and an inhalation hazard, although it can also be absorbed through the skin. A report by Hine (1969) notes that methyl bromide has been responsible for more deaths among occupationally exposed workers in California than the organophosphates. It is hypothesized that methyl bromide has a greater potential for toxicity than other organic bromides, because its greater lipophilicity provides increased access to the brain.

Various studies demonstrate methyl bromide's toxicity in humans. Ingram (1951) reports ill effects (symptoms not specified) after exposure to methyl bromide at concentrations of 100 ppm. Similar exposure concentrations were also reported by Hine (1969) in a case study of two date packers in California. Johnson (1977) indicates that 34 packers became sick when exposed to an average methyl bromide concentration of 50 ppm, although concentrations in the packing room may have been as high as 100–150 ppm during the purging of a fumigation chamber.

Watrous (1942) described nausea, vomiting, and headache in 90 workers who were exposed for 2 weeks to concentrations "generally below" 35 ppm. These symptoms emphasized the need to create a TLV to protect workers from the nausea, vomiting, and headaches associated with lower levels of exposure. This need is strengthened by the fact that since these symptoms are usually delayed in onset, workers may not have sufficient warning of this substance's potential neurotoxicity.

The presence of neurologic symptoms at levels below 35 ppm indicates that a ceiling limit of 20 ppm is not adequate to protect workers from the effects of methyl bromide poisoning. OSHA proposes a PEL of 5 ppm TWA, with a skin notation, to more adequately protect workers against these incapacitating symptoms and to reduce this existing risk substantially. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl bromide if the Agency determines that this limit will substantially reduce significant risk.

MANGANESE FUME
CAS: 7439-96-5; Chemical Formula: MnO
H.S. No. 1236a

OSHA currently has a ceiling limit of 5 mg/m³ for manganese fume. Because of its potential for damage to the lungs and central nervous system, the ACGIH recommends an 8-hour TWA of 1 mg/m³ and a 3-mg/m³ STEL for manganese fume.

Symptoms of manganese poisoning range from sleepiness and weakness in the legs (Fairhall 1957) to difficulty in walking and uncontrolled laughter (Fairhall and Neal 1943). Health surveys of employees exposed to manganese fume have demonstrated a high incidence of pneumonia in these workers (Davies 1946). Tanaka and Lieben (1969) found seven cases of pneumonia and 15 borderline cases of pneumonia among 144 workers exposed to manganese dust or fume concentrations greater than 5 mg/m³; three of these cases were associated with fume rather than dust exposure. Those workers exposed to fume levels below 5 mg/m³ exhibited no signs of pneumonia. In a separate study by Smyth, Ruhf, Whitman, and Dugan (1973), 3 cases of manganese poisoning were detected among 71 employees exposed to levels of 13.3 mg/m³ fume.

OSHA is proposing a 1-mg/m³ TWA and a 3-mg/m³ STEL for manganese fume. The Agency preliminarily concludes that both a TWA limit and STEL are required to protect exposed employees from the risk of manganese poisoning, lung damage, and pneumonia associated with exposure to these fumes. The health evidence forms a reasonable basis for proposing a new limit for manganese fume. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MANGANESE CYCLOPENTADIENYL TRICARBONYL
CAS: 12079-65-1; Chemical Formula: C_5H_5-$Mn(CO)_3$
H.S. No. 1237

OSHA currently has no limit for exposure to manganese cyclopentadienyl tricarbonyl (MCT). The ACGIH recommends a TLV-TWA of 0.1 mg/m³ (as manganese), with a skin notation.

A Russian study reported that a single 2-hour exposure to MCT at 120 mg/m³ was fatal to 80 percent of albino rats, although rabbits, guinea pigs, and rats survived a single 2-hour exposure at 20 to 40 mg/m³. Chronic exposure of rats for 11 months at levels averaging 1 mg/g³ for 4 hours daily showed delayed effects (7 months from onset of exposure) on neuromuscular excitability, evidence of kidney damage, and decreased resistance to infection (Arkipova, Tolgskaya, and Kocketkova 1965). The tails of 10 white mice were dipped in a gasoline mixture containing 1 gram MCT per 100 ml; a second group of mice had their tails immersed in gasoline without MCT. An equal number of fatalities were observed in the gasoline plus MCT and gasoline only groups after four or five 2-hour applications, and all tails exhibited necrosis. The authors concluded that these effects were caused by the gasoline and not by the MCT (Arkipova, Tolgskaya, and Kocketkova 1965). Further studies in rabbits showed that MCT applied dermally as an oil emulsion caused irritation of the skin. These authors also investigated the dermal toxicity of tetrahydrofuran in MCT solutions versus tetrahydrofuran in oil. All animals whose tails had been dipped in the hydrofuran solution of MCT died within an hour, while animals whose tails had been dipped in pure tetrahydrofuran did not (Arkipova, Tolgskaya, and Kocketkova 1965). The same authors concluded that MCT is toxic at low concentrations, has cumulative properties, affects the nervous system, is irritating to the skin, and causes early histological changes in the respiratory tract.

More recent reports describe MCT-induced pulmonary edema and convulsions in the rat (Penney et al. 1985). The ED_{50}s for convulsions were 32 mg/kg orally and 20 mg/kg intraperitoneally; LD_{50}s were 24 mg/kg orally and 14 mg/kg intraperitoneally. Necrosis of the bronchiolar tissue and pulmonary parenchymal damage were seen in mice and rats given intraperitoneal doses (Haschek et al. 1982).

OSHA has preliminary concluded that occupational exposure to MCT poses a risk of neuropathic effects, kidney damage, skin irritation, pulmonary edema, and tissue damage. The Agency is therefore proposing an 8-hour TWA PEL of 0.1 mg/m³ for manganese cyclopentadienyl tricarbonyl, with a skin notation, to protect workers against the risk of these effects, which have been shown to occur at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for manganese cyclopentadienyl tricarbonyl. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MANGANESE TETROXIDE
CAS: 1317-35-7; Chemical Formula: Mn_3O_4
H.S. No. 1238

OSHA currently has no limit for manganese tetroxide (compounds and fume). The ACGIH recommends a TLV-TWA of 1 mg/m³, as manganese, for this brownish-black powder and its fume. Ferromanganese fume has been determined by x-ray diffraction analysis to consist primarily of manganese tetroxide.

Findings from a Russian study indicated that intratracheal suspensions of manganese oxide, manganese dioxide, and manganese tetroxide particles (particle size less than 3um) produced pneumonitis and other similar pulmonary effects in rats (Levina and Robachevsky 1955). These investigators also determined that manganese tetroxide has a greater toxicity than the lower oxides of manganese and that freshly prepared oxides were more potent than those stored for 6 months to a year.

Two cases of manganese fume poisoning were reported in a plant where concentrations were between 2.7 and 4.7 mg/m³ (Whitlock, Kimuso, and Bittenbender 1966), but other investigators have questioned these air analysis data and believe that exposures to manganese tetroxide concentrations of 5 mg/m³ or less cause no harmful effects (Whitman and Brandt 1966). In a 7-year study, Smyth and co-workers investigated chronic manganese poisoning in workers exposed to both ferromanganese fumes and dust. Five of 71 employees suffered from chronic manganism; of these five cases, three resulted from fume exposure and two from dust exposure. Two of the three fume-exposure victims were exposed over a 5-year period to an estimated average ferromanganese concentration of 13.3 mg/m³; however, the third victim worked in an operation where air concentrations of manganese were less than 1 mg/m³, which suggests that certain individuals may be hypersusceptible to manganese poisoning. The dust-exposed victims worked in areas where air concentrations were in the range of 30 to 50 mg/m³ throughout the study period (Smyth, Ruhf, Whitman, and Dugan 1973).

Martonik (cited in ACGIH 1986, p. 357) reports that the fume has greater toxicity than the dust. During a 2-year period, at least one case of acute manganese poisoning was documented at a fume concentration level of 7.5 mg/m³ and another case at the same welding operation may have been manganism.

OSHA is proposing a 1 mg/m³ 8-hour TWA for manganese tetroxide (compounds and fume). The Agency preliminarily concludes that this limit will provide protection against the risk of chronic manganese poisoning, pneumonitis, and other respiratory effects associated with exposure to manganese tetroxide at the levels presently permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for manganese tetroxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MERCURY (VAPOR)
CAS: 7439-97-6
H.S. No. 1241

OSHA currently has a ceiling limit of 0.1 mg/m³ for mercury (including vapor). The ACGIH recommends a TLV-TWA of 0.05 mg/m³ for mercury vapor, measured as mercury, and a skin notation. Elemental mercury is a silvery, odorless, heavy liquid.

Inhalation of high concentrations of mercury vapor for relatively brief periods can cause pneumonitis, bronchitis, chest pain, dyspnea, coughing, stomatitis, gingivitis, salivation, and diarrhea (NIOSH 1973; Ashe, Largent, Dutra et al. 1953). Chronic mercurialism is manifested by central nervous system effects, including tremor, a variety of neuropsychiatric disturbances, and loss of appetite (Kazantzis 1968; Smith, Vorwald, Patil, and Mooney 1970).

Severe organ damage occurred in rabbits exposed for 4 hours to an average vapor concentration of 28.8 mg/m³. Damage was observed in the kidneys, liver, brain, heart, lungs, and colon (Ashe, Largent, Dutra et al. 1953). The oral LD_{50} in rats for mercuric vapor is 18 mg/kg (NTIS PB 214-270, as cited in ACGIH 1986, p. 358). A study by Smith, Vorwald, Patil, and Mooney (1970) indicated that workers in the chlorine-producing industry who were exposed to mercury showed that chronic exposures to a 1-mg/m³ vapor concentration produced no effects in these workers. Six of 75 workers regularly exposed to 0.05 to 0.1 mg/m³ of mercury vapor in a glassware manufacturing plant reported insomnia, and one was found to have tremors (Danziger and Possick 1973). One of 11 workers employed in a mercury mine or refining plant and exposed at vapor concentrations below 0.1 mg/m³ had sore gums, loose teeth, or excess salivation (Rentos and Seligman 1968).

NIOSH (1973) has recommended a 10-hour TWA limit of 0.05 mg/m³ for inorganic mercury and concluded that hyperactivity, rather than tremor, may be the most typical symptom of chronic mercurialism. Two studies report no evidence of mercury vapor poisoning in industrial settings where characteristic exposures ranged between 0.05 and 0.1 mg/m³ (Danziger and Possick 1973; McGill et al. 1964).

In workers exposed at levels about 0.1 mg/m³, toxic symptoms were seen (Rentos and Seligman 1968). Turrian, Grandjean, and Turrian (1956) found that 33 percent of workers exposed to the vapor at levels above 0.05 mg/m³ had erethism, while only 8 percent of those exposed below this level manifested this symptom. About 20 percent of workers in both groups exhibited tremor. The ACGIH notes that, after exposure to the vapor, "a relatively high percentage of the absorbed mercury remains in the brain" compared with the amount deposited in the brain after exposure to the aryl and inorganic compounds (ACGIH 1986, p. 359). The ACGIH accordingly recommends a higher TLV-TWA for these compounds.

OSHA proposes a PEL of 0.05 mg/m³ TWA for mercury vapor, with a skin notation. The Agency preliminarily concludes that this limit will protect workers against the risk of acute and chronic mercury poisoning that exists from workplace exposures to this vapor at levels above 0.05 mg/m³. The skin notation is proposed because the vapors of elemental mercury can be readily absorbed through the skin. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for mercury (vapor) if the Agency determines that this limit will substantially reduce significant risk.

MERCURY, (ORGANO) ALKYL COMPOUNDS
CAS: 7439-97-6
H.S. No. 1242

OSHA has a current PEL of 0.01 mg/m³ TWA and a ceiling limit of 0.04 mg/m³ for the alkyl compounds of mercury. The ACGIH recommends a TLV-TWA of 0.01 mg/m³ and a TLV-STEL of 0.03 mg/m³ for these compounds, as mercury. A skin notation is also recommended by the ACGIH. Alkyl mercury compounds include volatile liquids, such as dimethyl and diethyl mercury, as well as many complex salts, which are usually solids.

Alkyl mercury compounds pose greater health hazards than do the inorganic compounds or mercury because they can penetrate the blood-brain barrier and the placenta very quickly. The primary toxic effects associated with exposure to the organic compounds of mercury are injuries to the central and peripheral nervous

systems and to the kidneys (Casarett and Doull 1975). In addition, data concerning mouse and rat exposures to alkyl mercury compounds have demonstrated toxicity to the gastrointestinal system, pancreas, liver, gonads, and cardiovascular system. Suppression of the immune system and impairment of the endocrine system have also been demonstrated (Shakbazyan et al. 1977). Fatalities in mice have been reported at exposures of 10 to 30 mg/m³ for 3 to 5 hours (Trakhtenberg 1950).

Methyl mercury is among the most damaging of the alkyl compounds to humans because it accumulates in the body and causes developmental effects (Wilson 1977). A 3-month exposure to approximately 1 mg/m³ diethyl mercury caused death in two individuals (Hill 1943). Another fatal case of alkyl mercury poisoning has also been described (Hook, Lundgren, and Swensson 1954). On the basis of his work with laboratory animals, Trakhtenberg (1950) stated that even a concentration as low as 0.00001 mg/m³ could not be tolerated by humans on a continuing basis. However, a later study reported no consistent, acute effects of mercury poisoning at air concentrations between 0.01 and 0.1 mg/m³, despite the fact that brief excursions considerably above this range occurred (Dinman, Evans, and Linch 1958).

OSHA is proposing a PEL of 0.01 mg/m³ TWA and a 15-minute STEL of 0.03 mg/m³ for the alkyl compounds of mercury, with a skin notation. The Agency preliminarily concludes that exposure to the alkyl mercury compounds poses a risk of severe neuropathic and other systemic injury. The Agency believes that both the short-term and 8-hour limits are necessary to reduce these risks and that the skin notation will protect against the dermal absorption possible in the absence of any OSHA limit or skin notation. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for mercury, (organo) alkyl compounds if the Agency determines that this limit will substantially reduce significant risk.

PENTABORANE
CAS: 19624-22-7; Chemical Formula: B_5H_9
H.S. No. 1304

OSHA's current limit for pentaborane is 0.005 ppm as an 8-hour TWA. The ACGIH has the same 8-hour TWA but additionally recommends a 15-minute STEL of 0.015 ppm. Pentaborane is a colorless liquid with a strong and penetrating odor.

In both humans and animals, inhalation of pentaborane vapor causes central nervous system effects (Svirbely 1954; Rozendaal 1951; Lowe and Freeman 1957; Cordasco, Cooper, Murphy, and Anderson 1962).

The 5-minute LC_{50} for rats and mice is 67 and 40 ppm, respectively; for 60 minutes, these values are 10 and 6 ppm for rats and mice, respectively (Weir, Bath, and Weeks 1961, as cited in ACGIH 1986, p. 459). Rats exposed repeatedly to 3-ppm pentaborane by inhalation exhibited tremors, hyperexcitability, belligerency, and weight loss (Svirbely 1954). Rats, rabbits, monkeys, and dogs exposed repeatedly to pentaborane vapor at concentrations of 1 ppm for 4 weeks or 0.2 ppm for 6 months lost weight (Levinkas, Paslian, and Bleckman 1958). In the same experiments, rats and rabbits exposed at 1 ppm showed reduced activity and impaired locomotor ability, respectively, and monkeys and dogs exhibited apathy, loss of appetite, insensitivity to pain, loss of mobility, tremor, and impaired coordination. The ACGIH (1986, p. 459) notes that the 0.2 ppm concentration reported in the Levinkas et al. study (1958) was a calculated rather than measured value and that the actual exposure level was probably closer to 0.01 ppm.

Humans accidentally overexposed to pentaborane experience tremors, convulsions, behavioral changes, loss of memory, impaired judgment, and other symptoms of central nervous system intoxication (Svirbely 1954; Rozendaal 1951; Lowe and Freeman 1957; Cordasco, Cooper, Murphy, and Anderson 1962).

OSHA is proposing an 8-hour TWA of 0.005 ppm for pentaborane and a STEL of 0.015 ppm. The Agency preliminarily concludes that these limits will protect workers against the risk of central nervous system effects, such as tremors and convulsions, behavioral changes, and loss of judgment, potentially associated with exposure to pentaborane at levels only slightly above those that would be premitted by the 8-hour TWA alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for pentaborane if the Agency determines that this limit will substantially reduce significant risk.

PHENYL MERCAPTAN
CAS: 108-98-5; Chemical Formula C_6H_5SH
H.S. No. 1316

OSHA has no current limit for phenyl mercaptan. The ACGIH recommends a TLV-TWA of 0.5 ppm. NIOSH recommends a 15-minute ceiling limit of 0.1 ppm for phenyl mercaptan (benzenethiol). Phenyl mercaptan is a colorless liquid with an offensive, garlic-like odor.

The primary acute hazards of exposure to phenyl mercaptan are central nervous system stimulation followed by post-convulsive CNS depression, severe eye and skin irritation, systemic toxicity to spleen, kidney, lung, and liver tissues, and narcotic effects (ACGIH 1986, p. 478).

Phenyl mercaptan has been reported to have 4-hour inhalation LC_{50} values of 33 and 28 ppm for rats and mice, respectively (Doull and Plzak 1962; Fairchild and Stokinger 1958). The oral LD_{50} for the rat is reported to be 46 mg/kg (McCord and Witheridge 1949; Robles 1975, as cited in ACGIH 1986, p. 478). For the rabbit and rat, the dermal LD_{50} values are 134 mg/kg and 300 mg/kg, respectively (Doull and Plzak 1962; Fairchild and Stokinger 1958; Schafer 1972). The responses of animals to exposure to phenyl mercaptan were uniform regardless of species and progressed from CNS stimulation to incoordination, skeletal and muscular paralysis, respiratory depression, followed at high concentrations by coma and death. High doses (not further specified) administered via inhalation produced lung, liver, and kidney changes in mice (Doull and Plzak 1962; Fairchild and Stokinger 1958; Schafer 1972). In rabbits, phenyl mercaptan is a severe eye and skin irritant (McCord and Witheridge 1949; Robles 1975; Schafer 1972).

In humans, phenyl mercaptan is a moderately toxic skin irritant and causes severe dermatitis, headaches, and dizziness at unspecified levels (Fairchild and Stokinger, 1958; McCord and Witheridge 1949).

OSHA is proposing an 8-hour TWA limit of 0.5 ppm for phenyl mercaptan. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of CNS effects, skin irritation, and systemic injury potentially associated with occupational exposure to phenyl mercaptan at the uncontrolled levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for phenyl mercaptan. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PROPYLENE GLYCOL DINITRATE
CAS: 6423-43-4; Chemical Formula: $C_3H_6N_2O_6$
H.S. No. 1342

OSHA currently has no limit for propylene glycol dinitrate. The ACGIH

recommends a TLV–TWA of 0.05 ppm, with a skin notation. When freshly prepared, propylene glycol dinitrate is a colorless liquid with a disagreeable odor.

Exposure to this substance affects blood pressure, causes methemoglobinuria and respiratory toxicity, injures liver and kidney tissues, and distorts vision. It can also cause headache and incoordination.

The oral LD_{50} value for the rat is between 480 and 250 mg/kg (Clark and Litchfield 1969; Andersen and Mehl 1973), and the subcutaneous LD_{50} is 530 mg/kg (Andersen and Mehl 1973). Mice are reported to be somewhat more resistant, with a subcutaneous LD_{50} of slightly more than 1200 mg/kg; however, cats appear to be even more susceptible to propylene glycol dinitrate with a subcutaneous LD_{50} of between 200 and 300 mg/kg (Clark and Litchfield 1969). In all species studied, death occurs by anoxia, which is caused by almost complete conversion of hemoglobin to methemoglobin (Clark and Litchfield 1969). Skin tests in albino rabbits did not produce irritation, but ocular instillation caused transient conjunctival redness (Jones, Strickland, and Siegel 1972). Twenty-day skin exposures in rabbits at 1 g/kg showed minor irritation, and at 2 g/kg, rabbits became weak and cyanotic; one of five rabbits died, and this animal's hemoglobin and hematocrit values had decreased. When the dose was increased to 4 g/kg, the rabbits methemoglobin values rose to 34.5 percent at death, an indication, along with elevated serum and urinary nitrate levels, that propylene glycol dinitrate is readily absorbed through the skin (Jones, Strickland, and Siegel 1972). Continuous 90-day inhalation exposures in dogs at 10 ppm showed kidney and liver changes; exposures at 35 ppm caused heavy iron deposits in the liver, spleen, and kidneys. Female (but not male) rats showed a drop in blood pressure within 30 minutes after injection of doses above 5 mg/kg. Rhesus monkeys displayed mydriasis in 90-day exposures at 35 ppm but no change in avoidance behavior during a visual discrimination and acuity threshold test (Jones, Strickland, and Siegel 1972).

In humans, 8-hour exposures to 0.2 ppm or higher propylene glycol dinitrate resulted in visual distortion and headache (Stewart et al. 1974). Subjects developed a tolerance for the headache response, but the visual effects were cumulative. Impaired balance occurred after 6.5 hours of exposure at 0.5 ppm, and a 40-minute exposure at 1.5 ppm caused eye irritation. Subjects exposed at 0.5 ppm for 8 hours experienced a consistent elevation in diastolic pressure but no pulmonary irritation. At concentrations of 0.03 to 1.5 ppm, no hematologic effects were observed (Stewart et al. 1974). Studies of human exposures to levels below 0.1 ppm do not report evidence of chronic neurotoxicity (Horvath et al. 1981).

OSHA proposes a TWA limit of 0.05 ppm, with a skin notation, for propylene glycol dinitrate. The Agency believes that this limit will protect workers against the risk of hepatotoxic, hematologic, and central nervous system effects that exists from workplace exposure in the absence of any OSHA PEL. The skin notation is proposed to protect against the risk of skin absorption. The health evidence forms a reasonable basis for proposing a new limit for propylene glycol dinitrate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

OSHA preliminary concludes that risks are associated with occupational exposure to the group of neuropathic toxicants shown in Table C1–1. The effects caused by such exposures include brain lesions, nausea, vomiting, general depression of the central nervous system, interference with sensory and motor functions, and alterations in the ability of the brain to process information. Affected workers may experience drowsiness, dizziness, loss of ability to concentrate, mood changes, reduced awareness, learning difficulty, unsteadiness, and auditory and visual disturbances. In addition, employees experiencing these effects are at risk and are likely to hurt themselves or others in accidents caused by their reduced functional capacity. OSHA believes that the health evidence for these neurotoxins forms a reasonable basis for proposing new or revised limits. At the time of the final rule, the Agency will establish these limits if it determines that significant risk will be substantially reduced thereby.

2. Substances for Which Proposed Limits are Based on Avoidance of Narcosis Effects

Introduction

Proposed limits for 19 substances are based primarily on evidence showing that occupational exposure to these substances causes narcosis. The narcotic effects of exposure to substances such as alcohols, aliphatic hydrocarbons, and chlorinated hydrocarbons have been recognized in industry as serious adverse effects for many years. Table C2–1 lists these chemicals, their CAS and HS numbers, and their OSHA, ACGIH, and NIOSH limits. For seven of these substances, the Agency proposes to lower the 8-hour limit and to revise or add a STEL. In five cases, the 8-hour limit will remain the same and a proposed STEL will be added. Eight-hour TWAs and/or STELs are being proposed for four previously unregulated substances; in two cases, OSHA is proposing the NIOSH REL, and, in the remaining case, an existing limit would be replaced by a new value.

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TABLE C2-1. Substances for Which Limits Are Based on Avoidance of Narcosis

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1044 Butane	106-97-8	—	800 ppm TWA	—
1049 sec-Butyl alcohol	78-92-2	150 ppm TWA	100 ppm TWA 150 ppm STEL	—
1050 tert-Butyl alcohol	75-65-0	100 ppm TWA	100 ppm TWA 150 ppm STEL	—
1111 Cyclopentane	287-92-3	—	600 ppm TWA	—
1163 Ethyl bromide	74-96-4	200 ppm TWA	200 ppm TWA 250 ppm STEL	—
1185 Gasoline	8006-61-9	—	300 ppm TWA 500 ppm STEL	—
1194 Heptane	142-82-5	500 ppm TWA	400 ppm TWA 500 ppm STEL	85 ppm TWA 440 ppm Ceiling (15 min)
1201 Hexane isomers	—	—	500 ppm TWA 1000 ppm STEL	100 ppm TWA 510 ppm Ceiling (15 min)

TABLE C2-1. Substances for Which Limits Are Based on Avoidance of Narcosis (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1218 Isoamyl alcohol	123-51-3	100 ppm TWA	100 ppm TWA 125 ppm STEL	--
1221 Isophorone+	78-59-1	25 ppm TWA	5 ppm Ceiling	4 ppm TWA
1254 Methyl chloride	74-87-3	100 ppm TWA 200 ppm STEL 300 ppm Ceiling	50 ppm TWA 100 ppm STEL	Lowest feasible level
1255 Methyl chloroform (1,1,1-Trichloroethane)	71-55-6	350 ppm TWA	350 ppm TWA 450 ppm STEL	350 ppm Ceiling (15 min)
1296 Octane	111-65-9	500 ppm TWA	300 ppm TWA 375 ppm STEL	75 ppm TWA 385 ppm Ceiling (15 min)
1306 Pentane	109-66-0	1000 ppm TWA	600 ppm TWA 750 ppm STEL	120 ppm TWA 610 ppm Ceiling (15 min)
1307 2-Pentanone (Methyl propyl ketone)	107-87-9	200 ppm TWA	200 ppm TWA 250 ppm STEL	150 ppm TWA
1308 Perchloroethylene (Tetrachloroethylene)	127-18-4	100 ppm TWA 200 ppm STEL 300 ppm Ceiling	50 ppm TWA 200 ppm STEL	Lowest feasible limit

TABLE C2-1. Substances for Which Limits Are Based on Avoidance of Narcosis (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1371 Stoddard solvent	8052-41-3	500 ppm TWA	100 ppm TWA (525 mg/m^3)	350 mg/m^3 TWA 1800 mg/m^3 Ceiling (15 min)
1397 Toluene	108-88-3	200 ppm TWA 300 ppm STEL 500 ppm Ceiling	100 ppm TWA 150 ppm STEL	100 ppm TWA (8-hr) 200 ppm Ceiling (10 min)
1406 Trichloroethylene+	79-01-6	100 ppm TWA 200 ppm STEL 300 ppm Ceiling	50 ppm TWA 200 ppm STEL	25 ppm TWA

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed PEL is based on NIOSH REL.

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Description of the Health Effects

Narcosis is the result of general depression of central nervous system (CNS) function. When the CNS becomes sufficiently depressed, the awareness or consciousness of exposed workers is affected. Initial symptoms of narcosis include drowsiness, difficulty in concentration, and mood changes; these may progress to slurred speech, dizziness, and loss of coordination, and, in more severe cases, loss of consciousness, coma and death. Except in more serious cases, CNS depression is reversible on removal from exposure and causes no permanent damage to the CNS. However, because narcosis adversely affects workers' concentration and coordination, there is an increased risk of injuries and accidents caused by mistakes and errors in judgment.

The mechanism by which substances induce narcosis is poorly understood. CNS depressants may have the same mechanism of action as general anesthetics, which appear to produce a reversible effect on electrically excitable neuronal membranes.

Dose-Response Relationship and Narcotic Effects

The induction of narcosis following exposure to narcotic agents is expected to follow the classical S-shaped (sigmoidal) dose-response relationship. As exposure level increases, both the percent of exposed persons affected and the severity of the effect will increase. Although it is not known whether a true threshold exists for the occurrence of the molecular events leading to narcosis (i.e., disruption of electrical impulses in neurons), there is usually a level at which most exposed individuals will manifest the onset of symptoms associated with narcosis. The no-effect level for a particular substance will be determined largely by individual susceptibility, the extent to which the material is absorbed, and the rate at which it is metabolized and eliminated.

The following discussion describes OSHA's preliminary findings for the substances in this group and illustrates the potentially serious consequences of workplace exposure to these substances.

BUTANE
CAS: 106–97–8; Chemical Formula: C_4H_{10}
H.S. No. 1044

OSHA has no current limit for butane. the ACGIH recommends a threshold limit value of 800 ppm TWA for this colorless, flammable gas.

The primary risk of exposure to butane is its ability to cause narcosis at high exposure levels. Exposure to 10,000 ppm for 10 minutes causes drowsiness, but there are no reports of systemic toxicity or irritation (Gerarde 1963).

In rats, the 4-hour LC_{50} for butane is 658 gm/m³, or about 280,000 ppm (NIOSH 1977). Humans exposed to 1000 ppm for a single 8-hour day, or to 500 ppm for 2-week periods of 8-hour workdays, showed no harmful subjective or abnormal physiological responses but did show a reduced visual evoked response (VER) wave amplitude during the second week (Stewart et al. 1977).

OSHA is proposing a permissible exposure limit of 800 ppm TWA for butane. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of narcosis and drowsiness potentially associated with exposures at previously uncontrolled levels. The health evidence forms a reasonable basis for proposing a new limit for butane. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

sec-BUTYL ALCOHOL
CAS: 78–92–2; Chemical Formula: $CH_3CH_2CHOHCH_3$
H.S. No. 1049

OSHA's current limit for sec-butyl alcohol is 150 ppm as an 8-hour TWA. The ACGIH recommends a TLV–TWA of 100 ppm, with a 15-minute STEL of 150 ppm. sec-Butyl alcohol is a colorless liquid with a strong, wine-like odor.

The acute toxicity of sec-butyl alcohol is reported to be lower than that of n-butanol, for which OSHA is proposing a ceiling of 50 ppm. The oral LD_{50}s in rats for these two substances are 6.5 g/kg for sec-butyl alcohol and 4.4 g/kg for n-butanol, respectively (Smyth, Carpenter, and Weil 1951). Liquid sec-butyl alcohol is less injurious to the eyes than liquid n-butanol (ACGIH 1986, p. 77). Occupational exposures to sec-butyl alcohol at levels of about 100 ppm were reported not to be associated with difficulties (Bank, unpublished communication, as cited in ACGIH 1986, p. 77).

OSHA proposes to reduce the permissible exposure limit for sec-butyl alcohol to 100 ppm TWA, and to include a 150-ppm STEL, to afford adequate protection against the risk of narcosis and irritation caused by short-term elevated exposures. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sec-butyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

tert-BUTYL ALCOHOL
CASL 75–65–0; Chemical Formula: $(CH_3)_3COH$
H.S. No. 1050

OSHA currently has a limit of 100 ppm for tert-butyl alcohol. The ACGIH recommends a TLV–TWA of 100 ppm, with a TLV–STEL of 150 ppm. At ordinary temperatures and pressures, tert-butyl alcohol exists in the form of colorless hygroscopic crystals (ACGIH 1986).

Although similar to the other butyl alcohols in many respects, tert-butyl alcohol is more volatile and has a greater potential for narcotic effects (Weese 1928). Mice exposed to t-butyl alcohol exhibit a stronger narcotic response than they show when exposed to normal or iso-butyl alcohol (Weese 1928). Repeated daily doses of t-butyl alcohol that produced narcosis were not fatal in animals (Schaffarzick and Brown 1952). In humans, contact with t-butyl alcohol produces erythema and hyperemia (Oetel 1936).

OSHA proposes an 8-hour TWA PEL of 100 ppm for tert-butyl alcohol, with a 15-minute STEL of 150 ppm. The Agency preliminarily concludes that this combination of limits will protect against the risk of narcosis permitted at elevated short-term levels. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for tert-butyl alcohol if the Agency determines that this limit will subtantially reduce significant risk.

CYCLOPENTANE
CAS: 287–92–3; Chemical Formula: $CH_2CH_2CH_2CH_2CH_2$
H.S. No. 1111

OSHA currently has no limit for cyclopentane. The ACGIH recommends a TLV–TWA of 600 ppm for this flammable, mobile liquid.

The few existing animal data indicate the cyclopentane is a central nervous system depressant. As with other alicyclic hydrocarbons, high concentrations cause excitement, loss of equilibrium, stupor, coma, and, rarely, respiratory failure (Gerard 1963). No major toxicological animal studies on the effects of cyclopentane exposure have been reported, and evaluations of the toxic properties of this substance have therefore relied on the animal data for n-pentane. n-Pentane has been shown to cause narcosis in animals at exposures of 90,000 to 120,000 ppm for 5 to 60 minutes (Abritti et al. 1976). Swann (1974) reported that a concentration of 130,000 ppm is fatal. Almost no data are available concerning the chronic effects of cyclopentane exposure.

Abritti et al. (1976) report that petroleum solvents used in the Italian shoe industry contain up to 18 percent cyclopentane. Workers exposed to these solvents have been observed to suffer from polyneuropathy, and Oettel reported in 1936 that skin exposure to such solvents caused burning and skin blistering after 15 minutes of confined contact. It has not been determined whether the irritation was caused by cyclopentane or by other substances, such as n-hexane, in the solvent.

OSHA is proposing a PEL of 600 ppm TWA for this substance. OSHA has preliminarily concluded that occupational exposure to cyclopentane poses a risk of irritation and narcosis at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for cyclopentane. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ETHYL BROMIDE
CAS: 74-96-4; Chemical Formula: C_2H_5Br
H.S. No. 1163

OSHA currently has an 8-hour TWA limit of 200 ppm for ethyl bromide. The ACGIH also recommends a limit of 200 ppm as an 8-hour TWA, and in addition recommends a 15-minute STEL of 250 ppm. Ethyl bromide is a colorless, highly volatile, and flammable liquid with an ether-like odor; it becomes yellow when exposed to light and air.

The concentrations of ethyl bromide reported as lethal to guinea pigs are 3200 ppm for 9 hours and 1700 ppm for 12.5 hours (Sayers, Yant, Thomas, and Berger 1929). Von Oettingen (1955) reported the minimal lethal concentration of this substance for mice as 3500 ppm.

Ethyl bromide acts as a central nervous system depressant (narcotic); additionally, exposure irritates the lungs and causes congestion and fatty degeneration of the liver, intestinal hemorrhage, and kidney swelling. Several deaths have been reported from the use of ethyl bromide as general anesthetic (von Oettingen 1955).

OSHA is proposing a PEL of 200 ppm as an 8-hour TWA and a 15-minute STEL of 250 ppm for ethyl bromide. The Agency preliminarily concludes that these limits will work to reduce the risk of narcosis, kidney and liver damage, and respiratory irritation associated with occupational exposure to elevated levels of ethyl bromide. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethyl bromide if the Agency determines that this limit will substantially reduce significant risk.

GASOLINE
CAS: 8006-61-9; Chemical Formula: None
H.S. No. 1185

There is no current OSHA PEL for gasoline. The ACGIH has established a 300-ppm 8-hour TWA and a 500-ppm 15-minute STEL.

Studies have shown that exposure to 2000 ppm of gasoline for 30 minutes produces mile anesthesia, while exposure to concentrations between 500 and 900 ppm for 1 hour produces dizziness (Gerarde 1963; Runion 1975). However, these authors also found that people exposed to gasoline at concentrations 160 to 270 ppm for several hours do not experience any symptoms of narcosis.

OSHA is proposing an 8-hour TWA of 300 ppm, supplemented by a STEL of 500 ppm to ensure that levels do not exceed 300 ppm for any length of time; these limits are intended to protect against the early symptoms of narcosis. OSHA preliminarily concludes that uncontrolled exposure to gasoline place exposed employees at risk of experiencing drowsiness, headaches, dizziness, and loss of coordination. The health evidence forms a reasonable basis for proposing a new limit for gasoline. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

HEPTANE
CAS: 142-82-5; Chemical Formula: $CH_3(CH_2)CH_2CH_3$
H.S. No. 1194

The current OSHA limit for heptane is 500 ppm as an 8-hour TWA. The ACGIH TLVs for heptane are 400 ppm as a TWA and 500 ppm as a STEL. NIOSH (1977a) has recommended that workplace exposures not exceed 85 ppm as a 10-hour TWA or 440 ppm as a 15-minute ceiling limit.

Patty and Yant (1939) reported that exposure to 1,000 ppm for 6 minutes caused slight dizziness in humans; exposures to higher levels caused vertigo, incoordination, and hilarity. They also reported that a 4-minute exposure to 5,000 ppm produced complaints of nausea and loss of appetite. Based on this information, as well as animal data showing 10,000 to 15,000 ppm as being an effect level for narcosis (Fuhner 1921), the ACGIH concluded that heptane was more acutely toxic than hexane. They therefore recommended limits that are somewhat lower than for hexane isomers.

As discussed above in the discussions on pentane and hexane isomers, NIOSH has recommended the same occupational limits for all C_5–C_8 alkanes (i.e., 350 mg/m³ TWA and 1800 mg/m³ as a 15-minute ceiling). This recommendation considers that all C_5–C_8 alkanes possess potential neurotoxic capability similar to that of n-hexane. The ACGIH disagrees with this concept, believing that the neurotoxicity caused by exposure to n-hexane is the result of a unique metabolite, 2,5-hexanedione.

Because heptane is considered to be more acutely toxic than hexane, OSHA preliminarily concludes that it is appropriate to revise its limit for heptane to a level below that of hexane isomers and, thus, reduce the risk of narcosis. Therefore, OSHA proposes to revise its limit for heptane to 400 ppm TWA and 500 ppm STEL. As in the case of hexane isomers and pentane, OSHA solicits comment on the evidence that heptane is potentially neuropathic.

HEXANE ISOMERS
CAS: None; Chemical Formula: $(CH_3)_2C_2H_2$; $n(CH_3)_4C_2H_2$
H.S. No. 1201

OSHA has no current limit for the hexane isomers. The ACGIH TLVs for hexane isomers are 500 ppm TWA and 1000 ppm STEL. NIOSH has a recommended TWA limit for these isomers of 100 ppm, supplemented by a 510-ppm (15 min) ceiling.

A study by Drinker et al. (1943) shows that humans exposed to 1400 to 1500 ppm of hexane experienced nausea and headache. Patty and Yant (1929) found that a 10-minute exposure to 5000 ppm caused giddiness and dizziness in exposed subjects. A study by Nelson et al. (1943) showed no effects in unacclimated subjects exposed to hexane isomers in concentrations of 500 ppm, but narcotic effects have often been seen in people exposed at levels above 100 ppm (Elkins 1959). The ACGIH based its recommendation primarily on the Nelson et al. (1943) study.

NIOSH recommends limits for the hexane isomers of 100 ppm as a 10-hour TWA and 510 ppm as a 15-minute short-term limit. This recommendation is based on human and animal evidence that exposure to n-hexane below concentrations of 500 ppm is associated with the development of polyneuropathy (Inoue et al. 1970; Miyagaki 1967); NIOSH (1977a) did not distinguish between n-hexane and other hexane isomers when making its recommendation for an exposure limit. It should be noted that NIOSH concluded that all C_5–C_8 alkanes are potential neuropathic agents and cited a human study (Gaultier 1973) that reported

neuropathy among workers exposed to an alkane mixture containing less than 5 percent n-hexane.

The ACGIH (1986, p. 307) disagrees with NIOSH that all C_5–C_8 alkanes are potential neuropathic agents, citing evidence that a metabolite of n-hexane (2,5-hexanedione) is responsible for the unique neurotoxic properties of n-hexane (see discussion of n-hexane in Section IV–C1 of this Preamble). The ACGIH concluded that "it seems unlikely that all the hexanes would follow the same metabolic route in the body [as n-hexane], in view of the marked variations in structure of the molecule" (ACGIH 1986, p. 307).

After reviewing the evidence cited by ACGIH (1986) and NIOSH (1977a), OSHA preliminarily finds that workers exposed to hexane isomers are at significant risk of experiencing narcosis and of developing neuropathy in the absence of an OSHA limit. The NIOSH RELs for the hexane isomers (100 ppm TWA and 510 ppm STEL) are based on the hypothesis that all of the C_5–C_8 alkanes are potential neuropathic agents. OSHA tentatively accepts the analysis that a unique metabolite of n-hexane is responsible for such effects and therefore proposes at this time a 500-ppm TWA and a 1000-ppm STEL for the hexane isomers. Because of the scientific disagreement on this subject, OSHA specifically requests comments on the toxicity or absence of toxicity of the other C_5–C_8 alkanes. The health evidence forms a reasonable basis for proposing a new limit for hexane isomers. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ISOAMYL ALCOHOL (PRIMARY AND SECONDARY)
CAS: 123–51–3; Chemical Formula: $(CH_3)_2CHCH_2CH_2OH$—Primary; $(CH_3CH_2)_2CHOH$—Secondary
H.S. No. 1218

OSHA's current limit for the isoamyl alcohols is 100 ppm as an 8-hour TWA. The ACGIH has established an 8-hour TLV–TWA of 100 ppm and a 15-minute STEL of 125 ppm for these substances, which are colorless liquids that have pungent tastes and an alcoholic odor that causes coughing.

In rats, the oral LD_{50} for the primary isoamyl alcohol in 7.07 mg/kg (Smyth et al. 1969). Haggard, Miller, and Greenburg (1945) determined that isoamyl alcohol's anesthetic toxicity was approximately 12 times higher than that of ethyl alcohol; these authors believed that exposure to isoamyl alcohol would not cause chronic effects.

Smyth (1956) reported that the principal effect of inhalation exposure to this substance is narcosis, and this author believed that, by analogy with the narcotic effects of butyl alcohol, a 100-ppm level would protect exposed workers against narcosis but not against irritation. Nelson, Ege, Ross and co-workers (1943) stated that unacclimatized human volunteers reported throat irritation at a concentration of 100 ppm, and eye and mucous membrane irritation at higher levels.

OSHA is proposing an 8-hour TWA of 100 ppm and a 15-minute STEL of 125 ppm for the isoamyl alcohols (primary and secondary). The Agency preliminarily concludes that these limits will work together to ensure that workers are protected against the eye and mucous membrane irritation known to be associated with exposures above 100 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for isoamyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

ISOPHORONE
CAS: 78–59–1; Chemical Formula: $C_9H_{14}O$
H.S. No. 1221

The current OSHA limit for isophorone is 25 pm as an 8-hour TWA. The ACGIH has established a 5 ppm TLV as a ceiling limit, and NIOSH recommends a workplace standard of 4 ppm as a 10-hour TWA for isophorone. Isophorone is a colorless liquid at room temperature, and it has a comphor-like order.

Studies in animals and with human volunteers indicate that exposures to high concentrations of isophorone cause nephrotoxic and other adverse effects. A paper by Smyth, Seaton, and Fischer (1942) reported that guinea pigs and rats exposed to 550 ppm isophorone for 6 weeks demonstrated degenerative changes in the kidneys and liver. At an exposure level of 25 ppm, no adverse effects were noted, but at 50 ppm, the liver of one animal and the kidneys of four others were damaged. The entire group of 20 animals exposed at 50 ppm survived, but 2 of 16 animals died after this level was raised to 100 ppm (Smyth, Seaton, and Fischer 1942). Volunteers exposed for a few minutes to isophorone vapor at concentrations between 40 and 400 ppm experienced eye, nose, and throat irritation; several subjects exposed at the 200-ppm level developed headache, nausea, faintness, dizziness, and a feeling of suffocation (Smyth and Seaton 1940). Silverman, Schulte, and First (1946) reported that volunteers exposed to 25 ppm isophorone, the current OSHA PEL, complained of irritation of the eyes, nose, and throat. Another study conducted by the Western Electric Company (Ware, personal communication, 1973) reported that workers exposed for a one-month period to levels of 5 to 8 ppm isophorone demonstrated fatigue and malaise. When the workplace level was reduced to between 1 and 4 ppm, there were no complaints of adverse effects. The NIOSH Criteria Document for the ketones (1978) notes that all of the ketones are central nervous system depressants, and that workplace exposures to more than one ketone may produce additive effects.

OSHA is proposing to reduce the current 8-hour TWA PEL of 25 ppm to an 8-hour TWA of 4 ppm, to protect workers against the risk of fatigue, nausea, and headaches demonstrated to occur in exposed workers at levels between 5 and 8 ppm. The Agency preliminarily concludes that this limit will substantially reduce this occupational risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for isophorone if the Agency determines that this limit will substantially reduce significant risk.

METHYL CHLORIDE
CAS: 74–87–3; CHEMICAL FORMULA: CH_3Cl
H.S. No. 1254

OSHA's current limits for methyl chloride are 100 ppm as an 8-hour TWA, 200 ppm as a 15-minute ceiling, and 300 ppm as a 5-minute peak in any 3-hour period. The ACGIH has established a 50-ppm 8-hour TLV–TWA limit and a 100-ppm 15-minute STEL for this substance. NIOSH recommends the lowest feasible limit for methyl chloride and considers it a carcinogen. Methyl chloride is a colorless, sweet-smelling gas.

There is considerable evidence in humans and some in animals demonstrating that exposure to methyl chloride by inhalation or dermal absorption produces narcosis and other central nervous system effects, including respiratory failure and death (ACGIH 1986, p. 380). In animals, repeated exposures to 500 ppm or to higher concentrations can be life-threatening, but exposures to 300 ppm for 64 weeks caused no apparent effects (Smith and von Oettingen 1947).

Reports in the earlier literature described by Fairhall (1969) indicate that moderate (not further specified) exposure causes ocular symptoms that

may persist for weeks, while serious (not further specified) exposure has severe effects in the central nervous system. Patty (1963) states that serious exposure causes central nervous system, liver and kidney, and bone marrow effects, with symptoms of ataxia, staggering gait, weakness, tremors, vertigo, speaking difficulty, and blurred vision. Symptoms may be of several weeks' duration or may even be permanent (Patty 1963).

The Dow Chemical Company (as cited in ACGIH 1986, p. 380) studied the methyl chloride exposures of employees in 54 job classifications over a 4-month period. Exposures ranged from 5 to 78 ppm methyl chloride (8-hour TWA), averaged 30 ppm over the work shift, and occasionally included peaks as high as 440 ppm. Medical examination of these workers revealed no detectable effects of methyl chloride exposure. However, average 8-hour exposures in the range of 195 to 475 ppm caused symptoms of weakness, drowsiness, staggering gait, thickness of the tongue, and memory lapses in some of the employees (Dow Chemical Company, as cited in ACGIH 1986, p. 380).

In a study of six cases of industrial methyl chloride poisoning, workers chronically exposed to levels between 200 and 400 ppm developed neurotoxic symptoms after 2 or more weeks of exposure (Scharen-Weber, Spears, Cowles 1974). Symptoms included drowsiness, dizziness, mental confusion, misty vision, staggering gait, and slurred speech, and symptoms sometimes recurred after apparent recovery and in the absence of renewed exposure.

Repko and co-workers (1976) found that workers exposed to concentrations of methyl chloride ranging from 7.4 to 70 ppm but averaging 33.6 ppm displayed a significant performance decrement, and that exposures below 100 ppm produced significant but transitory changes in functional capacity.

OSHA is proposing an 8-hour TWA of 50 ppm and a 15-minute STEL of 100 ppm for methyl chloride. The Agency preliminarily concludes that these two limits together will protect workers from the risk of neurotoxic effects, including functional impairment, performance decrements, headaches, dizziness, slurred speech, and staggering gait associated with exposure to this substance at the levels permitted by OSHA's current PEL. The Agency believes that the proposed PEL and STEL will work together to reduce this risk substantially. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl chloride if the Agency determines that this limit will substantially reduce significant risk.

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE)

CAS: 71-55-6; Chemical Formula: CH_3CCl_3
H.S. No. 1255

OSHA currently has an 8-hour TWA limit of 350 ppm for methyl chloroform. The ACGIH has established the same TWA limit as well as a TLV-STEL of 450 ppm. NIOSH recommends a 15-minute ceiling limit of 350 ppm. Methyl chloroform is a clear, nonflammable liquid.

The primary health concerns associated with exposure to methyl chloroform are anesthesia and cardiac sensitization. The oral toxicity of methyl chloroform is low, with LD_{50} values ranging from 5.7 to 12.3 g/kg for rats, mice, rabbits, and guinea pigs. This substance does, however, defat the skin on contact causing redness and scaling (Torkelson et al. 1958). Skin absorption is relatively insignificant; the acute percutaneous LD_{50} in rabbits is greater than 16 g/kg; slight, reversible irritation was observed from applications of 0.5 g/kg to rabbit skin for 90 days (Torkelson et al. 1958). Repeated expsoure of animals to concentrations between 1000 and 10,000 ppm for 3 months produced anesthesia and lung and liver damage in some species, but exposure to 500 ppm of methyl chloroform vapor for 7 hours daily, 5 days/week for 6 months caused no toxic changes in guinea pigs, rabbits, or monkeys (Torkelson et al. 1958). Other animal studies (Gehring 1968; Plaa, Evans, and Hine 1958; Rowe et al. 1963) have reported that methyl chloroform has low hepatotoxicity, but cardiac sensitization has occurred at high doses (5000–10,000 ppm) (Rennick et al. 1949; Trochimowicz et al. 1976). Tests in rats and mice for teratogenicity and carcinogenicity have demonstrated negative results (Schwetz et al. 1975; NIOSH 1976; Weisberger 1977).

In humans, it has been reported that anesthetic effects may begin to occur at methyl chloroform concentrations approaching 500 ppm (Stewart et al. 1969). Deaths from anesthesia and/or cardiac sensitization have been noted in employees working in confined areas (Patty 1963). Kramer and co-workers (1978) conducted an epidemiological study of men and women exposed for periods ranging from several months to 6 years to methyl chloroform at levels that occasionally exceeded 200 ppm; when compared to matched-pair controls, no adverse exposure-related effects were found (Kramer, Ott, Fulerson et al. 1978).

OSHA is proposing a PEL of 350 ppm TWA and a STEL of 450 ppm for methyl chloroform The Agency preliminarily concludes that this combined PEL–STEL limit will protect workers against the risk of anesthetic and cardiac-sensitizing effects potentially associated with exposure at the elevated short-term levels permitted by an 8-hour limit alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl chloroform if the Agency determines that this limit will substantially reduce significant risk.

OCTANE

CAS: 111-65-9; Chemical Formula: $CH_3(CH_2)_6CH_3$
H.S. No. 1296

OSHA's current limit for octane is 500 ppm as an 8-hour TWA. The ACGIH has established a 300-ppm TWA and a 375-ppm STEL NIOSH (1977a) recommends a 75-ppm 10 hour TWA and a 385-ppm 15-minute ceiling limit.

Mice exposed to octane concentrations of 6600 to 13,700 ppm developed narcosis in 30 to 90 minutes (Fuhner 1921). Flury and Zernik (1931) believed the narcotic concentration in humans to be 5000 ppm; Patty and Yant (1929) placed the narcotic concentration at 8000 ppm. Based on this information, the ACGIH concluded that octane was 1.2 to 2 times more toxic than heptane, and recommended TLVs of 300 ppm TWA and 375 ppm STEL.

As discussed in more detail above for the other C_5–C_8 alkanes, the NIOSH (1977a) recommended limits are based on their finding that all C_5–C_8 alkanes present a neurotoxic hazard similar to n-hexane. The ACGIH disagrees with this conclusion, believing the neurotoxic properties of n-hexane to be unique among the alkane series.

Because octane is known to be more toxic than heptane, OSHA believes a lower limit is warranted to protect against the risk of narcosis. At this time, OSHA is proposing to revise its limits for octane to 300 ppm TWA and 375 ppm STEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for octane if the Agency determines that this limit will substantially reduce significant risk. OSHA also requests comment on the strength of the evidence that exposure to octane may present a more serious neuropathic hazard.

PENTANE

CAS: 109-66-0; Chemical Formula: C_5H_{12}
H.S. No. 1306

OSHA's current limit for pentane is 1000 ppm TWA. In 1976, the ACGIH adopted a 600-ppm TLV-TWA and a

750-ppm TLV–STEL. NIOSH (1977a) has recommended that workplace exposures to pentane not exceed 120 ppm as a 10-hour TWA and 610 ppm as a 15-minute short-term limit. Pentane is usually encountered in volatile petroleum fractions, some of which are used as solvents. Pure pentane is used as a blowing agent for plastics, in solvent extraction, and in ice manufacture.

Fairhall (1957) stated that narcosis and mucous membrane irritation were the only reported toxic effects resulting from exposure to pentane. The reported lethal concentration in humans is 130,000 ppm. (Flury and Zernik 1931; Swann et al. 1974). According to Patty and Yant (1929), humans exposed for 10 minutes to 5000 ppm did not complain of any adverse symptoms.

In a report by Gaultier et al. (1973), five cases of polyneuropathy occurred among employees exposed to a solvent containing 80 percent pentane, 14 percent heptane, and 5 percent hexane. Based largely on this report, NIOSH (1977a) recommended the same occupational limit for all C_5–C_8 alkanes as for the neuropathic agent n-hexane (350-mg/m³ TWA and 1800-mg/m³ 15-minute short-term limits; these limits are equal to about 120-ppm TWA and 610-ppm 15-minute short-term limits for pentane).

The ACGIH (1986) points out that the rationale used by NIOSH in setting a limit for pentane ignores the theory that n-hexane is uniquely neuropathic via metabolism to 2,5-hexanedione, which is the same metabolite that is formed during exposure to another neuropathic agent, methyl butyl ketone. The ACGIH (1986) established its limits of 600 ppm TWA and 750 ppm as a STEL to "provide a substantial margin of safety against narcotic and irritative effects," but did not rule out the possibility that "chronic exposure to high concentrations may lead to neuropathy" (ACGIH 1986). The ACGIH believed that the manifestation of such effects would require heavy exposures to pentane and concluded that its recommended limits would be adequately protective. At this time, OSHA accepts the evaluation that all C_5–C_8 alkanes are not equally toxic because a metabolite of n-hexane exhibits unique neurotoxic properties. The Gaultier study does not provide specific isomer exposure data supporting the RELs of 120 ppm (TWA) and 610 ppm (STEL). The Agency therefore proposes a TWA of 600 ppm and a STEL of 750 ppm as the permissible exposure limits for pentane. Because of the disagreement regarding the subject of equal C_5–C_8 alkane toxicity, OSHA is specifically requesting comments on this scientific question.

2-PENTANONE (METHYL PROPYL KETONE)

CAS: 107-87-9; Chemical Formula: $CH_3COC_3H_7$

H.S. No. 1307

The current OSHA limit for 2-pentanone is 200 ppm as an 8-hour TWA. ACGIH recommends a 200-ppm TLV–TWA and a 250-ppm TLV–STEL. NIOSH (1978g) has recommended a 150-ppm limit as a 10-hour TWA.

Both the ACGIH- and NIOSH-recommended limits are based on a study by Specht et al. (1940), who found that guinea pigs exhibited irritation and weakness on exposure to 2500 ppm, and that exposure to 5000 ppm produced narcosis and coma. The authors concluded that 2-pentanone was considerably less toxic than methyl butyl ketone but is more toxic than methyl ethyl ketone, and is likely to be more irritating than methyl ethyl ketone or acetone. The ACGIH-recommended limits are apparently based on a judgment that the 200-ppm TLV–TWA and 250-ppm TLV–STEL are low enough to prevent narcosis and irritation.

NIOSH (1978) applied the findings of Specht et al. (1940) to the findings of Nelson et al. (1943), who reported that volunteers complained of slight irritation on exposure to 100 ppm methyl ethyl ketone. Because 2-pentanone was believed by Specht et al. (1940) to be at least as irritating as methyl ethyl ketone, NIOSH (1978) believed that a "slight reduction" in the OSHA standard was warranted. Therefore, NIOSH recommended a 150-ppm limit for 2-pentanone.

Both the ACGIH and NIOSH limits are designed to reduce the acute health effects observed at 100 ppm. While the 150-ppm REL appears to be more protective, OSHA has preliminarily concluded that the combination of a 200-ppm TWA and a 250-ppm STEL is more protective and is necessary to prevent the adverse health effects associated with exposure to this chemical. OSHA therefore proposes these limits for adoption as the PEL to reduce the risks associated with exposures at elevated short-term levels. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 2-pentanone if the Agency determines that this limit will substantially reduce significant risk.

PERCHLOROETHYLENE (TETRACHLOROETHYLENE)

CAS: 127-18-4; Chemical Formula: $CCl_2=CCl_2$

H.S. No. 1308

OSHA's current limits for perchloroethylene are 100 ppm as an 8-hour TWA, 200 ppm as a 15-minute ceiling, and 300 ppm as a 5-minute peak not to be exceeded in any 3-hour period. The ACGIH has established an 8-hour TWA of 50 ppm and a 15-minute STEL of 200 ppm for perchloroethylene. NIOSH recommends maintaining exposures at the lowest feasible limit and classifies this chemical as a carcinogen. Perchloroethylene is a clear, colorless liquid with an ether-like odor.

The oral LD_{50} for mice is 8.85 mg/kg, and the lethal air concentration for this species is 6000 ppm for 4 hours (Handbook of Toxicology 1956). Rats were exposed 8 hours/day, 5 days/week for as long as 17 months to 70, 230, or 470 ppm (Carpenter 1937). At 70 ppm, all animals survived and no pathology was noted. Animals also survived the higher exposures, but changes were seen at postmortem in the kidneys and livers of these rats. Rats, guinea pigs, cats, rabbits, and monkeys were exposed to varying concentrations of perchloroethylene for 7 hours/day, 5 days/week for various durations (Rowe et al. 1952). Rats exposed at 1600 ppm developed drowsiness and depression after 1 week and liver and kidney changes after 4 weeks. Guinea pigs exposed to 400 ppm for 130 exposures developed heavier kidneys and livers and fatty degeneration of the liver. Rats, rabbits, and monkeys exposed for 130 7-hour exposures to 400 ppm showed no effects.

Mice exposed in another study to 200 ppm 4 hours/day for 1, 2, 4, or 8 weeks developed fatty degeneration of the liver (Kylin, Sumegi, and Yllner 1965). Exposure of pregnant rats to 300 ppm perchloroethylene on days 6 through 15 of gestation did not cause teratological effects but did produce developmental toxicity (Schuetz, Leong, and Gerhing 1975). This substance does not appear to be mutagenic (ACGIH 1986, p. 464).

In an NCI gavage study for carcinogenicity, perchloroethylene proved carcinogenic to the livers of mice but not to those of rats (NCI 1977). Application of perchloroethylene to the skin of rats and mice, with and without a promoter, did not induce cancer (Thiess et al. 1977).

In humans being treated for worms, perchloroethylene doses of 2.8 or 4 ml caused narcosis, exhilaration, and signs of inebriation; at doses of 1 to 8 ml, no changes were seen in liver function tests (Lambert 1933; Fernando et al. 1939). A worker exposed to an estimated concentration of 1470 ppm perchloroethylene and Stoddard solvent for 3.5 hours lost consciousness (Stewart

et al. 1961). Studies have shown that exposure to perchloroethylene at 2000 ppm for 1.5 minutes caused unconsciousness; exposure at 500 ppm for 50 minutes caused increased salivation, metallic taste, eye irritation, and other effects; exposure at 216 ppm for 2 hours caused eye burning, light-headedness, motor incoordination, and other effects (Carpenter 1973). A 4-hour exposure to 100 ppm caused eye irritation (Stewart et al. 1974).

Chronic exposure to 200 ppm perchloroethylene caused early signs of central nervous system depression, but exposure to 100 ppm on a regular basis apparently had no adverse effect (Stewart et al. 1974, 1977). Direct contact with the liquid causes erythema, skin burns, and dermal absorption (Morgan 1969; Gold 1969; Stewart and Dodd 1964).

Two epidemiological studies of occupationally exposed perchloroethylene workers have failed to show increases in the incidence of liver tumors among these workers (Blair, Decoufle, and Grauman 1979; Kaplan 1980, as cited in ACGIH 1986, p. 464).

OSHA is proposing an 8-hour TWA of 50 ppm and a 15-minute STEL of 200 ppm for perchloroethylene. The Agency preliminarily concludes that these limits, taken together, will protect workers against the risk of eye irritation, headaches, and other effects associated with exposure to perchloroethylene. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for perchloroethylene if the Agency determines that this limit will substantially reduce significant risk.

STODDARD SOLVENT
CAS: 8052–41–3; Chemical Formula: C_9H_{20}
H.S. No. 1371

OSHA's current limit for stoddard solvent is 500 ppm as an 8-hour TWA. The ACGIH has established a TLV-TWA of 100 ppm. NIOSH (1977h) recommends limits of 350 mg/m³ as a 10-hour TWA and 1800 mg/m³ as a 15-minute ceiling for all refined petroleum solvents; these limits correspond approximately to a 60 ppm TWA and 310 ppm STEL, respectively. Stoddard solvent is a refined petroleum solvent having a flash point in the range of 102 to 100 °F and containing 65 percent or more C_{10} and higher molecular weight hydrocarbons.

The current OSHA limit of 500 ppm (equivalent to the 1968 ACGIH TLV) was based on the toxicities of the major components of stoddard solvent (i.e., 80 to 85 percent nonane and isodecane and 15 to 20 percent trimethyl benezene); specifically, the recommended limit was calculated from the TLVs established for pentane and trimethyl benzene. The revised ACGIH limit of 100 ppm thus reflects a reduction in the TLVs for pentane and trimethyl benzene. The ACGIH (1986) noted that a report by Carpenter et al. (1978), who found slight kidney damage among rats exposed to 330 ppm for 65 days, provided additional evidence that the earlier limit was too high.

The NIOSH limit of 350 mg/m³ TWA and 1800 mg/m³ is derived from its recommended limits for C_5–C_8 alkanes, which are designed to protect against neuropathic effects. NIOSH recommended the same limit for stoddard solvent because of the lack of data on chronic effects and because of a report of polyneuropathy occurring among workers exposed to jet fuels containing mixtures of kerosene and gasoline. NIOSH reasoned that although C_5–C_8 alkanes present in jet fuel may have been responsible, it was possible that the heavier hydrocarbon components may also have been responsible. Thus, the recommended limits for stoddard solvent reflect a concern that higher molecular weight hydrocarbons may be neuropathic.

The NIOSH RELs for stoddard solvent are based on the hypothesis of equivalent neuropathic toxicity for all of the C_5–C_8 alkanes. OSHA has tentatively rejected this approach. OSHA therefore proposes that the 100 ppm TWA be adopted as the new PEL to reduce the risk; this limit is based on information developed for analogous solvents. The Agency requests comments on this issue, as discussed above.

TOLUENE
CAS: 108–88–3; Chemical Formula: $C_6H_5CH_3$
H.S. No. 1397

The current OSHA standard for toluene is 200 ppm as an 8-hour TWA limit, with a 300 ppm ceiling and a 500 ppm peak for a maximum of 10 minutes in 8 hours. The ACGIH has established an exposure limit for toluene at 100 ppm as an 8-hour TWA and 150 ppm as a 15-minute STEL. NIOSH recommends a 100 ppm 8-hour TWA and a 10-minute ceiling of 200 ppm. Toluene is a flammable, colorless liquid with an aromatic hydrocarbon odor.

The acute toxicity of toluene in animals is greater than that of benzene. Patty (1963) reports that the lethal doses of toluene and benzene in mice are 10,000 and 14,000 ppm, respectively. The oral LD_{50} in rats is 7.53 ml/kg (Smyth et al. 1969). Exposure of rats to 2500 or 5000 ppm of toluene caused a temporary decrease in white cell count but no evidence of damage to the blood-forming organs or the liver. Fairhall (1957) stated that severe toluene exposure can cause a marked drop in the red blood cell count and partial destruction of the blood-forming elements of the bone marrow, but other researchers report that numerous animal studies indicate that toluene is not a bone marrow toxin (Gerarde 1960). A study by Greenberg, Mayers, Heinmann, and Moskowitz (1942) reported that painters exposed to toluene levels of 100 to 1100 ppm exhibited enlarged livers, a moderate decrease in red blood cell counts, enlarged red blood cells, and absolute lymphocytosis, but no leukopenia. Wilson (1943) observed workers exposed to toluene at varying levels up to 1500 ppm. At levels less than 200 ppm, signs of headache, fatigue, and nausea were present. Those workers exposed to 200 to 500 ppm toluene experienced temporary amnesia, lack of coordination, and anorexia. Levels of exposure from 500 to 1500 ppm resulted in a marked loss of coordination, diminished reaction time, pronounced weakness, and heart palpitations. Red cell counts were also decreased, and two cases of aplastic anemia required lengthy hospital treatment; however, the author noted that he could not rule out the possibility that benzene contamination of the toluene was the cause of these effects. Incidences of aplastic anemia (one fatal) have been noted in six glue sniffers; toluene was the base solvent in the glue (Powers 1965). A man who had inhaled toluene regularly at unspecified levels for 14 years developed permanent encephalopathy (Knox and Nelson 1966). Von Oettingen, Neal, Donahue, et al. (1942) found that exposures of 200 ppm for an unspecified duration caused slight changes in muscle coordination in human volunteers. Later studies by Ogata, Tomokuni and Takatsuka (1970) showed an increase in reaction time, and a decrease in pulse rate, and a decrease in systolic blood pressure at exposures to 200 ppm for 7 hours.

OSHA is proposing an 8-hour TWA PEL of 100 ppm and a STEL of 150 ppm for toluene. The Agency preliminarily concludes that studies clearly indicate that a risk of hepatotoxicity, hematopoietic, and nervous system effects exists at levels substantially below the current 200-ppm 8-hour TWA PEL. OSHA believes that the new limits will protect exposed workers from the risk of these serious health effects, which have been demonstrated to occur even as a result of less than full-shift exposures.

TRICHLOROETHYLENE)
CAS: 79-01-6; Chemical Formula:
$CCl_2=CHCl$
H.S. No. 1406

OSHA's current limit for trichloroethylene, adopted from ANSI, is 100 ppm TWA, 200 ppm as a ceiling not to be exceeded for more than 5 minutes every 2 hours, and 300 ppm as a peak limit. The ACGIH has recommended a 50-ppm TLV-TWA and a 200-ppm TLV-STEL. NIOSH (1978h) considers trichloroethylene to be a potential human carcinogen and has recommended a 25-pm 10-hour TWA.

The ACGIH (1986) cited several studies establishing that trichloroethylene primarily affects the central nervous system and liver; some of these studies have indicated that chronic exposure to less than 100 ppm trichloroethylene is associated with a variety of nervous disturbances. Haas (1960) and Grandjean (1955) reported nervous symptoms among workers exposed for 5 years or more to concentrations ranging from 1 to 335 ppm; the frequency of complaints increased when average exposures exceeded 40 ppm. Bardodej and Vyskocil (1956) also reported symptoms of trichloroethylene poisoning, including tremors, giddiness, anxiety, and alcohol intolerance, among workers exposed above 40 ppm. In contrast, controlled laboratory experiments with human subjects exposed for up to several days to 100 or 200 ppm have generally reported no behavioral or subjective responses. The ACGIH concluded that although the symptoms reported by workers are subjective and commonly found among individuals with no chemical exposure, the consistency of the reports "suggests the possibility of some subjective complaints as concentrations exceed about 50 ppm" (ACGIH 1986). Therefore, the ACGIH recommended a TLV-TWA of 50 ppm and a TLV-STEL of 200 ppm to minimize complaints of headache, fatigue, and irritability.

The ACGIH (1986) also reviewed some of the carcinogenicity data on trichloroethylene. In an NCI bioassay (1976b), mice given trichloroethylene by gavage developed hepatocellular carcinomas, but rats did not. The species difference in response was attributed to a difference in the way trichloroethylene is metabolized between the mouse and rat (Stott et al. 1982). An inhalation study on mice, rats, and Syrian hamsters (Henschler et al. 1980) found only an increase in the occurrence of malignant lymphomas in mice, which the authors believed were peculiar to the strain of mouse used (NMRI). The ACGIH also cited a number of epidemiologic investigations of cohorts as large as 7,688 workers, in which no correlation between cancer mortality and exposure to trichloroethylene was found (Novotna et al. 1971; Axelson et al. 1978; Tola et al. 1980).

After reviewing some of the same data, NIOSH (1978h) concluded that the results of the NCI gavage study indicate trichloroethylene (TCE) to be a potential human carcinogen, although it was "not considered to be a potent carcinogen." In addition, NIOSH concluded that the current 100 ppm limit would not sufficiently protect against neuropathic symptoms caused by exposure to trichloroethylene. NIOSH's recommended limit of 25 ppm was based on an evaluation of several industrial hygiene reports showing that many degreasing operations, including those using open-top tanks, are maintaining exposures at less than 50 ppm TWA. NIOSH believed that a 25-ppm TWA level could be uniformly achieved by the use of engineering control technology.

Since publication of the 1978 NIOSH report, several recent bioassays on trichloroethylene have been published and are currently being reviewed by EPA. Fukuda et al. (1983) exposed female rats and mice to 50, 150, or 450 ppm trichloroethylene for 103 weeks and reported an increase incidence of lung tumors among mice only. Maltoni et al. (1986) exposed rats and mice to 100, 300, or 600 ppm trichloroethylene and reported a significant increase of renal adenocarcinomas and Leydig cell tumors in rats, and a signfiant increase in hepatomas and lung tumors in mice. In 1986, the NIP reported an increase in the incidence of kidney tumors in rats given trichloroethylene by gavage; however, the NTP considered the response to be weak (3 of 49 animals) and reported that the results were only statistically significant after corrections for high mortality were made.

The 50-ppm TWA and 200-ppm STEL established by the ACGIH were established to minimize subjective complaints of headache, fatigue, and irritability. However, NIOSH has concluded that TCE is a potential human carcinogen, although not a "potent" one. NIOSH recommended a REL of 25 ppm TWA because the current PEL does not sufficiently protect against nervous system effects. NIOSH believes this REL is feasible and can be achieved by engineering control technology. In light of the uncertainty of the carcinogenicity issue, OSHA proposes adoption of a 25-ppm TWA REL to substantially reduce occupational risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for trichloroethylene if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

OSHA preliminarily concludes that workers exposed to these narcosis-causing substances are at risk of loss of consciousness, uncoordinated movements, inability to concentrate, and drowsiness; these highly undesirable and serious health effects may additionally have the potential to cause serious workplace accidents and injuries. The new or reduced exposure limits being proposed by OSHA are intended to protect employees from experiencing these risks in their places of work and will create a substantial reduction in such risks. The health evidence for these substances forms a reasonable basis for proposing the revision or addition of limits at the proposed levels. At the time of the final rule, OSHA will establish limits for these narcotic substances if the Agency determines that these limits will reduce significant risk.

3. Substances for Which Proposed Limits Are Based on Avoidance of Sensory Irritation

Introduction

Exposure to many chemical agents is associated with the development of sensory irritation, which is initiated when these substances come into contact with mucous membranes or skin. Limits have been set for a large group of chemicals on the basis of their sensory irritant effects. These substances, which number 79, are shown in Table C3-1, along with their current OSHA limits, CAS numbers, NIOSH RELs, ACGIH TLVs, and OSHA HS numbers. For six of these chemicals, OSHA is proposing to reduce the 8-hour TWA, and for an additional nine, the Agency proposes both to reduce the 8-hour limit and to add a STEL. In 22 cases, the 8-hour limit would remain unchanged but a STEL would be added. In six instances, a ceiling is proposed for deletion, and this limit would be replaced by an 8-hour TWA and/or STEL limits. Thirty of these chemicals were previously unregulated by OSHA, and for these, OSHA is proposing 8-hour

limits, 8-hour limits supplemented by a STEL, or ceiling limits. For five substances, OSHA is proposing to replace an existing TWA limit with a ceiling limit. For 15 of these substances, the NIOSH and ACGIH limits are different (see Table C3–1). OSHA is proposing the NIOSH REL for three substances.

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TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1001 Acetaldehyde	75-07-0	200 ppm TWA	100 ppm TWA 150 ppm STEL	--
1002 Acetic acid	64-19-7	10 ppm TWA	10 ppm TWA 15 ppm STEL	--
1004 Acetone+	67-64-1	1000 ppm TWA	750 ppm TWA 1000 ppm STEL	250 ppm TWA
1007 Acrolein	107-02-8	0.1 ppm TWA	0.1 ppm TWA 0.3 ppm STEL	--
1010 Allyl alcohol	107-18-6	2 ppm TWA, Skin	2 ppm TWA, Skin 4 ppm STEL	--
1012 Allyl glycidyl ether	106-92-3	10 ppm Ceiling	5 ppm TWA, Skin 10 ppm STEL	9.6 ppm Ceiling (15 min)
1013 Allyl propyl disulfide	2179-59-1	2 ppm TWA	2 ppm TWA 3 ppm STEL	--
1021 Ammonia	7664-41-7	50 ppm TWA	25 ppm TWA 35 ppm STEL	50 ppm Ceiling (5 min)
1022 Ammonium chloride fume	12125-02-9	--	10 mg/m^3 TWA 20 mg/m^3 STEL	--

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1036 Borates, tetra, Na (anhydrous)	1303-96-4	—	1 mg/m^3 TWA	—
1037 Borates, tetra, Na (decahydrate)	1303-96-4	—	5 mg/m^3 TWA	—
1038 Borates, tetra, Na (pentahydrate)	1303-96-4	—	1 mg/m^3 TWA	—
1042 Bromine	7726-95-6	0.1 ppm TWA	0.1 ppm TWA 0.3 ppm STEL	—
1045 2-Butanone (MEK)	78-93-3	200 ppm TWA	200 ppm TWA 300 ppm STEL	200 ppm TWA
1047 n-Butyl acetate	123-86-4	150 ppm TWA	150 ppm TWA 200 ppm STEL	—
1053 n-Butyl lactate	138-22-7	—	5 ppm TWA	—
1054 n-Butyl mercaptan	109-79-5	10 ppm TWA	0.5 ppm TWA	0.5 ppm Ceiling (15 min)
1063 Camphor	76-22-2	2 ppm TWA	2 ppm TWA 3 ppm STEL	—

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1064 Caprolactam (dust)	105-60-2	—	1 mg/m^3 TWA 3 mg/m^3 STEL	—
1065 Caprolactam (vapor)	105-60-2	—	20 mg/m^3 TWA 40 mg/m^3 STEL	—
1077 Cesium hydroxide	21351-79-1	—	2 mg/m^3 TWA	—
1079 Chlorine+	7782-50-5	1 ppm Ceiling	1 ppm TWA 3 ppm STEL	0.5 ppm Ceiling (15 min)
1083 Chloroacetyl chloride	79-04-9	—	0.05 ppm TWA	—
1084 o-Chlorobenzylidene malononitrile	2698-41-1	0.05 ppm TWA	0.05 ppm Ceiling, Skin	—
1105 Cyanogen	460-19-5	—	10 ppm TWA	—
1106 Cyanogen chloride	506-77-4	—	0.3 ppm Ceiling	—
1119 Dibutyl phosphate	107-66-4	1 ppm TWA	1 ppm TWA 2 ppm STEL	—
1122 1,3-Dichloro-5,5-dimethylhydantoin	118-52-5	0.2 mg/m^3 TWA	0.2 mg/m^3 TWA 0.4 mg/m^3 STEL	—

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1127 Dichloroethyl ether	111-44-4	15 ppm Ceiling, Skin	5 ppm TWA 10 ppm STEL, Skin	—
1130 2,2-Dichloropropionic acid	75-99-0	—	1 ppm TWA	—
1137 Diethylamine	109-89-7	25 ppm TWA	10 ppm TWA 25 ppm STEL	—
1140 Diisobutyl ketone	108-83-8	50 ppm TWA	25 ppm TWA	25 ppm TWA
1158 Epichlorohydrin	106-89-8	5 ppm TWA, Skin	2 ppm TWA, Skin	—
1162 Ethyl benzene	100-41-4	100 ppm TWA	100 ppm TWA 125 ppm STEL	—
1164 Ethyl ether	60-29-7	400 ppm TWA	400 ppm TWA 500 ppm STEL	—
1165 Ethyl mercaptan	75-08-1	10 ppm Ceiling	0.5 ppm TWA	0.5 ppm Ceiling (15 min)
1169 Ethylene glycol	107-21-1	—	50 ppm Ceiling	—
1171 Ethylidene norbornene	16219-75-3	—	5 ppm Ceiling	—

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1183 Furfural	98-01-1	5 ppm TWA, Skin	2 ppm TWA, Skin	—
1184 Furfuryl alcohol	98-00-0	50 ppm TWA	10 ppm TWA 15 ppm STEL, Skin	50 ppm TWA
1187 Glutaraldehyde	111-30-8	—	0.2 ppm Ceiling	—
1196 Hexachlorocyclo-pentadiene	77-47-4	—	0.01 ppm TWA	—
1204 Hexylene glycol	107-41-5	—	25 ppm Ceiling	—
1206 Hydrogen bromide	10035-10-6	3 ppm TWA	3 ppm Ceiling	—
1208 Hydrogen fluoride+	7664-39-3	3 ppm TWA	3 ppm Ceiling	3 ppm TWA 6 ppm Ceiling (15 min)
1211 2-Hydroxypropyl acrylate	999-61-1	—	0.5 ppm TWA, Skin	
1217 Iron salts (soluble)	Varies with compound	—	1 mg/m^3 TWA	—
1224 Isopropyl acetate	108-21-4	250 ppm TWA	250 ppm TWA 310 ppm STEL	—

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1225 Isopropyl alcohol	67-63-0	400 ppm TWA	400 ppm TWA 500 ppm STEL	400 ppm TWA 800 ppm Ceiling (15 min)
1228 n-Isopropylamine	75-31-0	5 ppm TWA	5 ppm TWA 10 ppm STEL	—
1243 Mesityl oxide	141-79-7	25 ppm TWA	15 ppm TWA 25 ppm STEL	10 ppm TWA
1248 Methyl 2-cyano-acrylate	137-05-3	—	2 ppm TWA 4 ppm STEL	—
1261 Methyl isobutyl carbinol	105-30-6	25 ppm TWA, Skin	25 ppm TWA 40 ppm STEL, Skin	—
1263 Methyl mercaptan	74-93-1	10 ppm Ceiling	0.5 ppm TWA	0.5 ppm Ceiling (15 min)
1264 Methyl n-amyl ketone++	110-43-0	100 ppm TWA	50 ppm TWA	100 ppm TWA
1267 alpha-Methyl styrene	98-83-9	100 ppm Ceiling	50 ppm TWA 100 ppm STEL	—
1270 o-Methylcyclo-hexanone	583-60-80	100 ppm TWA, Skin	50 ppm TWA 75 ppm STEL, Skin	—

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1298 Osmium tetroxide	20816-12-0	0.002 mg/m^3 TWA	0.002 mg/m^3 TWA 0.006 mg/m^3 STEL	—
1302 Paraffin wax fume	8002-74-2	—	2 mg/m^3 TWA	—
1322 Phosphoric acid	7664-38-2	1 mg/m^3 TWA	1 mg/m^3 TWA 3 mg/m^3 STEL	—
1325 Phosphorous trichloride	7719-12-1	0.5 ppm TWA	0.2 ppm TWA 0.5 ppm STEL	—
1334 Potassium hydroxide	1310-58-3	—	2 mg/m^3 Ceiling	—
1350 Rosin core solder	—	—	0.1 mg/m^3 TWA	—
1365 Sodium bisulfite	7631-90-5	—	5 mg/m^3 TWA	—
1367 Sodium hydroxide	1310-73-2	2 mg/m^3 TWA	2 mg/m^3 Ceiling	2 mg/m^3 Ceiling (15 min)
1368 Sodium metabisulfite	7681-57-4	—	5 mg/m^3 TWA	—
1376 Sulfur monochloride	10025-67-9	1 ppm TWA	1 ppm Ceiling	—
1377 Sulfur pentafluoride	5714-22-7	0.025 ppm TWA	0.01 ppm Ceiling	—

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1387 Tetrahydrofuran	109-99-9	200 ppm TWA	200 ppm TWA 250 ppm STEL	—
1389 Tetrasodium pyrophosphate	7722-88-5	—	5 mg/m^3 TWA	—
1392 Thioglycolic acid	68-11-1	—	1 ppm TWA, Skin	—
1405 1,2,4-Trichloro-benzene	120-82-1	—	5 ppm Ceiling	—
1408 Triethylamine	121-44-8	25 ppm TWA	10 ppm TWA 15 ppm STEL	—
1421 Vanadium (V_2O_5, dust)	7440-62-2	0.5 mg/m^3 Ceiling	0.05 mg/m^3 TWA	0.05 mg/m^3 Ceiling (15 min)
1422 Vanadium (V_2O_5, fume)	7440-62-2	0.1 mg/m^3 Ceiling	0.05 mg/m^3 TWA	0.05 mg/m^3 Ceiling (15 min)
1424 Vinyl acetate	108-05-4	—	10 ppm TWA 20 ppm STEL	4 ppm Ceiling (15 min)
1429 VM & P Naphtha	8032-32-4	—	300 ppm TWA	75 ppm TWA 400 ppm Ceiling (15 min)

TABLE C3-1. Substances for Which Limits Are Based on Avoidance of Irritant Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1431 Xylene	1330-20-7	100 ppm TWA	100 ppm TWA 150 ppm STEL	100 ppm TWA 200 ppm Ceiling (10 min)
1435 Zinc chloride fume	7646-85-7	1 mg/m^3 TWA	1 mg/m^3 TWA 2 mg/m^3 STEL	—

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed limit is the NIOSH REL.

++ OSHA's current limit is retained.

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Description of the Health Effects

Irritant effects are readily perceived by affected individuals. The symptoms of sensory irritation include stinging, itching, and burning of the eyes, tearing (or lacrimation), a burning sensation in the nasal passages, rhinitis (nasal inflammation), cough, sputum production, chest pain, wheezing, and dyspnea (breathing difficulty). In the majority of cases, the onset of symptoms occurs rapidly upon exposure to the irritant; it is therefore easy to associate the causative agent with the irritant effect.

These effects cause severe discomfort and may be seriously disabling, as is the case with dyspnea or wheezing. The tearing and eye irritation associated with exposure to sensory irritants is often severe and can be as disabling as the weeping caused by exposure to tear gas. In addition to these primary effects, workers distracted by irritant effects are considerably more likely than non-exposed workers to have accidents and thus to endanger both themselves and others. (These adverse health effects also clearly have substantial productivity impacts.)

The eye irritation caused by exposure to irritants is believed to result from stimulation of the sensory nerve endings in the cornea. There is little information available on the relationship between the severity of the effect and the physical or chemical properties of the irritating substance. In addition, the mechanism of action underlying this irritant effect is not well understood. Mechanisms that have been suggested include physical action of the irritant on nerve endings, binding of the irritant to sulfhydryl groups of protein, inhibition of cellular respiration, and cholinesterase inhibition (Grant 1986). The symptoms of eye irritation are usually transient and do not generally persist after cessation of exposure; however, exposure to concentrations of lacrimators that exceed the levels associated with transient eye irritation may produce corneal or conjunctival injury that requires medical treatment (Grant 1986).

Sensory irritation of the pulmonary system primarily affects the upper respiratory tract and causes an increase in sputum production; inflammation of the nasal passages, trachea, and upper bronchial tree; and decreased cilial clearance. These effects produce a burning sensation in the nasal passages and throat; coughing; sneezing; and acute bronchitis. The development of bronchitis indicates that the cilial clearance mechanism has been compromised and the resulting mucus retention increases the risk of secondary bacterial infection. Wheezing may also be apparent, particularly if the affected individual has a history of hyper-reactive airways disease. If exposure is sufficiently intense, the irritant may reach the lower portion of the bronchial tree, causing a chemical burn of the parenchyma and the sudden collection of fluid in interstitial spaces and alveoli (pulmonary edema). Irritation-induced edema may have a delayed onset (12 hours or more) and can cause hypoxia and difficulty in breathing.

For the great majority of substances in this group, current limits are derived from human evidence that exposure to the chemical agent at a particular airborne concentration will be associated with sensory irritation. For a few substances in this group, animal evidence provided the basis for limit setting. Several general types of evidence may be used to lower existing limits:

- Consideration of new human evidence;
- Reinterpretation of human data that formed the basis for setting the 1968 TLV;
- Consideration of evidence from industrial experience showing that employees are not experiencing irritation; and
- Evaluation of new animal evidence.

The studies that provide the basis for the sensory irritant levels being proposed by OSHA are generally controlled-exposure experiments using human volunteers or reports of employee complaints arising in industrial settings. Almost all of these studies report either a NOE level for irritation (described either as the "complaint level" or the level that can be "tolerated" for 8 hours) or an exposure level below which there have been no reported complaints.

Dose-Response Relationships and Sensory Irritation

The onset of sensory irritation is considered a "threshold" or NOE level; that is, for any sensory irritant, there is an exposure level below which very few if any individuals will experience sensory irritation. As exposure increases above this level, a larger proportion of exposed individuals will notice the effect and the effect will become increasingly severe. At some level above this NOEL, all exposed persons will experience sensory irritation, although the intensity of the response may vary.

The risk of experiencing irritation that is associated with exposures below the NOEL will be minimal (except in the hypersensitive individual), while the risk of experiencing the irritant effect will increase directly as exposure increases. At some point above the NOE level, i.e., at some dose of the substance, the response will be 100 percent, and all exposed persons will experience irritation. According to general toxicologic principles, the shape of the curve that describes responses above the NOEL is sigmoidal, and the steepness of the curve is a function of the variability in individual responses to the particular irritant. For example, if nearly all persons exposed to the substance will experience a response at approximately the same concentration (dose), the curve will be steep; if, on the other hand, the percentage of people responding increases only slowly as concentration rises, the curve will be considerably flatter.

Analyses of the toxicologic data for the the substances in this group of chemicals follow. The following paragraphs describe OSHA's preliminary findings for the substances in this group of sensory irritants.

ACETALDEHYDE
CAS: 75-07-0; Chemical Formula: CH_3CHO
H.S. No. 1001

OSHA's current PEL for acetaldehyde is 200 ppm as an 8-hour TWA. The 200-ppm 1968 TLV established by the ACGIH for acetaldehyde was based on a sensory irritation study conducted by Silverman et al. (1946) that showed that unacclimatized individuals experienced eye irritation at 50 ppm, but that a level of 200 ppm was tolerable for an 8-hour day. The ACGIH has subsequently lowered its limit for acetaldehyde to 100 ppm as an 8-hour TWA and supplemented this with a STEL of 150 ppm. NIOSH has no REL for this substance.

Reexamination of the data reported by Silverman et al. (1946) reveals that, at 200 ppm of acetaldehyde, all exposed persons experienced inflammation of the conjunctivae of the eyes, which manifested as redness. OSHA therefore preliminarily concludes that the current PEL of 200 ppm places exposed employees at risk of conjunctivitis and other irritation and that a reduction to 100 ppm is necessary to reduce this risk. OSHA also finds that a STEL is necessary to supplement the 8-hour limit, because without a STEL, workers could be exposed at levels many times those that have been shown to cause corneal injury, sensitization, and respiratory tract irritation. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for acetaldehyde if

the Agency determines that this limit will substantially reduce significant risk.

ACETIC ACID
CAS: 64–19–17; Chemical Formula: CH_3COOH
H.S. No. 1002

The current OSHA PEL for acetic acid is a 10-ppm 8-hour TWA. The ACGIH recommends a TLV–TWA of 10 ppm and a TLV–STEL of 15 ppm. Acetic acid is a clear, colorless, flammable liquid with a pungent odor.

The 10-ppm TWA was established on the basis of work indicating that industrial exposure to acetic acid at 10 ppm was non-irritating (Sterner 1943). Patty (1949) reported that exposures to 800 to 1200 ppm cannot be tolerated by humans for longer than three minutes. One of six rats exposed to 16,000 ppm died (Smyth 1956), and guinea pigs exhibited minor changes in respiration after exposure at 5 ppm, with more pronounced effects at 100 ppm (Amdur 1961).

In humans, conjunctival irritation has been reported for exposures below 10 ppm (duration not specified) (Baldi 1963), and workers exposed to concentrations of 60 ppm during the workshift, plus one hour daily at 100 to 260 ppm, for 7 to 12 years developed respiratory irritation, conjunctivitis, bronchitis, pharyngitis, and erosion of exposed teeth (Parmeggiani and Sassi 1954). Vigliana and Zurlo (1956) observed respiratory, gastrointestinal, and skin irritation in the same group of workers.

To protect against these irritant effects, which were associated with short-term exposures, OSHA is proposing to supplement the existing 10-ppm 8-hour TWA with a STEL of 15 ppm.

The Agency preliminarily concludes that the combined TWA–STEL is necessary to protect exposed workers against the risk of respiratory, gastrointestinal, and skin irritation associated with industrial exposures to acetic acid. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for acetic acid if the Agency determines that this limit will substantially reduce significant risk.

ACETONE
CAS: 67–64–1; Chemical Formula: CH_3COCH_3
H.S. No. 1004

OSHA's current Z table limit for acetone is 1000 ppm as an 8-hour TWA. The ACGIH recommends a 750-ppm TLV and a 1000-ppm STEL for this substance, while the NIOSH REL is 250 ppm TWA.

The 1000-ppm limit for acetone was established primarily on the basis of information that indicated that workers experienced irritation at exposure levels ranging from 2500 to 3000 ppm (Oglesby et al. 1949). The 1000-ppm TLV represented the hygienic standard observed in the 1960s and earlier for that group of vapors considered by industrial hygienists to be relatively harmless. In the interval since the adoption of the 1968 TLVs by OSHA, additional information has been developed that shows that exposure to 1000 ppm of acetone causes sensory irritation in some workers. The ACGIH (1986) reports that a study by Vigliani and Zurlo (1955) found that acetone production workers exposed at the 700-ppm level for 3 hours daily for 7 to 15 years experienced inflammation of the respiratory tract, stomach, and duodenum, giddiness, and loss of strength; some of these effects go beyond irritation effects. In another study reported on by the ACGIH, 10 men exposed to various acetone concentrations for 3 to 5 minutes found a level of 200 ppm satisfactory and experienced "slight" irritation at 300 ppm, but could still "tolerate" exposure at 500 ppm (Nelson et al. 1943). The ACGIH concluded that a TLV of 750 ppm was appropriate because Nelson's results were based on "extremely short, 3 to 5 minute, exposures," while DiVincenzo's findings demonstrated "no effects from acetone at 500 ppm except an awareness of odor" (ACGIH 1986).

In recommending a 250-ppm 10-hour TWA limit, NIOSH relied on the Nelson et al. (1943) study, as well as a controlled human exposure study (Matsushita 1969) showing that subjects exposed to 500 ppm for 6 hours experienced mucosal irritation as well as general weakness the following day. Another study cited by NIOSH (Parmeggiani and Sassi 1954) indicated that employees exposed to acetone in the range of 307 to 918 ppm experienced mucosal irritation and CNS disturbances. NIOSH (1978j) concluded that adverse effects will occur upon exposure to acetone concentrations below 500 ppm, and therefore recommended a 250-ppm TWA limit.

OSHA preliminarily concludes that the 750-ppm TLV does not protect against deleterious health effects observed at 700 ppm, 500 ppm, and 300 ppm and that a 250-ppm 8-hour TWA limit is necessary to provide adequate protection against the risk of acetone-induced irritation at these levels. Feasibility is indicated by the fact that more than 95 percent of a very large number of air samples reported in the IMIS data base reveal exposures below 250 ppm. OSHA therefore proposes that the 250-ppm REL be adopted as the OSHA PEL to reduce the risk of irritation for exposed individuals. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for acetone if the Agency determines that this limit will substantially reduce significant risk.

ACROLEIN
CAS: 107–02–8; Chemical Formula: $CH_2=CHCHO$
H.S. No. 1007

OSHA currently has an 8-hour TWA PEL of 0.1 ppm (0.25 mg/m^3) for acrolein. The ACGIH recommends a 0.1-ppm TLV-TWA for this substances, as well as a STEL of 0.3 ppm for a 15-minute period. Acrolein is a colorless or yellowish flammable liquid with a disagreeable, choking odor.

In early inhalation studies of cats (Iwanoff 1911), exposure to 10 ppm acrolein for 3.5 hours was found to have only transient effects, including salivation, lacrimation, respiratory irritation, and mild narcosis. However, later studies reported that an exposure to 1 ppm of acrolein produced marked nose and eye irritation in 5 minutes or less (Cook 1945). Over longer periods, studies have demonstrated fatalities in 1 of 6 rats exposed for 4 hours to airborne concentrations of acrolein at 8 ppm; at 16 ppm, the mortality was 100 percent (Smyth 1956). Irritation of the upper respiratory tract is the primary symptom of acrolein inhalation, but lung edema can occur after exposure to high concentrations (Henderson and Haggard 1943). In addition, skin contact with acrolein causes skin burns and severe injury to the cornea.

OSHA is proposing 0.1 ppm as an 8-hour time-weighted average and a 15-minute short-term limit of 0.3 ppm to provide the necessary protection against the acutely irritating effects of short-term exposure to acrolein. The Agency preliminarily concludes that the combined TWA-STEL being proposed will reduce the risk of severe irritation, skin burns, and corneal damage to which workers could be exposed with an 8-hour TWA alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for acrolein if the Agency determines that this limit will substantially reduce significant risk.

ALLYL ALCOHOL
CAS: 107–18–6; Chemical Formula: $CH_2=CHCH_2OH$
H.S. No. 1010

OSHA has a current PEL of 2 ppm TWA for allyl alcohol with a skin notation. The ACGIH also has a TLV-TWA of 2 ppm, supplemented by a STEL of 4 ppm and a skin notation. Allyl alcohol is a colorless liquid with a pungent, mustard-like odor.

The most important adverse effects of occupational exposures to allyl alcohol are upper-respiratory-tract irritation and burns of the eyes. Severe eye irritation has been reported in humans at exposure levels of 25 ppm, and milder irritation has been reported at 5 ppm (Dunlap, Kodarma, Wellington et al. 1958; McCord 1932). Necrosis of the cornea and temporary blindness occurred in one individual exposed to allyl alcohol at a level irritating to the eyes and nose (Smyth 1956). Skin absorption may lead to serious systemic injury (visceral congestion, periportal congestion of the liver, hematuria, and nephritis); when evaporation is prevented or reduced, skin contact causes burns (ACGIH 1986, p. 18).

Exposure to airborne concentrations of allyl alcohol causes a series of characteristic effects, including lacrimation, photophobia, blurred vision, and retrobulbar pain (Dunlap, Kodarma, Wellington et al. 1958). Exposed individuals do not develop a tolerance for this substance, and they also do not become sensitized (Kodama and Hine 1958).

OSHA proposes a short-term limit of 4 ppm (15 minutes) and an 8-hour TWA PEL of 2 ppm to provide protection against the risk associated with severe eye irritation resulting from exposure to allyl alcohol. This short-term limit ensures that workers will be protected against the health effects associated with exposures at levels only somewhat above the current 8-hour TWA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for allyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

ALLYL GLYCIDYL ETHER
CAS: 106-92-3; Chemical Formula: $C_6H_{10}O_2$
H.S. No. 1012

OSHA's current PEL for allyl glycidyl ether (AGE) is 10 ppm (45 mg/m^3) as a ceiling. The ACGIH recommends a TLV-TWA of 5 ppm and a 15-minute STEL of 10 ppm and additionally has a skin notation. NIOSH has recommended a 15-minute ceiling of 9.6 ppm for this colorless liquid, which has a characteristic, but not unpleasant, odor.

In limited human exposure studies, AGE has been demonstrated to cause dermatitis and eye irritation; the substance produces moderate primary skin irritation and severe eye irritation in animals (Hine, Kodama, Wellington et al. 1956). At 260 ppm, animals experienced irritation of the eyes and respiratory distress; at high levels (e.g., 400, 600, and 900 ppm), corneal opacities and severe respiratory difficulties occurred (Hine, Kodama, Wellington et al. 1956). The percutaneous LD_{50} for rabbits is 2.55 g/kg. Intragastric administration of AGE in mice, rats, and rabbits has also been demonstrated to cause depression of the central nervous system (Hine, Kodama, Wellington et al. 1956).

In humans, skin sensitization occurs readily (Hine and Rowe 1962), and, based on animal studies, percutaneous absorption would appear likely. In addition to primary irritation and sensitization, the potential exists for cross-sensitization with other epoxy agents (ACGIH 1986, p. 20).

OSHA is proposing to establish a PEL of 5 ppm as an 8-hour TWA and to supplement this with a 15-minute STEL of 10 ppm, and with a skin notation, to ensure protection against primary irritation and to minimize sensitization effects. The Agency preliminarily concludes that this combination of full-shift and short-term limits, in addition to a skin notation, will reduce the risk of sensitization, primary irritation, and percutaneous absorption to which workers could otherwise be exposed at the current ceiling of 10 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for allyl glycidyl ether if the Agency determines that this limit will substantially reduce significant risk.

ALLYL PROPYL DISULFIDE
CAS: 2179-59-1; Chemical Formula:
$CH_2=CHCH_2S_2C_3H_7$
H.S. No. 1013

The current OSHA PEL for allyl propyl disulfide is 2 ppm (12 mg/m^3) as an 8-hour TWA. The ACGIH recommends a TLV-TWA of 2 ppm and a TLV-STEL of 3 ppm (18 mg/m^3). Allyl propyl disulfide is a liquid with a pungent, irritating odor.

Nearly all occupational exposures to allyl propyl disulfide, the primary volatile constituent of onion oil, occur in the processing of onions and onion products. Allyl propyl disulfide's irritative effects on the human eye, nose, and upper respiratory tract are well recognized. The most severe irritation effects have occurred when workers were exposed to allyl propyl disulfide in the vicinity of onion slicing machines, where average concentrations of 3.4 ppm have been measured (Feiner, Burke, and Baliff 1946).

OSHA proposes a 2-ppm 8-hour TWA limit and a STEL of 3 ppm to protect against irritation and lacrimation, which can occur as a result of higher short-term exposures. OSHA preliminarily concludes that adding a STEL of 3 ppm will reduce the risk of lacrimation and upper respiratory tract irritation to which employees could otherwise be exposed. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for allyl propyl disulfide if the Agency determines that this limit will substantially reduce significant risk.

AMMONIA
CAS: 7664-41-7; Chemical Formula: NH_3
H.S. No. 1021

OSHA's current limit for ammonia is 50 ppm TWA. The ACGIH revised its TLV-TWA to 25 ppm in 1973, and added a 35-ppm STEL in 1976. NIOSH (1974a) has recommended a 5-minute short-term limit of 50 ppm for ammonia. Ammonia is principally used as a feedstock in the manufacture of fertilizers and other chemical substances, and is also used as a refrigerant.

The chief effect resulting from exposure to ammonia is eye and upper respiratory tract irritation. Vigliani and Zurlo (1956) reported respiratory tract irritation and irritation of the conjunctivae in workers exposed to 100 ppm; exposure to a concentration of 20 ppm caused complaints of discomfort among uninjured workers. An analysis of plant surveys (Bureau of Industrial Hygiene, Detroit Department of Health, 1965-1970) conducted by ACGIH (1986) showed that the "complaint level" was between 20 and 25 ppm. ACGIH (1986) also stated in their documentation for the ammonia TLVs that general field experience with a "large number of workers" exposed to ammonia from printing and copying machines indicated that concentrations of 20 to 25 ppm were the maximum concentrations not associated with complaints of irritation. The ACGIH selected a 25-ppm TLV-TWA and a 35-ppm TLV-STEL "to protect against irritation to eyes and respiratory tract and minimize discomfort among uninjured workers" (ACGIH 1986).

In recommending a 5-minute 50-ppm short-term limit, NIOSH relied on several reports that ammonia concentrations as low as 50 ppm are moderately irritating (Vigliani and Zurlo 1956; Industrial Biotest Laboratories 1973; MacEwen et al. 1970; Mangold 1971; Pagnotto 1973). NIOSH concluded

that the "irritating or annoying effects * * * [are] more dependent upon concentration than length of exposure," and that "a standard expressed as a time-weighted average is inappropriate since it would permit fluctuations to concentrations considerably higher than 50 ppm" (NIOSH 1974a, p. 69). Therefore, NIOSH recommended a 50-ppm ceiling limit to restrict 5-minute fluctuations in exposure levels and to "ensure that such possibly irritating exposures are brief" (NIOSH 1974a, p. 70).

The ACGIH (1986) disagreed that a short-term limit alone was more appropriate than a TWA limit, citing animal evidence (Stombaugh 1960) indicating that continuous, 24-hour exposure over several days produced effects not observed from high, short-term exposures. NIOSH also reviewed this and other evidence (Doig and Willoughby 1971; Coon et al. 1970), showing that laboratory animals exhibited chronic lung inflammation and marked thickening of the tracheal epithelium following continuous exposure to average concentrations exceeding 100 ppm. Continuous exposure to concentrations below 100 ppm did not generally result in microscopic lung abnormalities (Coon et al. 1970; Stombaugh et al. 1969).

OSHA believes that the human evidence discussed by the ACGIH (1986) and NIOSH (1974a) clearly indicates that the current limit of 50 ppm as an 8-hour TWA would permit short-term exposures to levels well above those reported to caused conjunctival and respiratory tract irritation, even among workers who are acclimated to the effects of ammonia. OSHA preliminarily concludes that there is a risk of mucosal irritation at the current PEL and that it is necessary to lower the PEL to reduce that risk. The 50-ppm 5-minute ceiling recommended by NIOSH is above exposure levels that are reported to be moderately irritating to the eyes and respiratory tract. Therefore, OSHA is proposing to revise its existing PEL for ammonia to 25 ppm as a TWA and 35 ppm as a STEL. Extensive air sampling data reported in the IMIS data base show that more than 90 percent of exposures are below 25 ppm TWA and thus demonstrate the feasibility of the proposed limits. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ammonia if the Agency determines that this limit will substantially reduce significant risk.

AMMONIUM CHLORIDE (FUME)
CAS: 12125-02-8 Chemical Formula: NH_4Cl
H.S. No. 1022

No current OSHA PEL for ammonium chloride fume has been established. The ACGIH recommends a TLV-TWA of 10 mg/m³ and a 20-mg/m³ TLV-STEL. Ammonium chloride is a white crystalline solid, somewhat hygroscopic, with a cool, saline taste.

Ammonium chloride is an irritant to the skin and respiratory passages when inhaled and produces mild systemic toxicity when ingested (Sax 1968). Large amounts of fume can be generated during galvanizing operations, and these fumes should be controlled to prevent irritation of the respiratory tract (ACGIH 1986, p. 28).

OSHA proposes a permissible exposure limit of 10 mg/m³ TWA, with a 15-minute short-term limit of 20 mg/m³, to protect workers exposed to ammonium chloride fume in the numerous applications in general industry involving this substance. The Agency preliminarily concludes that this combination of TWA and STEL limits will protect workers against the risk of respiratory irritation and systemic effects, and will eliminate or reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for ammonium chloride fume. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BORATES, TETRA, SODIUM SALTS (ANHYDROUS AND PENTAHYDRATE)
CAS: 1303-96-4 Chemical Formula: $Na_2B_4O_7$ (anhydrous), $Na_2B_4O_7 \cdot 5H_2O$ (pentahydrate)
H.S. Nos. 1036 and 1038

OSHA currently has no limit for exposure to anhydrous or pentahydrate sodium tetraborate. The ACGIH recommends a TLV-TWA of 1.0 mg/m³. The anhydrous form is a light gray, odorless solid; the pentahydrate form is white, odorless, and crystalline.

In the workplace, the salient toxic effects of the tetraborates are acute irritation of the skin, eyes, nose, and upper respiratory tract. Dermatitis, cough, nasal irritation, shortness of breath, and nosebleeds resulting from visible (but unstated) concentrations of borate dust in mining and milling facilities have been reported (Birmingham and Key 1963). There is evidence that respiratory ill health may be associated with inhalation exposures to dehydrated sodium borate dust (Hogan 1965; Ury 1966).

To prevent these acute irritant effects and to protect against chronic respiratory effects, OSHA is proposing an 8-hour TWA PEL of 1.0 mg/m³ for the anhydrous and pentahydrate forms of sodium tetraborate. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of acute irritation and chronic respiratory ill health potentially associated with these substances, which have not previously been regulated by OSHA. The health evidence forms a reasonable basis for proposing a new limit for borates. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BORATES, TETRA, SODIUM (DECAHYDRATE)
CAS: 1303-96-4; Chemical Formula: $N_2B_4O_7 \cdot 10H_2O$
H.S. No. 1037

OSHA currently has no limit for decahydrate sodium tetraborate. The ACGIH recommends a TLV-TWA of 5.0 mg/m³ for this white, odorless, and crystalline substance.

In humans, exposure to more than 1 gram of borax ($N_2B_4O_7 \cdot 10H_2O$) through gastroenteric or percutaneous absorption can cause acute toxicity in the form of severe gastrointestinal irritation, kidney injury, and even death from central nervous system depression or vascular collapse. It is also known that chronic exposure to small amounts can cause mild gastroenteritis and dermatitis (Browning 1969; Deichmann and Gerarde 1969; Thienes and Haley 1972). However, neither of these types of systemic poisoning have been reported in the workplace (Browning 1969).

In the workplace, the salient toxic effects of the tetraborates are acute irritation of the skin, eyes, nose, and upper respiratory tract. Dermatitis, cough, nasal irritation, shortness of breath, and nosebleeds resulting from visible (but unstated) concentrations of borate dust in mining and milling facilities have been reported (Birmingham and Key 1963). There is evidence that respiratory ill health may be associated with inhalation exposures to dehydrated sodium borate dust (Hogan 1965; Ury 1966).

To prevent exposed workers against these acute irritant effects and the potential for chronic respiratory ill health, OSHA is proposing an 8-hour PEL of 5.0 mg/m³ for decahydrate sodium tetraborate. The Agency preliminarily concludes that this limit will protect workers exposed to this form of sodium tetraborate from the risk posed by these acute and chronic irritant and respiratory effects. The health evidence forms a reasonable basis for proposing a new limit for borax. At the time of the final rule, OSHA will promulgate a new limit if the

Agency determines that this limit will substantially reduce significant risk.

BROMINE
CAS: 7726-95-6; Chemical Formula: Br_2
H.S. No. 1042

OSHA's current limit for bromine is 0.1 ppm TWA. The ACGIH recommends a TLV-TWA of 0.1 ppm with a TLV-STEL of 0.3 ppm. Bromine is a dark, reddish-brown, non-combustible, diatomic liquid that has irritating vapors.

Early studies of bromine exposure indicated that workers exposed to 0.75 ppm for 6 hours exhibited no symptoms (Flury and Zernik 1931). Later studies reported physiological responses to different concentrations of bromine and used these findings to make the following recommendations: The maximal allowable concentration for prolonged exposure should be 0.1 to 0.15 ppm, and the maximal allowable concentration for short exposure (i.e., 30 minutes to 1 hour) should be 4 ppm (Henderson and Haggard 1943). These investigators found levels of 40 to 60 ppm dangerous for short-term exposures, and a level of 1000 ppm proved rapidly fatal even during short exposures. These authors reported that the effects of exposure to bromine include respiratory irritation and lung edema. Elkins (1951) reported that exposure at 1 ppm in a plant handling liquid bromine was excessively irritating.

OSHA proposes a PEL of 0.1 ppm (8-hour TWA) and a STEL of 0.3 ppm for a 15-minute period. The Agency believes that both the TWA and short-term limits are necessary to reduce the risk of respiratory irritation and lung damage that could occur in the absence of a short-term limit. The Agency believes that the combined TWA-STEL will substantially reduce this risk among occupationally exposed workers. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for bromine if the Agency determines that this limit will substantially reduce significant risk.

2-BUTANONE (METHYL ETHYL KETONE)
CAS: 78-93-3; Chemical Formula: $CH_3COCH_2CH_3$
H.S. No. 1045

OSHA's current limit for 2-butanone is 200 ppm TWA. The ACGIH's recommended limit is 200 ppm TWA, with a STEL of 300 ppm. NIOSH recommends a 200-ppm 10-hour TWA limit for 2-butanone. 2-Butanone is a colorless, flammable liquid and has an objectionable odor.

2-Butanone is an ocular and upper respiratory tract irritant. Some authors (Nelson, Nelson, Ross et al. 1943) report that exposures to 200 ppm caused mild eye irritation in some subjects and that others experienced these effects even at concentrations of 100 ppm. Studies conducted in the 1940s noted low-grade intoxication at 300 to 600 ppm (Smith and Mayers 1944), slight nose and throat irritation at 100 ppm, and mild eye irritation at 200 ppm (Nelson, Nelson, Ross et al. 1943). Later studies have shown that approximately 50 percent of exposed individuals experience eye and nose irritation at 200 ppm (as reported in ACGIH 1986, p. 395).

OSHA is proposing a 15-minute STEL of 300 ppm and an 8-hour TWA limit of 200 ppm to protect exposed individuals against the short-term exposures known to cause irritation. However, since a significant number of all exposed workers experience adverse irritant effects even at 200 ppm, the Agency realizes that the 300-ppm STEL may not be fully protective. Therefore OSHA specifically requests comments on the adequacy of the proposed limits to reduce the risk of such irritation in exposed employees. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 2-butanone if the Agency determines that this limit will substantially reduce significant risk.

n-BUTYL ACETATE
CAS: 123-86-4; Chemical Formula: $CH_3COO(CH_2)_3CH_3$
H.S. No. 1047

The current OSHA limit for n-butyl acetate is 150 ppm, measured as an 8-hour TWA. The ACGIH (1986) also recommends an 8-hour TWA of 150 ppm with the addition of a 200-ppm 15-minute STEL. n-Butyl acetate is a colorless liquid with a fruity odor.

n-Butyl acetate is an irritant to the eyes, skin, and respiratory system. In a study involving cats exposed for 6 hours to 6100 ppm, slight narcotic effects were noted (Flury and Wirth 1933). When exposed to 4200 ppm n-butyl acetate for 6 days at 6 hours per day, cats experienced slight irritation of the respiratory passage; at 3100 ppm, changes in blood cell morphology were recorded. At exposures of 1600 ppm, these cats exhibited slight irritation of the eyes and salivation (Flury and Wirth 1933). Air concentrations of 10,000 ppm (n-butyl acetate proved fatal to rats after 8 hours; 4 hours of exposure at the same level produced no deaths (Smyth, et al. 1956). A paper by Sayers, Schrenk, and Patty (1936) reported that guinea pigs demonstrated eye irritation effects at 3300 ppm, became unconscious after 9 hours exposure to 7000 ppm, and died after 4 hours of exposure to 14,000 ppm.

Human volunteers complained that throat irritation, which began at an exposure level of 2000 ppm n-butyl acetate, worsened and became quite severe at 300 ppm (Nelson, Ege, Morwich et al. 1943).

OSHA is proposing an 8-hour TWA of 150 ppm and a 200-ppm STEL for n-butyl acetate. The Agency preliminarily concludes that these limits are necessary to protect workers from the risks of eye, skin and respiratory irritation, in addition to narcotic effects, potentially associated with exposures to this substance at the levels permitted by the 8-hour limit alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-butyl acetate if the Agency determines that this limit will substantially reduce significant risk.

n-BUTYL LACTATE
CAS: 138-22-7; Chemical Formula: $C_7H_{14}O_3$
H.S. No. 1053

OSHA currently has no limit for n-butyl lactate. The ACGIH-recommended limit is a TLV-TWA of 5 ppm. Butyl lactate is a colorless liquid ester of lactic acid.

In humans, prolonged exposures to n-butyl lactate at approximately 7 ppm, with brief peak excursions to 11 ppm, caused headache, irritation of the pharyngeal and laryngeal mucosa, and coughing in all workers, and occasional nausea, vomiting, and sleepiness in some (Zuidema and Pel 1969, as cited in ACGIH 1986, p. 82). Headache, coughing, and irritation of the pharynx were sometimes related to n-butyl lactate concentrations of 4 ppm; however, no adverse effects were observed at a concentration of 1.4 ppm. Studies employing improved sampling and analytic methods have subsequently concluded that, although the odor of n-butyl lactate is discernible at the 7-ppm level, this concentration does not produce objectionable or injurious effects (Turner 1972).

OSHA proposes a limit of 5 ppm TWA for n-butyl lactate to protect against the risk of irritation, headache, nausea, and coughing associated with occupational exposures to this substance. However, the Agency notes that studies show adverse effects at levels below the proposed 5-ppm limit. OSHA specifically requests data on the health effects associated with exposures to this substance and the airborne concentrations at which such effects occur. The health evidence forms a reasonable basis for proposing a new

limit for n-butyl lactate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

n-BUTYL MERCAPTAN
CAS: 109-79-5; Chemical Formula: $CH_3CH_2CH_2CH_2SH$
H.S. No. 1054

This chemical is used as a solvent and chemical intermediate, and as an odorant for natural gas. OSHA's current limit for n-butyl mercaptan is 10 ppm as an 8-hour TWA. The ACGIH has recommended a TLV-TWA of 0.5 ppm. The NIOSH REL for n-butyl mercaptan is 0.5 as a 15-minute short-term exposure.

Humans exposed to concentrations of butyl mercaptan report that the "readily noticeable" odor level for this substance is between 0.1 and 1 ppm, although the odor threshold is significantly below this level (ranging from 0.001 to 0.0001 ppm). Gobbato and Terribile (1968) have reported that symptoms of CNS toxicity occurred in humans exposed for 1 hour to concentrations of n-butyl mercaptan believed to lie in the range of 50 to 500 ppm. These same authors reported that mucosal irritation occurred in human volunteers exposed to 4 ppm of ethyl mercaptan, a closely related substance. Irritation did not occur at exposures to 0.4 ppm. The ACGIH established the TLV at 0.5 ppm, which is approximately halfway between 0.1- to 1.0-ppm levels reported as being readily noticeable (ACGIH 1986). Thus, the ACGIH TLV was not set at a level designed to protect against detecting the odor of butyl mercaptan, but to avoid the intolerable odor effects of higher concentrations of this substance. NIOSH (1978) recommended a 15-minute short-term limit of 0.5 ppm because the toxic action of n-butyl mercaptan, like that of other thiol compounds, is expressed as an acute effect. NIOSH concluded that a short-term limit was more appropriate than a TWA limit, and that "use of a ceiling [i.e., short-term] concentration instead of a TWA has the effect of increasing the protection provided to the worker about twofold" (NIOSH 1978, p. 85).

OSHA preliminarily concludes that the current PEL for n-butyl mercaptan is insufficient to protect workers from experiencing the adverse acute effects caused by exposure to this substance. The current PEL of 10 ppm is between 10 and 100 times higher than the concentration of n-butyl mercaptan that is readily detected by smell and is more than twice the concentration reported as causing mucosal irritation for a closely related substance. OSHA finds that workers are at risk of these acute effects in the absence of a more stringent limit and is proposing to reduce its exposure limit for n-butyl mercaptan to 0.5 ppm TWA. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-butyl mercaptan if the Agency determines that this limit will substantially reduce significant risk.

CAMPHOR (SYNTHETIC)
CAS: 76-22-2; Chemical Formula: $C_{10}H_{16}O$
H.S. No. 1063.

OSHA currently has a limit of 2 ppm for camphor. The ACGIH recommends a TLV-TWA of 2 ppm and a TLV-STEL of 3 ppm. Synthetic camphor is a colorless or white crystalline substance with an aromatic odor.

Synthetic camphor is known to cause severe injuries in animals exposed for prolonged periods by inhalation to 6 mg/m^3. Exposure may cause convulsions, congestion and changes in the gastrointestinal tract, and damage to the kidneys and brain (Flury and Zernik 1931). Animal bioassays showed that camphor was not carcinogenic in rats injected subcutaneously; however, when the cancer promoter, croton oil, was concurrently applied to the skin of mice, two of 110 treated mice developed carcinomas (Graffi et al. 1953).

In humans, there are reports of industrial exposure to camphor that resulted in coma, dyspnea, and headache; one fatality from inhalation of the vapor has been noted (Flury and Zernik 1931). Exposures for up to 10 months in a synthetic camphor packing plant are reported not to have involved eye and nose irritation if concentrations were maintained at or below 2 ppm (Gronka, Bobkoski, Tomchick, and Rakow 1969). However, the same authors report that these packing plant workers did experience nose and throat inflammation.

OSHA proposes a TWA of 2 ppm and a STEL of 3 ppm for synthetic camphor to prevent the risk of irritation to the eyes, nose, and central nervous system potentially associated with elevated exposures to this substance. The Agency preliminarily concludes that the combined TWA-STEL is necessary to reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for synthetic camphor if the Agency determines that this limit will substantially reduce significant risk.

CAPROLACTAM (DUST)
CAS: 105-60-2; Chemical Formula: $C_6H_{11}NO$
H.S. No. 1064

OSHA has no current permissible exposure limit for caprolactam dust. The ACGIH recommends a 1-mg/m^3 TLV-TWA for this substance, with a short-term exposure limit of 3 mg/m^3. Caprolactam is a white crystalline solid with an unpleasant odor.

In humans, caprolactam has been shown to be a convulsant, a dermal and respiratory irritant, and a dermal sensitizer, but dosage levels in humans are ill-defined (Ferguson and Wheller 1973; Tumà, Fossela, and Waidhofer 1981). In animals, exposure to caprolactam by several routes can cause convulsions, tremors, mydriasis, opisthotonus (Elison, Lein, Zinger, et al. 1971; Lein, Lein, and Tong 1971) and salivation (Goldblatt et al. 1954). Cardiovascular and respiratory effects have been reported in rabbits and cats, with an initial increase in blood pressure followed by a decrease in blood pressure and an increased respiratory rate (Goldblatt, Farquharson, Bennett, and Askew 1954). Weight loss and initial growth depression occur in rates and mice (Morrison, Ross, and Ruth 1980).

One animal study observed that caprolactam's convulsant effects on rats, rabbits, and cats occur at injection doses above 100 mg/kg (Goldblatt et al. 1954). Results of studies in guinea pigs were consistent with these findings (Hohensee 1951). In a 90-day feeding study of dogs, Burdock, Kolwick, Alsakor, and Marshal (1984) reported that dogs given dietary dose levels of 0.1, 0.5, and 1.0 percent caprolactam showed weight losses at 1.0 percent and lesser losses at 0.5 percent. Hematologic and ophthalmologic changes did not occur. In a 2-year bioassay of rats and mice, caprolactam was not observed to be carcinogenic (NCI/NTP 1982). A Polish study in animals observed hematologic and systemic changes, increased mortality, kidney and liver damage, and growth inhibition in animals given daily doses of 50 or 100 mg/kg (Zwierzchowski et al. 1967).

The results of early studies of caprolactam's teratogenicity in rats and rabbits indicate that it is not teratogenic even at doses as high as 1000 mg/kg/day (Gas, Powers, Robinson et al. 1984).

Studies of industrial exposures to caprolactam dust in Germany report severe irritation on inhalation of 10 percent caprolactam in dust (Hohensee 1951). Workers experienced a bitter taste, nervousness, epistaxis, upper respiratory tract irritation, and dry and splitting skin on the lips and nose (Hohensee 1951). Ferguson and Wheller (1973) found that some workers exposed to caprolactam vapors experienced nose

and throat irritation at concentrations above 10 ppm, and others reported irritation at levels below 10 ppm. Direct contact with the solid form of caprolactam produces primary skin irritation (Ferguson, unpublished communication, as cited in ACGIH 1986, p. 96–2). Brief (unpublished communication, as cited in ACGIH 1986, p. 96–2) also reports that the dust produces skin irritation.

OSHA is proposing a permissible exposure limit of 1 mg/m³ TWA and a 3-mg/m³ STEL for caprolactam dust to prevent the risk of respiratory and skin irritation and of sensitization, to which workers can be subjected in the absence of any OSHA limit. The Agency preliminarily concludes that this combination of limits will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for caprolactam (dust). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CAPROLACTAM (VAPOR)
CAS: 105–60–2; Chemical Formula: $C_6H_{11}NO$
H.S. No. 1065

OSHA has no current permissible exposure limit for caprolactam as vapor. The ACGIH recommends a TVL–TWA of 20 mg/m³ for the vapor, supplemented by a STEL of 40 mg/m³. Caprolactam is a white, crystalline solid at room temperature, and thus high vapor levels occur only at elevated temperatures.

The health effects of exposure to caprolactam vapor are identical to those described for caprolactam dust, except that contact with the vapor is reported to be even more irritating (Hohensee 1951). Workers exposed to the vapor at approximately 12 ppm complained of a bitter taste in the mouth, nervousness, epistaxis, upper respiratory tract congestion, and dry and splitting skin; other workers reported experiencing heartburn, flatulence, and a heavy feeling in the stomach (Hohensee 1951).

In another report of industrial exposure to the vapor, Ferguson and Wheeler (1973) reported that workers routinely exposed to unspecified levels and occasionally to concentrations as high as 100 ppm for 18 years reported severe discomfort from burning nose, throat, and eyes. This irritation response was dose-related, with no workers reporting effects at 7 ppm or below, some experiencing transient upper respiratory tract irritation at levels above that, and others reporting eye irritation at concentrations of 25 ppm and above (Ferguson and Wheeler 1973). Ferguson (private communication, 1972, as cited in ACGIH 1986, p. 96.1) noted that a group of 143 workers, some of whom were exposed for as long as 17 years to vapor concentrations of 5 to 10 ppm showed no evidence of adverse effects. At higher vapor exposures (53 to 521 mg/m³), all subjects experienced eye irritation (Ferguson, private communication, 1972). Human volunteers exposed at low relative humidities to concentrations of the vapor in the range of 10 to 100 ppm showed a dose-related response, but at higher relative humidities, no irritation was observed below a concentration of 14 ppm (Ferguson and Wheeler 1973).

OSHA is proposing to establish an 8-hour TWA exposure limit of 20 mg/m³ for caprolactam vapor and to supplement this with a STEL of 40 mg/m³. The Agency preliminarily concludes that this combination of limits will protect workers from the risk of eye, upper respiratory, and skin irritation to which they could otherwise be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for caprolactam vapor. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CESIUM HYDROXIDE
CAS: 21351–79–1; Chemical Formula: CsOH
H.S. No. 1077

OHSA currently has no limit for cesium hydroxide. The ACGIH recommends a threshold limit vlaue of 2 mg/m³ as an 8-hour TWA. Cesium hydroxide is a colorless or yellowish fused crystalline mass; it is the strongest base known and is highly soluble in water and alcohol.

Animal studies indicate that cesium hydroxide has an acute oral toxicity of about one-third that of potassium hydroxide, which causes lesions of the nasal septum and irritation of the eyes and respiratory tract (Kanpov 1971, as cited in ACGIH 1986, p. 495). The oral LD_{50} for cesium hydroxide in rats is 1016 mg/kg. A concentration of 5 percent cesium hydroxide did not produce skin irritation; however, severe irritation of the eyes resulted from contact with a 5-percent concentration of cesium hydroxide. Cesium hydroxide does not cause skin sensitization (Johnson, Lewis, and Perone 1972).

OSHA proposes a TWA of 2 mg/m³ as an 8-hour permissible exposure limit for cesium hydroxide. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of severe eye irritation associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for cesium hydroxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CHLORINE
CAS: 7782–50–5; Chemical Formula: Cl_2
H.S. No. 1079

The current OSHA limit for chlorine is a 1-ppm ceiling limit. The ACGIH has recommended a TLV–TWA of 1 ppm with a TLV–STEL of 3 ppm. NIOSH (1976e) has recommended a limit of 0.5 ppm over a 15-minute sampling duration.

Exposure to chlorine at concentrations around 5 ppm has been associated with respiratory symptoms, erosion of teeth, and inflammation of mucous membranes (Flury and Zernik 1931; Patty 1963). Ferris et al. (1964) reported slight effects on the respiratory system in workers exposed to chlorine ranging from negligible to 7 ppm. Rupp and Henschler (1967) reported burning of the eyes among human subjects exposed to 0.4 ppm; some of these subjects reported painful eyes after 15 minutes' exposure to this level. In a separate test, subjects reported respiratory irritation upon exposure to 0.5 ppm, and a concentration of 1 ppm was described as being uncomfortable.

After reviewing these reports, the ACGIH recommended the 1-ppm TLV–TWA and 3-ppm TLV–STEL to "minimize chronic changes in the lungs, accelerated aging, and erosion of the teeth" (ACGIH 1986, p. 117). NIOSH (1976e) reviewed these studies, as well as others (Matt 1889; Beck 1959) that reported ocular and respiratory irritation associated with exposure to chlorine levels of around 1 ppm for 30 minutes or less. NIOSH (1976e) recommended a 15-minute 0.5-ppm limit to prevent possible eye and respiratory tract irritation.

The current OSHA limit for chlorine (1 ppm ceiling) and the ACGIH TLVs (1 ppm TWA and 3 ppm STEL) are inadequate to protect against the risk to workers' health. Studies show that humans exposed to 0.4 ppm experienced burning of the eyes, and when exposed to 0.5 ppm they experienced respiratory irritation. The subjects were "uncomfortable" when exposed to 1 ppm of chlorine. OSHA therefore proposes adoption of the NIOSH REL (0.5 ppm ceiling) to prevent possible eye and respiratory irritation and thus substantially to reduce this risk. The Agency's preliminary feasibility analysis is based on limited data at this level; additional feasibility information is requested from the public. The health

evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for chlorine if the Agency determines that this limit will substantially reduce significant risk.

CHLOROACETYL CHLORIDE
CAS: 79-04-9; Chemical Formula: $ClCH_2COCl$
H.S. No. 1083

OSHA has no current limit for chloroacetyl chloride. The ACGIH recommends a TLV-TWA of 0.05 ppm. Chloroacetyl chloride is a colorless liquid with a pungent odor.

The oral LD_{50} in rats fed this substance is between 0.12 and 0.25 g/kg. Chloroacetyl chloride is corrosive to the skin and eyes, and skin absorption of this substance can be lethal. Inhalation of 4 ppm for 5 to 10 minutes caused respiratory problems in rats; however, no effect was observed in these animals when they inhaled 2.5 ppm for a period of 7 hours (Dow Chemical Company 1977, as cited in ACGIH 1986, p. 122). Thirty-day inhalation studies with rats, mice, and hamsters showed eye and respiratory irritation at 2.5 ppm and no effect at 0.5 ppm (Dow Chemical Company 1977, as cited in ACGIH 1986, p. 122).

Reports of the acute effects associated with exposure to chloracetyl chloride in humans include mild to moderate skin burns and erythema, eye burns and tearing, cough, dyspnea, and cyanosis, as well as mild gastrointestinal effects. Eye and respiratory irritation occurred in an industrial setting characterized by an exposure level of 0.009 to 0.017 ppm, with excursions as high as 0.140 ppm (Dow Chemical Company 1977, as cited in ACGIH 1986, p. 122). An accidental drenching with a mixture containing chloroacetyl chloride resulted in extensive first- and second-degree burns, pulmonary edema, and three episodes of cardiac arrest, followed by coma and anoxia-induced brain damage (Pagnotto 1978, as cited in ACGIH, p. 122). Other ingredients of the mixture involved in the accident included xylidine, benzene, and sodium carbonate. Rescuers of this victim experienced hand blisters, chest tightness, and nausea for 2 days.

OSHA proposes a PEL of 0.05 ppm TWA for chloroacetyl chloride. The Agency preliminary concludes that this limit is necessary to protect exposed employees from the risk of eye, skin, and respiratory irritation; gastrointestinal effects; and severe systemic effects, including life-threatening coma, cardiac arrest, and pulmonary edema, to which workers could presently be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for chloroacetyl chloride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

o-CHLOROBENZYLIDENE MALONONITRILE
CAS: 2698-41-1; Chemical Formula: $ClC_6H_4CH=C(CN)_2$
H.S. No. 1084

OSHA's existing PEL for o-chlorobenzylidene malononitrile (OCBM) is 0.05 ppm as an 8-hour TWA. The ACGIH recommends a ceiling limit of 0.05 ppm, with a skin notation. o-chlorobenzylidene malononitrile is a white crystalline solid with a pepper-like odor.

This substance has extremely irritating properties. It causes intense eye and skin irritation, coughing, difficulty in breathing, chest tightness, running nose, dizziness, nausea, and vomiting. These effects are evident on exposure to concentrations between 12 and 20 mg/m^3, and they become incapacitating within 20 seconds of exposure; the effects persist for approximately 5 to 10 minutes after the victim has been removed to fresh air (*Military Chemistry and Chemical Agents* 1963).

OCBM is only slightly toxic to laboratory animals when they are exposed intravenously, subcutaneously, or through inhalation (Punte, Weimer, Ballard, and Wilding 1962). In animals, it has been demonstrated that OCBM is metabolized by the body to cyanide (Frankenberg and Sorbo 1973). Short-term exposures to high levels of OCBM did not cause carcinogenic, teratogenic, or embryolethal effects in animals (McNamara et al. 1973).

Three of four human volunteers exposed to a 1.5-mg/m^3 concentration of OCBM aerosol dispersed from a 10-percent solution in methylene chloride for 90 minutes developed headaches, and one showed mild eye and nose irritation. Headaches persisted for 24 hours in two subjects. At 4 to 5 mg/m^3, subjects' problem-solving abilities were affected and they showed eye irritation, conjunctivitis, lacrimation, and skin burning (Punte, Owens, and Gutentag 1963). Other researchers observed no persistent clinical abnormalities in seven subjects exposed to OCBM at concentrations ranging from 1 to 13 mg/m^3 over a 15-day period; however, none of these subjects developed a tolerance for the compound. Severe skin senitization has also been reported in workers handling OCBM (Schumes and Taylor 1973).

OSHA is proposing a ceiling limit of 0.05 ppm and a skin notation for o-chlorobenzylidene malononitrile. The Agency preliminarily concludes that these limits are necessary to protect workers from the risk of severe eye and upper respiratory tract irritation, skin sensitization, dyspnea, nausea, lacrimation, vomiting, and performance decrement associated with brief exposures to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for o-chlorobenzylidene malononitrile if the Agency determines that this limit will substantially reduce significant risk.

CYANOGEN
CAS: 460-19-5; Chemical Formula: $(CN)_2$
H.S. No. 1105

OSHA currently has no limit for cyanogen. The ACGIH recommends a TLV-TWA of 10 ppm for this colorless gas, which has a pungent, almond-like odor.

The acute toxicity for cyanogen in various animal species is high (Flury and Zernik 1931). One-hundred ppm was fatal to cats in 2 to 3 hours, and 400 ppm was fatal to rabbits in less than 2 hours. However, rabbits exposed to 100 ppm for 4 hours showed practically no effects. Cats exposed to 50 ppm were severely affected but recovered (Flury and Zernik 1931). Investigations in the rat suggest that cyanogen is approximately 10 times less acutely toxic than is hydrogen cyanide (McNerney and Schrenk 1960).

Human tests showed that subjects experienced almost immediate eye and nasal irritation at exposures of 16 ppm (McNerney and Schrenk 1960).

OSHA proposes a PEL of 10 ppm TWA for cyanogen. Because of the high acute toxicity of this substance in experimental animals, the Agency preliminarily concludes that this limit is necessary to protect against the risk of irritation and systematic effects associated with exposure at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for cyanogen. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CYANOGEN CHLORIDE
CAS: 506-77-4; Chemical Formula: ClCN
H.S. No. 1106

OSHA currently has no limit for cyanogen chloride. The ACGIH recommends a ceiling limit of 0.3 ppm

for this colorless liquid or gas, which has a pungent odor.

The chronic effects of cyanogen chloride, which include hoarseness, conjunctivitis, and edema of the eyelid, have long been recognized (Reed 1920).

Flury and Zernik (1931) observed the effects of exposure to cyanogen chloride in five animal species. In mice, a concentration of approximately 500 ppm was fatal within 3 minutes; in cats, 120 ppm was fatal in 3.5 minutes; 48 ppm was fatal to dogs in 6 hours; in goats, a 1000-ppm exposure for 3 minutes caused death after 70 hours; and 1200 ppm was fatal to the rabbit. Several other studies have demonstrated that animals exposed to cyanogen chloride exhibit pulmonary edema and interference with cellular metabolism (Jandorf and Bodansky 1946; Aldrich and Evans 1946).

Human data indicate that 1 ppm is the lowest irritant concentration for a 10-minute exposure; 2 ppm was intolerable for this time period, and 48 ppm was fatal in 30 minutes (Prentiss 1937). The Michigan Department of Public Health (1977) reported that a concentration of about 0.7 ppm caused severe eye and nasal irritation, forcing workers to quit the area.

OSHA is proposing a ceiling limit of 0.3 ppm for cyanogen chloride. The Agency preliminarily concludes that this ceiling is necessary to protect exposed workers from the risks of severe irritation, metabolic effects, and pulmonary edema associated with exposure to this substance at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for cyanogen chloride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will subtantially reduce significant risk.

DIBUTYL PHOSPHATE
CAS: 107-66-4; Chemical Formula: $(n\text{-}C_4H_9O)_2(OH)PO$
H.S. No. 1119

OSHA currently has an 8-hour TWA PEL of 1 ppm for dibutyl phosphate. The ACGIH recommends a TLV-TWA of 1 ppm and a TLV-STEL of 2 ppm for this pale amber liquid.

There are no published reports of toxic reactions caused by exposure to dibutyl phosphate. However, in a personal communication to the ACGIH, Mastromatteo reported that workers exposed to relatively low levels of dibutyl phosphate developed respiratory tract irritation and headache (Mastromatteo, as cited in ACGIH 1986, p. 175).

OSHA is proposing an 8-hour TWA PEL of 1 ppm and a 15-minute STEL of 2 ppm for dibutyl phosphate. The Agency preliminarily concludes that both a TWA and a STEL are necessary to protect exposed workers from the risk of respiratory tract irritation and headaches reported at low levels of exposure and to substantially reduce this risk. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for dibutyl phosphate if the Agency determines that this limit will substantially reduce significant risk.

1,3-DICHLORO-5,5-DIMETHYLHYDANTOIN
CAS: 118-52-5; Chemical Formula: $C_5H_6Cl_2N_2O_2$
H.S. No. 1122

OSHA currently has a limit of 0.2 mg/m³ TWA for 1,3-dichloro-5,5-dimethylhydantoin (DCDMH). The ACGIH recommends a TLV-TWA of 0.2 mg/m³ TWA and a TLV-STEL OF 0.4 mg/m³ for this white powder, which has a mild odor similar to that of chlorine.

1,3-Dichloro-5,5-dimethylhydantoin produces systemic toxicity in laboratory animals. The acute oral LD_{50} in rats of both sexes is 542±84 mg/kg when administered as a 10-percent aqueous suspension. Rats dying within 48 hours of administration showed gastrointestinal hemorrhage at necropsy. The animals tolerated aqueous solutions of DCDMH maintained at 20-ppm available chlorine (Industrial Bio-Test Laboratories, as cited ACGIH 1986, p. 183).

Limited human exposure data have been provided by Baier, who reported that individuals experienced extreme respiratory irritation at an average level of 1.97 mg/m³, but that some experienced this degree of irritation even at 0.7 mg/m³ (Baier, as cited in ACGIH 1986, p. 183).

OSHA is proposing a PEL of 0.2 mg/m³ TWA and a STEL of 0.4 mg/m³ for DCDMH. These limits are based on evidence of systemic toxicity in laboratory animals and respiratory irritation at low exposure levels in human subjects. The Agency preliminarily concludes that both a TWA and STEL are required to protect exposed workers from the risk of respiratory irritation that has been shown to occur at levels only slightly above the level specified by the 8-hour TWA limit. OSHA believes that the two limits will reduce this risk substantially. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 1,3-dichloro-5,5-dimethylhydantoin if the Agency determines that this limit will substantially reduce significant risk.

DICHLOROETHYL ETHER
CAS: 111-44-4; Chemical Formula: $(CH_2ClCH_2)_2O$
H.S. No. 1127

OSHA currently has a 15-ppm ceiling limit, with a skin notation, for dichloroethyl ether. The ACGIH recommends a TLV-TWA of 5 ppm with a TLV-STEL of 10 ppm, also with a skin notation. Dichloroethyl ether is a colorless, flammable liquid with a nauseating odor.

The primary health hazards associated with exposure to this substance are irritation of the eyes and respiratory system and pulmonary damage. Schrenk, Patty, and Yant (1933) report that guinea pigs exposed to the vapor of dichloroethyl ether at 500 ppm experienced immediate and severe eye and nose irritation, respiratory disturbances after 1.5 to 3 hours, and death after 5 to 8 hours. Lung, kidney, liver, and brain damage were also observed in these animals; exposure to a reduced level of 105 ppm caused eventual death after 10 hours of continuous exposure. A one-hour exposure to 105 ppm caused irritation only (Carpenter, Smyth, and Pozzani 1949). At 35 ppm, for an unspecified duration, irritation but no other adverse effects were observed (Schrenk, Patty, and Yant 1933). Rats responded similarly, with 4-hour exposures to 250 ppm proving lethal (Carpenter, Smyth, and Pozzani 1949).

Repeated exposures to 69 ppm (7 hours/day, 5 days/week for 130 days) caused no serious injury in rats or guinea pigs; only mild stress-related effects were noted (Kosyan 1969). However, other studies of guinea pigs have shown mild primary irritative effects on the skin, and fatalities occurred when 300 mg/kg was applied dermally as a pure liquid for 24 hours (Smyth, Jr. and Carpenter 1948). Direct contact of dichloroethyl ether with the eye causes moderate pain, conjunctival irritation, and transient corneal injury (Carpenter and Smyth 1946). A sufficient amount of dichloroethyl ether can be absorbed through the skin to be lethal (Carpenter and Smyth 1946). Mice have been reported to develop hepatomas after prolonged oral administration (80 weeks) at 300 mg/kg (Innes et al. 1969).

Humans exposed briefly to dichloroethyl ether at concentrations above 550 ppm experienced intolerable eye and nasal irritation, with coughing, nausea, and retching. Concentrations between 100 and 260 ppm were irritating but tolerable; however, the odor of

dichloroethyl ether was still nauseating at 35 ppm (Schrenk, Patty, and Yant 1933). Eye irritation has been reported from industrial exposure to a concentration of dichloroethyl ether of 2.5 ppm (Bell and Jones 1958). A single fatality, presumably from inhalation of the vapor, has been reported but not documented (Elkins 1959).

OSHA proposes an 8-hour TWA limit of 5 pm and a STEL of 10 ppm, with a skin notation, for dichloroethyl ether. The Agency preliminarily concludes that this combination of limits will protect workers against the risk of irritation, lung injury, and nausea associated with occupational exposure to elevated levels of dichloroethyl ether. The skin notation is proposed because dichloroethyl ether can cause systemic toxicity if percutaneously absorbed. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for dichloroethyl ether if the Agency determines that this limit will substantially reduce significant risk.

2,2-DICHLOROPROPIONIC ACID
CAS: 75-99-0; Chemical Formula: CH_3CCl_2COOH
H.S. No. 1130

OSHA currently has no limit for 2,2-dichlororopionic acid. The ACGIH recommends a TLV of 1 ppm TWA for this liquid.

In a communication to the ACGIH (1986, p. 190), the Dow Chemical Company (1977) reported that 2,2-dichloropropionic acid is corrosive to the skin and can cause permanent injury to the eye. The oral LD_{50} in rats is between 0.7 and 1 g/kg. Seven-hour exposures to a saturated atmosphere of the acid vapor caused no ill effects in rats, and a 120-day study of dietary exposure in rats showed a no-effect level of 15 mg/kg/day (Dow Chemical Company, as cited in ACGIH 1986, p. 190).

Acute human exposures have been reported to cause mild to moderate skin, eye, respiratory, and gastrointestinal irritation. Minimal respiratory irritation was observed in workers exposed at concentrations of between 2 and 7 ppm (ACGIH 1986, p. 190).

OSHA is proposing a PEL of 1 ppm TWA for 2,2-dichloropropionic acid. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of eye, respiratory, and gastrointestinal irritation at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for 2,2-dichloropropionic acid. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIETHYLAMINE
CAS: 109-89-7; CHEMICAL FORMULA: $(C_2H_5)_2NH$
H.S. No. 1137

OSHA's current limit for diethylamine is 25 ppm as an 8-hour TWA. The ACGIH has established an 8-hour TLV-TWA of 10 ppm and a 15-minute STEL of 25 ppm for this substance, which is a colorless liquid with an ammonia-like odor.

Diethylamine is a strong irritant of the eyes, skin, and mucous membranes, and chronic sublethal exposures cause tracheitis, bronchitis, pneumonitis, and pulmonary edema (ACGIH 1986, p. 197). In rabbits, the dermal LD_{50} is 0.82 ml/kg, and instillation of solutions of 1 percent or greater into the eyes of rabbits caused corneal opacity (Sutton 1963). Direct contact of the skin with diethylamine causes necrosis (ACGIH 1986, p. 197). Rabbits exposed 7 hours/day, 5 days/week for 6 weeks to 50 or 100 ppm diethylamine survived; those exposed to 50 ppm showed marked lung and corneal irritation, and, occasionally, degeneration of the heart muscle (Brieger and Hodes 1951). In the animals exposed to 100 ppm, these changes were more severe, and the parenchymatous degeneration of the heart muscle was marked (Brieger and Hodes 1951).

OSHA is proposing an 8-hour TWA of 10 ppm and a STEL of 25 ppm for diethylamine. The Agency preliminarily concludes that this combined limit will protect workers from the risk of skin burns, corneal injury, pulmonary irritation, and skin, eye, and upper respiratory tract irritation potentially associated with exposures to this substance at the levels permitted by an 8-hour limit alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for diethylamine if the Agency determines that this limit will substantially reduce significant risk.

DIISOBUTYL KETONE
CAS: 108-83-8; Chemical Formula: $[(CH_3)_2CHCH_2]_2CO$
H.S. No. 1140

OSHA currently has an 8-hour limit of 50 ppm TWA for diisobutyl ketone. NIOSH recommends a 10-hour TWA of 25 ppm, and the ACGIH has established a TWA limit of 25 ppm for this clear liquid with a mild ether-like odor.

The primary health effects associated with exposure to diisobutyl ketone are eye, nose, and throat irritation, although experimental animals have shown some systemic effects. Diisobutyl ketone has a uniformly low acute toxicity by all routes of exposure. Rats and guinea pigs survived single exposures of from 7.5 to 16 hours to essentially saturated vapor (McOmie and Anderson 1949). Smyth and co-workers (1949) reported that five of six rats died after exposure to 2000 ppm for 8 hours; they also reported a percutaneous LD_{50} for rabbits of greater than 20 ml/kg. Direct application of diisobutyl ketone to rabbit skin was only mildly irritating, and no eye irritation was reported after instillation into the rabbit eye. The oral toxicity for the rat was reported as 5.8 g/kg (Smyth et al. 1949). Carpenter and Smyth (1946) reported a no-effect level for diisobutyl ketone of 125 ppm in rats and guinea pigs given thirty 7-hour exposures. At 250 ppm, the liver and kidney weights of female rats increased, and the liver weights of male guinea pigs decreased; at levels of 530 and 920 ppm, rats showed increased liver and kidney weights; and at 1650 ppm, increased mortality was noted (Carpenter and Smyth 1946).

Silverman, Schulte, and First (1946) reported eye irritation and complaints of objectionable odor in volunteer human exposures to concentrations above 25 ppm. No worker illnesses have been linked to diisobutyl ketone exposure (ACGIH 1986, p. 203)

OSHA proposes a TWA limit of 25 ppm for diisobutyl ketone. The Agency preliminarily concludes that this limit will protect workers against the risk of irritation that is asociated with workplace exposures to diisobutyl ketone levels greater than 25 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for diisobutyl ketone if the Agency determines that this limit will substantially reduce significant risk.

EPICHLOROHYDRIN
CAS: 106-89-8; Chemical Formula: C_3H_5ClO
H.S. No. 1158

OSHA currently has a limit on 5 ppm TWA, with a skin notation, for epichlorohydrin. the ACGIH has established a limit of 2 ppm TWA, also with a skin notation. NIOSH recommends reducing employee exposure to the lowest feasible limit, and considers epichlorohydrin a carcinogen.

In animals, epichlorohydrin is irritating and systemically toxic by all routes of exposure (Shell Chemical Corporation 1958, as cited in ACGIH 1986, p. 233). Fatalities are caused and central nervous system and respiratory

tract effects resulting from exposure to high concentrations.

In mice, single 30-minute exposures to 8300 ppm of epichlorohydrin vapor caused muscular paralysis and death from respiratory failure; similar results have been reported for dermal application of the liquid at 0.5 ml/kg in rats, and repeated oral administration at 0.1 mg/kg in mice (Shell Chemical Corporation 1980, as cited in ACGIH 1986, p. 233). At 32 ppm (7 hours/day, 5 days/week) for 91 days, rats failed to show normal weight gain, and at 16 ppm they showed increased kidney size (ACGIH 1986, p. 233). Gage (1959) confirmed these findings and demonstrated lung, liver, and kidney injury in rats from repeated 6-hour exposures at concentrations ranging from 17 to 120 ppm. No effects were observed by this author at 9 ppm. The oral LD_{50} in rats is reported as 260 mg/kg, and the dermal LD_{50} in rabbits is reported as 755 mg/kg (Lawrence 1972). A 4-hour exposure at a level of 250 ppm was fatal to rats (Carpenter 1949).

There have also been reports of carcinogenicity in mice from dermal application and subcutaneous injection (Van Duuren et al. 1974), as well as reproductive effects from injestion; mutagenic effects were observed in microbial systems and in the fruit fly (NIOSH 1976).

In humans exposed to concentrations above 100 ppm for brief periods, lung edema and kidney lesions have been reported (NIOSH 1976). Exposure at 20 ppm caused burning of eyes and nasal mucosa (Wexler 1971). Another exposure to an unknown concentration caused eye and throat irritation, nausea, dyspnea, bronchitis, and an enlarged liver (Schultz 1964). Painful irritation of subcutaneous tissues follows skin contact in humans (ACGIH 1986, p. 233).

OSHA proposes an 8-hour TWA limit of 2 ppm, with a skin notation, for epichlorohydrin. The Agency preliminarily concludes that this limit will protect workers from the risk of dermal, respiratory, liver, and kidney effects that are potentially associated with exposure to epichlorohydrin at elevated concentrations. The skin notation is retained because of this substance's capacity to penetrate the skin and cause toxicity. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ephclorohydrin if the Agency determines that this limit will substantially reduce significant risk.

ETHYL BENZENE
CAS: 100-41-4, Chemical Formula C_8H_{10}
H.S. No. 1162

OSHA currently has an 8-hour TWA limit of 100 ppm for ethyl benzene. The ACGIH recommends a limit of 100 ppm TWA and a 15-minute STEL of 125 ppm for this colorless, flammable liquid with an aromatic odor.

Ethyl benzene is a skin and mucous membrane irritant. It is reported to be the most severe irritant of the benzene series (Oettel 1936). In rabbits, repeated dermal application of the liquid causes reddening, exfoliation, and blistering of the skin (Wolf et al. 1956). The acute toxicity of ethyl benzene is low, with death reported to occur at 10,000 ppm in guinea pigs exposed for a few minutes; at 5000 ppm, ethyl benzene was described as dangerous to life for those exposed for 30 to 60 minutes. Dying animals suffered intense congestion and edema of the lungs, as well as generalized visceral hyperemia (Yant, Schrenk, Waite, and Patty 1930). The narcotic dose in laboratory animals is reported to be 10,000 ppm (reached within 18 minutes) and narcosis is preceded by vertigo, unsteadiness, and ataxia (Yant, Schrenk, Waite, and Patty 1930).

Chronic inhalation exposures of guinea pigs, monkeys, rabbits, and rats at concentrations of from 400 ppm to 2200 ppm, 7 to 8 hours/day, 5 days/week for as long as 6 months produced no effects in these species, except that liver damage occurred, on the average, in animals exposed to 400 ppm for 186 days (Wolf et al. 1956).

Observations in humans suggest that intolerable eye and nose irritation occurs at 5000 ppm; immediate and severe eye irritation and tearing and moderate nose irritation is exhibited at 2000 ppm; and irritation that reportedly can be tolerated occurs at 1000 ppm. At 200 ppm, the vapor produces transient eye irritation (Gerarde 1963).

OSHA is proposing a PEL of 100 ppm TWA and a 15-minute STEL of 125 ppm for ethyl benzene. The Agency preliminarily concludes that both of these limits are required to protect those exposed from the risk of irritation associated with occupational exposure to ethyl benzene above the 100-ppm level even for a brief period. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethyl benzene if the Agency determines that this limit will substantially reduce significant risk.

ETHYL ETHER
CAS: 60-29-7; Chemical Formula: $C_2H_5OC_2H_5$
H.S. No. 1164

OSHA currently has a limit of 400 ppm TWA for ethyl ether. The ACGIH recommends the same time-weighted average limit, with a STEL of 500 ppm for a 15-minute period. Ethyl ether is a colorless, volatile, mobile liquid with a distinct odor and a burning, sweet taste. It is extremely flammable and is a severe fire and explosion hazard when exposed to heat or flame.

Ethyl ether causes narcosis and general anesthesia. Concentrations of 3.6 to 6.5 volumes percent in air are anesthetic to humans; 7- to 10-percent concentrations cause respiratory arrest, and concentrations greater than 10 percent are fatal (ACGIH 1986, p. 259). Repeated workplace exposures deliberately induced to produce the so-called "ether jag" have caused narcosis, exhaustion, headache, dizziness, sleepiness, excitation, and other psychic disturbances (Hake and Rowe 1963). In women, albuminuria and polycythemia may result (Browning 1965). Repeated exposure may cause skin desiccation; irritation of the mucous membranes and eyes occurs on contact with the liquid or after exposure to high concentrations of the vapor (Hake and Rowe 1973). Nelson and co-workers (1943) reported that workers began to experience nasal irritation at 200 ppm (Nelson, Ege, Ross et al. 1943). Henderson and Haggard calculated that the amount of ether absorbed by a man of average height at a concentration of 400 ppm would not cause intoxication. Armor (1950) observed that exposure effects occur only at levels of 500 ppm and above.

OSHA is proposing a PEL of 400 ppm TWA and a 15-minute STEL of 500 ppm for ethyl ether. The Agency preliminarily concludes that both of these limits are necessary to protect against the risk of narcosis and irritation potentially associated with excursions above the 8-hour TWA level. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethyl ether if the Agency determines that this limit will substantially reduce significant risk.

ETHYL MERCAPTAN
CAS: 75-08-1; Chemical Formula: C_2H_5SH
H.S. No. 1165

OSHA currently has a ceiling limit of 10 ppm for ethyl mercaptan. The ACGIH recommends a TLV of 0.5 ppm TWA. The NIOSH recommended exposure limit for this substance is 0.5 ppm as a 15-minute ceiling. Ethyl mercaptan is a colorless liquid with a persistent and penetrating leek-like odor.

Acute animal toxicity data concerning ethyl mercaptan are taken from a single study that reports the following findings. The 4-hour inhalation LC_{50} values in rats and mice are 2770 ppm and 4420 ppm,

respectively. In the rat, the intraperitoneal LD_{50} is reported to be approximately 450 mg/kg. One drop applied to rabbit eyes caused only slight irritation, but high concentrations of vapor caused considerable irritation within 15 minutes. Maximal sublethal intraperitoneal doses have been reported to induce deep sedation, with higher exposures causing restlessness, muscular incoordination, skeletal muscular paralysis, cyanosis, respiratory depression, coma, and death. Although inhalation tests showed no noteworthy pathology in rats, intraperitoneal injection caused lymphotic infiltration of the liver with occasional necrosis (Fairchild and Stokinger 1958).

In chronic inhalation studies of rabbits, rats, and mice, a 5-month exposure to 40 ppm caused minimal cardiovascular and other systemic effects (Blivona 1965).

Studies of human volunteers, exposed at 4 ppm for 3 hours daily for 5 to 10 days, have reported minimal effects. At this level, all subjects experienced altered taste and olfactory reactions, periodic nausea, mucous membrane irritation, and fatigue. Exposure to 0.4 ppm produced no unpleasant symptoms (ACGIH 1986, p. 262).

OSHA is proposing to reduce its current ceiling limit of 10 ppm for ethyl mercaptan to 0.5 ppm as a time-weighted average, to protect workers against the risk of nausea, fatigue, and irritation associated with exposure to concentrations well below the current PEL. The Agency preliminary concludes that the revised limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethyl mercaptan if the Agency determines that this limit will substantially reduce significant risk.

ETHYLENE GLYCOL
CAS: 107-21-1; Chemical Formula: CH_2OHCH_2OH
H.S. No. 1169

OSHA currently has no limit for ethylene glycol. The ACGIH recommends a ceiling limit of 50 ppm (approximately 125 mg/m³) for this clear, colorless, odorless, and hygroscopic liquid.

Ethylene glycol poses virtually no exposure risk at room temperature because of its low vapor pressure; at elevated temperatures, however, exposures are possible and adverse effects have been reported as a result of exposure to mists.

In studies of rats, guinea pigs, rabbits, dogs, and moneys, Coon and colleagues (1970) reported that animals exposed over a 30-day period to concentrations at 10 or 57 mg/m³ for 8 hours daily, 5 days per week, showed no adverse effects. Moderate to severe eye irritation did occur in rats and rabbits exposed at 12 mg/m³ for 24 hours per day for 90 days. (Coon et al. 1970). Wiley and co-workers reported no ill effects in animals exposed to approximately 350 to 400 mg/m³, 8 hours per day, for 16 weeks (Wiley, Hueper, and von Oettingen 1936).

Rowe concluded that daily exposure to 100 ppm of the vapor did not cause systemic or eye injuries (1962), although Troisi described nystagmus in overexposed workers (concentrations not reported) (1950). In a human inhalation study, Wills and collegues (1974) reported that volunteers exposed to the aerosol from 20 to 22 hours per day for 4 weeks, at an average concentration of 12 ppm, complained of throat irritation, mild headache, and lower back pain. Complaints were more pronounced when the concentration was raised to 140 mg/m³ (50 ppm) for part of a day. Average concentrations of 80 ppm were found intolerable by the subjects, who reported a burning sensation in the throat and respiratory passages; irritation was also common at 60 ppm (1974).

Based on evidence of an occupational risk of severe throat and respiratory irritation associated with exposure to the vapor and mist, OSHA proposes a ceiling limit of 50 ppm for ethylene glycol; this level is just below the level at which clinical symptons were noted. The Agency preliminarily concludes that this limit will substantially reduce the risk associated with the uncontrolled exposures at the currently uncontrolled level. The health evidence forms a reasonable basis for proposing a new limit for ethylene glycol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ETHYLIDENE NORBORNENE
CAS: 16219-25-3; Chemical Formula: C_9H_{12}
H.S. No. 1171

OSHA currently has no limit for ethylidene norbornene. The ACGIH recommends a ceiling limit of 5 ppm. This colorless liquid reacts with oxygen.

In a range-finding study, five of six rats died following a 4-hour exposure to 4000 ppm 5-ethylidene-2-norbornene (Smyth, Carpenter, Weil et al. 1967). Other studies of longer duration have reported that exposures to 237 ppm for 7 hours per day, 5 days per week for 88 days, resulted in death for 21 of 24 rats. No deaths resulted from repeated exposures at 90 ppm, but renal lesions and enlarged livers were observed, liver lesions, testicular atrophy, and hydrothorax occurred at the 237-ppm level (Kinkead, Pozzani, Geary, and Carpenter 1971). Beagle does similarly exposed to 93 ppm for 89 days survived, but exhibited such effects as testicular atrophy, hepatic lesions, and slight blood changes. Less pronounced effects were seen after exposure to 61 ppm, but no effects were seen at 22 ppm (Kinkead, Pozzani, Geary, and Carpenter 1971).

Human volunteers exposed for 30 minutes to ethylidene norbornene concentrations of 11 ppm experienced eye and nose irritation; at 6 ppm, transient eye irritation occurred (ACGIH 1986, p. 261).

OSHA proposes a ceiling limit of 5 ppm to minimize the risk of irritation that has been documented to occur in occupational exposures to concentrations as low as 6 ppm for 30-minute periods. The Agency preliminarily concludes that this limit will reduce this risk substantially. The health evidence forms a reasonable basis for proposing a new limit for ethylidene norbornene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FURFURAL
CAS: 98-01-1; Chemical Formula: $C_5H_4O_2$
H.S. No. 1183

OSHA currently has an 8-hour TWA limit of 5 ppm, with a skin notation, for furfural. The ACGIH recommends a TLV-TWA of 2 ppm, also with a skin notation. Furfural is a colorless, oily liquid that turns rust-colored when exposed to air and light.

An inhalation exposure to 260 ppm of furfural was fatal to rats but not to mice or rabbits. A 4-week exposure of dogs to 130 ppm for 6 hours a day caused liver damage, but no adverse effects were observed at 63 ppm (AIHA 1965).

Bugyi and Lepold (1952) describe numbness of the tongue and oral mucosa, absence of a sense of taste, and labored breathing in workers exposed to furfural (at unspecified levels) in a poorly ventilated facility. Koreman and Resnik (1930) state that inhalations of from 1.9 to 14 ppm furfural caused headaches, itching throat, and eye irritation; Kuhn (1944) reported that exposure to furfural damages the eyesight in some individuals. NIOSH (1975) describes widespread eye and respiratory tract irritation in workers at a griding wheel plant exposed to furfural vapor at levels ranging from 5 to 16 ppm.

However, Dunlop and Peters (1953) report that a 15-year study of furfural use in the synthetic resin industry revealed that this substance is not hazardous to health in facilities that are adequately ventilated, and that only occasional individual sensitivity was found.

OSHA proposes a PEL of 2 ppm TWA, with a skin notation, for furfural. The Agency preliminarily concludes that these limits will protect workers against the risk of headaches and eye and respiratory irritation associated with exposure to furfural at the levels permitted by OSHA's existing PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for furfural if the Agency determines that this limit will substantially reduce significant risk.

FURFURYL ALCOHOL
CAS: 98-00-0; Chemical Formula: $C_5H_6O_2$
H.S. No. 1184

OSHA's current limit for furfuryl alcohol is 50 ppm TWA. NIOSH (1979) has also recommended a 50-ppm limit as a 10-hour TWA. The ACGIH recommends a 10-ppm TLV–TWA, a 15-ppm TLV–STEL and a skin notation.

The basis for the ACGIH-recommended limits are two foundry studies in which furfuryl alcohol was released during core preparation. Apol (1973) reported no discomfort among workers exposed to 10.8 ppm furfuryl alcohol, but severe lacrimation occurred at 15.8 ppm. Formaldehyde was also present at a concentration of 0.33 ppm. Burton and Rivera (1972) found no irritation, headache, or dizziness among workers exposed to 8-hour TWA concentrations of 5 and 6 ppm, with excursions up to 16 ppm. The ACGIH concluded that a TLV–TWA of 10 ppm with a 15-ppm TLV–STEL would protect workers against irritation effects.

NIOSH (1979) also reviewed these studies, but concluded that it was unknown whether the lacrimation reported by Apol (1973) was caused by furfuryl alcohol, formaldehyde, or both combined. They also noted that the current OSHA limit (50 ppm) is five times lower than the concentration reported to cause no adverse effects in monkeys (Woods and Seevers 1954–56). NIOSH (1979) concluded that the 50-ppm limit should remain, since no information exists showing that this limit offers inadequate protection.

The 50-ppm REL is based on the hypothesis that severe lacrimation noted in a foundry study was due to the presence of formaldehyde. More serious effects than severe lacrimation would occur at this formaldehyde level, and therefore OSHA believes that the health effects observed at 15.8 ppm are caused by exposure to furfuryl alcohol. OSHA thus finds that the REL does not provide adequate protection and proposes a 10-ppm (TWA), 15-ppm (STEL), and a skin notation for this substance to reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for furfuryl alcohol if the Agency determines that this limit will substantially reduce significant risk.

GLUTARALDEHYDE
CAS: 111-30-8; Chemical Formula: OCH $(CH_2)_3$CHO
H.S. No. 1187

OSHA currently has no limit for glutaraldehyde. The ACGIH recommends a ceiling limit of 0.2 ppm. Glutaraldehyde is an aliphatic dialdehyde which forms colorless crystals.

Glutaraldehyde is strongly irritating to the nose, eyes, and skin (*Human Sensory Irritation Threshold of Glutaraldehyde Vapor* 1976, as cited in ACGIH 1986, p. 285) and can cause allergic contact dermatitis from occasional or incidental occupational exposure (Jordan et al. 1972). The rat oral LD_{50} has been variously reported as 250, 820, and 2380 mg/kg (Stonehill et al. 1965; Smyth 1963, as cited in Fassett 1981; NIOSH 1975). The dermal LD_{50} in the rabbit is 2560 mg/kg, and the 4-hour inhalation LD_{50} in the rat is 5000 ppm (NIOSH 1975).

Mice exposed to alkalinized glutaraldehyde at 8 and 33 ppm for 24 hours have showed marked nervous behavior and panting and washing of the face and limbs; those exposed to 33 ppm exhibited signs of toxic hepatitis at autopsy (Varpela et al. 1971).

In a study of cold-sterilizing operation in which the operator was exposed for 12 minutes to an activated 2-percent aqueous solution, a measurement of 0.38 ppm glutaraldehyde was taken in the operator's breathing zone; the operator and the investigators experienced severe eye, nose, and throat irritation as well as sudden headache at the end of this procedure (Schneider and Blejer 1973). Another study employing very precise methods of airborne concentration measurement reported the irritation response level for glutaraldehyde to be 0.3 ppm and the odor recognition threshold to be 0.04 ppm (Colwell 1976, as cited in ACGIH 1986, p. 285).

OSHA proposes a ceiling level of 0.2 ppm for glutaraldehyde. The Agency preliminarily concludes that this ceiling limit will prevent the risk of irritation to the eyes, nose, and throat potentially associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for glutaraldehyde. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

HEXACHLOROCYCLOPENTADIENE
CAS: 77-47-4; Chemical Formula: C_5Cl_6
H.S. No. 1196

OSHA has no current limit for hexachlorocyclopentadiene. The ACGIH recommends a TLV–TWA of 0.01 ppm. Hexachlorocyclopentadiene is a yellow to amber-colored, nonflammable liquid with a pungent odor.

Hexachlorocyclopentadiene has a high order of acute toxicity in laboratory animals. Rabbits, mice, rats, and guinea pigs died from inhaling 89.5 percent of the vapor in air (Treon, Cleveland, and Cappel 1955). In 150 daily exposures of 7 hours each, rabbits, rats, and guinea pigs survived concentrations of 0.15 ppm, but a similar exposure was fatal to four of five mice. At approximately twice this concentration, mice, rats, and most rabbits died by or before the 25th exposure, but guinea pigs survived 30 exposures. The vapors caused tearing, labored respiration, and, at high concentrations, tremors. Treon and associates observed degenerative changes in the brain, heart, liver, adrenal glands, and kidneys; pulmonary irritation occurred in all species, even at the lowest concentration of 0.15 ppm. At higher concentrations, pulmonary edema, hyperemia, necrotizing bronchitis, and bronchiolitis were observed.

In humans, there are few data concerning hexachlorocyclopentadiene's toxicity. Irritation is known to occur, but the intolerable odor and eye irritation associated with exposure to hexachlorocyclopentadiene have discouraged prolonged exposures (McGilvray 1971, as cited in ACGIH 1986, p. 300).

OSHA is proposing an 8-hour TWA of 0.01 ppm for this severely toxic substance. The Agency preliminarily concludes that this limit will protect exposed workers against the risks of exposure to this acute toxin at the levels permitted in the absence of any OSHA limit. These risks include intense eye and pulmonary irritation and multiple organ damage. The health evidence forms a reasonable basis for proposing a new limit for hexachlorocyclopentadiene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines

that this limit will substantially reduce significant risk.

HEXYLENE GLYCOL
CAS: 107-41-5; Chemical Formula: $(CH_3)_2$-$COHCH_2$-$CHOH$-CH_3
H.S. No. 1204

OSHA currently has no limit for hexylene glycol. The ACGIH recommends a ceiling limit of 25 ppm for this liquid, which has a mild, sweetish odor.

In mice, the LD_{50} is reported to be 3.8 ml/kg, and it is reported to be 4.79 g/kg in rats. A single dose of 2.0 ml/kg induced hypnosis in mice. Undiluted hexylene glycol instilled into the rabbit eye caused irritation and corneal injury (Smyth and Carpenter 1948).

The Shell Chemical Corporation has reported that oral administration of hexylene glycol can cause nervous system depression that is manifested by an initial state of excitation, followed by deep depression (Shell Chemical Corporation, as cited in ACGIH 1986, p. 309). When the liquid is applied to the skin, mild to moderate irritation occurs, although skin absorption does not. At high concentrations, hexylene glycol vapors evoke a strong sensory response: a 5-minute exposure at 1000 ppm produced eye irritation and throat and respiratory discomfort. At concentrations of 50 ppm for 15 minutes, slight eye irritation is reported (ACGIH 1986, p. 309).

OSHA is proposing a ceiling limit of 25 ppm for hexylene glycol to minimize the risk of neuropathy and irritation that may occur as a result of even brief excursions at the high concentrations permitted in the absence of any OSHA limit. The Agency preliminarily concludes that this limit will substantially reduce this significant risk. The health evidence forms a reasonable basis for proposing a new limit for hexylene glycol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

HYDROGEN BROMIDE

CAS: 10035-10-6; Chemical Formula: HBr
H.S. No. 1206

The current OSHA PEL for hydrogen bromide is 3 ppm as an 8-hour TWA. The ACGIH recommends the same 3 ppm value as a ceiling limit not to be exceeded at any time during the working day. Hydrogen bromide (HBr) is a colorless, corrosive, non-flammable gas with an acrid odor.

Animal studies have demonstrated that hydrogen bromide has a considerably higher acute toxicity than hydrogen chloride (HCl) in mice and a somewhat higher acute toxicity than this chemical in rats (NIOSH 1977). In mice, the LC_{50} is 800 ppm HBr in air for 60 minutes (and 2500 HCl in air for 30 minutes); in rats, the LC_{50} is 2800 ppm HBr in air for 60 minutes (and 5000 ppm HCl in air for 30 minutes).

The chief toxic effect of hydrogen bromide in humans is primary irritation of the nose and throat. Irritation begins within several minutes at levels between 3 and 6 ppm. At 2 ppm, the odor of HBr is detectable, but no irritation is experienced (Connecticut State Department of Health, as cited in ACGIH 1986, p. 312). No chronic effects have been associated with exposure to hydrogen bromide.

Based on evidence that hydrogen bromide is a primary irritant without known chronic toxicity, OSHA is proposing a 3-ppm ceiling for this substance. The Agency preliminarily concludes that this limit will protect against the risk of primary irritation to which workers can be exposed at the current PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for hydrogen bromide if the Agency determines that this limit will substantially reduce significant risk.

HYDROGEN FLUORIDE
CAS: 7664-39-3; Chemical Formula: HF
H.S. No. 1208

The current OSHA standard for hydrogen fluoride is 3 ppm as an 8-hour TWA. The ACGIH has established a ceiling limit of 3 ppm for this substance, and NIOSH recommends 3 ppm as a 10-hour TWA and a 15-minute ceiling of 6 ppm for hydrogen fluoride. Hydrogen fluoride is a fuming, colorless liquid; at temperatues above 19°C (66°F), it becomes a colorless gas.

Guinea pigs and rabbits survived 40 ppm for 41 hours, but exposure to 300 ppm for 2 hours or more was fatal (Machle, Thamann, Kitzmiller, and Cholak 1934). Animals exposed to 3 ppm hydrogen fluoride for 30 days showed no adverse effects (Ronzani 1909). Stokinger and co-workers (1949) reported that animals repeatedly exposed to 7 ppm on a daily basis exhibited mild respiratory tract irritation. One study by Largent (1961) demonstrated kidney, liver, and lung damage in laboratory animals repeatedly exposed to 17 ppm hydrogen fluoride. At 8.6 ppm, the pathologic changes seen in exposed animals were minor, except for lung damage in one dog (Largent 1961).

In studies with humans, Largent (1960, 1961) reported that volunteers exposed repeatedly to concentrations of hydrogen fluoride as high as 4.7 ppm for 6 hours/day for 10 to 50 days experienced irritation and burning of the eyes and nose, in addition to reddening of the skin, at concentrations above 3 ppm. Industrial experience has shown that direct contact of the skin with hydrogen fluoride results in severe burns that may have delayed onset but later develop into ulcers that eventually scar (Patty 1981). A report by Eagers (1969) described several industrial accidents in which workers died in a matter of hours after accidential splashing from ruptured containers of hydrogen fluoride (the cause of death was respiratory failure and cardiac arrest). Kleinfeld (1965) reported a fatal case of hydrogen fluoride poisoning that caused death from pulmonary edema.

NIOSH (1976) cites numerous studies that consistently show that long-term occupational exposures to hydrogen fluoride lead to fluorosis in workers. The NIOSH limit is based in part on a study by Derryberry, Bartholomew, and Fleming (1963) showing that the threshold limit for minimal increases in bone density caused by fluoride (fluorosis) is below 4.3 ppm of hydrogen fluoride.

The Agency is proposing an 8-hour TWA limit of 3 ppm and a 6-ppm 15-minute ceiling for hydrogen fluoride. These are the current NIOSH-recommended limits for this substance. OSHA preliminarily concludes that both a TWA and a STEL are required to protect exposed workers from the risk of fluorosis, eye burning, and skin and upper respiratory tract irritation potentially associated with exposure at the levels permitted by the TWA alone. The Agency believes that these limits will substantially reduce these risks. The health evidence forms a reasonable basis for proposing a new limit for hydrogen fluoride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2-HYDROXYPROPYL ACRYLATE
CAS: 999-61-1; Chemical Formula: $CH_2CHCOOCH_2CHOHCH_3$
H.S. No. 1211

OSHA currently has no limit for 2-hydroxypropyl acrylate. The ACGIH recommends a TLV-TWA limit of 0.5 ppm and a skin notation. 2-hydroxypropyl acrylate (HPA) is a liquid at room temperature.

In experimental animals, 2-hydroxypropyl acrylate has a high acute toxicity. The Dow Chemical Company (1977), as cited in ACGIH 1986, p. 320) has reported an oral LD_{50} for the rat of 0.25 g/kg, and a dermal LD_{50} in the

rabbit of approximately 0.25 mg/kg. In guinea pigs, direct contact with HPA caused severe eye burns and skin corrosion and sensitized some of the experimental animals. Rats exposed to a concentration 650 ppm HPA in air for 7 hours did not die. Longer-term inhalation studies (30 days for 2 hours/day/6 days/week) in rats, dogs, rabbits, and mice resulted in some irritation at 5 ppm (Dow Chemical Company, as cited in ACGIH 1986, p. 320).

OSHA is proposing an 8-hour TWA Limit of 0.5 ppm and skin notation. The Agency preliminarily concludes that these limits will protect exposed workers from the risk of irritant effects and skin and eye burns associated with exposure to 2-hydroxypropyl acrylate at the previously uncontrolled level. OSHA believes these limits will substantially reduce these risks. The health evidence forms a reasonable basis for proposing a new limit for 2-hydroxy-propyl acrylate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

IRON SALTS (SOLUBLE)
CAS: 7705–08–0 (ferric chloride); 10421–48–4 (ferric nitrate); 10028–22–5 (ferric sulfate); 7758–94–3 (ferrous chloride); 7720–78–7 (ferrous sulfate); Chemical Formula: Varies with compound
U.S. No. 1217

OSHA currently has no limit for soluble iron salts. The ACGIH recommends a limit of 1 mg/m^3, as iron, for these substances.

When injected into the bloodstream of experimental animals, iron salts (especially the ferric salts) are highly toxic (ACGIH 1986, p. 328). The acute intravenous dose of ferric chloride that is lethal to rabbits is about 7.2 mg/kg (Drinker, Warren, and Page 1935). The salts are also considered irritants to the respiratory tract when inhaled as dusts and mists (Drinker and Nelson 1944). Stewart and Faulds (1934) described the ferric salts as skin irritants. The oral toxicities of iron salts are considered to be moderate to low, and marked gastrointestinal irritation results from ingestion (U.S. Dept. of Labor 1941); 30 grams is the estimated fatal dose for humans (Smyth 1956).

OSHA is proposing an 8-hour TWA PEL of 1 mg/m^3, as iron, for the soluble salts of iron. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of skin and mucous membrane irritation associated with exposure to these salts at the existing uncontrolled levels. The health evidence forms a reasonable basis for proposing a new limit for iron salts. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ISOPROPYL ACETATE
CAS: 108–21–4; Chemical Formula: $CH_3COOCH(CH_3)_2$
H.S. No. 1224

OSHA currently has a 250 ppm TWA limit for isopropyl acetate. The ACGIH recommends a TLV-TWA of 250 ppm and a 15-minute STEL of 310 ppm for this colorless liquid, which has a fruity odor.

The oral LD_{50} for rats is reported to be 6.75 g/kg; five of six rats died after a 4-hour exposure to 32,000 ppm, and one of six rats died after a 4-hour exposure to 16,000 ppn (Smyth, Carpenter, West, and Pozzani 1954).

The primary problems in occupational exposures to isoproply acetate are eye and mucous membrane irritation. In humans, exposure to 200 ppm isoproply acetate caused eye irritation, with nose and throat irritation occurring at higher concentrations (Silverman, Schulte, and First 1946). Data show that isopropyl acetate is more similar to ethyl acetate than to n-propyl acetate in its toxic-effects (von Oettingen 1960).

OSHA proposes an 8-hour TWA PEL of 250 ppm and a STEL of 310 ppm for isopropyl acetate. The Agency preliminarily concludes that both a TWA and a STEL are necessary to protect exposed workers from the risk of eye and respiratory irritation associated with elevated exposure to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for isopropyl acetate if the Agency determines that this limit will substantially reduce significant risk.

ISOPROPYL ALCOHOL
CAS: 67–63–0; Chemical Formula: $CH_3CHOHCH_3$
H.S. No. 1225

OSHA currently has a limit of 400 ppm TWA for isopropyl alcohol. The ACGIH recommends a TLV-TWA limit of 400 ppm, with a 500-ppm TLV-STEL. NIOSH has recommended a limit of 400 ppm TWA, with a 15-minute ceiling of 800 ppm. Isopropyl alcohol is a colorless, flammable liquid with a slight odor resembling that of rubbing alcohol.

Rats exposed at concentrations of 12,000 ppm for 4 hours survived, but extending the duration of exposure to 8 hours killed the animals (Smyth, unpublished results, 1937–1955, as cited in ACGIH 1986, p. 337).

Isopropyl alcohol has been demonstrated to be mildly irritating to the eyes, nose, and throat in humans exposed to 400 ppm (Nelson et al. 1943); at 800 ppm, these symptoms were more intense. In addition, it has narcotic, irritative, and acute toxic effects at higher concentrations. Weil has reported that an excess of paranasal sinus cancers has been observed among workers manufacturing isopropyl alcohol (1952). It has been established that the cancers associated with isopropyl alcohol manufacture were caused by isopropyl oil and not by isopropyl alcohol itself (NIOSH 1976).

OSHA is proposing a PEL of 400 ppm TWA and a STEL of 500 ppm for isopropyl alcohol. The short-term limit is being added to reduce the risk of irritation and narcotic effects at the higher short-term concentrations permitted by the TWA alone. The Agency preliminarily concludes that the addition of the STEL will reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for isopropyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

n-ISOPROPYLAMINE
CAS: 75–31–0; Chemical Formula: $(CH_3)_2CHNH_2$
H.S. No. 1228

OSHA currently has a limit of 5 ppm TWA for n-isopropylamine. The ACGIH recommends a TLV-TWA of 5 ppm and a TLV-STEL of 10 ppm for this flammable, volatile, colorless liquid, which has an odor similar to that of ammonia.

The most serious effect of n-isopropylamine in laboratory animals is respiratory tract irritation, which can be severe enough to cause lung edema. Rats survived a 4-hour inhalation at 4000 ppm, but an 8000-ppm exposure resulted in fatalities (Smyth, Carpenter, and Weil 1956).

Proctor and Hughes (1978) have reported that the odor of n-isopropylamine becomes strong and unpleasant at the 10-to 20-ppm level; nose and throat irritation is experienced even as a result of brief exposures.

OSHA is proposing a PEL of 5 ppm TWA and a 15-minute STEL of 10 ppm for this substance. The Agency preliminarily concludes that both a TWA and STEL are required to protect exposed workers from the risk of upper respiratory tract irritation known to occur even at brief excursions above the 8-hour PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-isopropylamine if the Agency

determines that this limit will substantially reduce significant risk.

MESITYL OXIDE
CAS: 141–79–7; Chemical Formula: $(CH_3)_2C=CHCOCH_3$
H.S. No. 1243

OSHA's current limit for mesityl oxide is 25 ppm TWA. The ACGIH has recommended a 15-ppm TLV-TWA and a 25-ppm TLV-STEL. NIOSH (1978j) recommended a 10-ppm limit as a 10-hour TWA.

Silverman et al. (1946) found that a majority of test subjects experienced eye irritation upon exposure to 25 ppm mesityl oxide and nasal irritation at 50 ppm. A toxicity data sheet published by Shell Chemical Corporation (cited in ACGIH 1986, p. 361) confirmed 25 ppm as being the maximum comfort level. Smyth et al. (1942) reported liver and kidney damage among rats and guinea pigs exposed to 100 ppm mesityl oxide for 6 weeks; no adverse effects were reported for animals exposed to 50 ppm. After reviewing these data, the ACGIH (1986, p. 361) concluded that the former TLV of 25 ppm should be reduced to 15 ppm because of the greater systemic toxicity of mesityl oxide compared to other saturated ketones. NIOSH (1978j), relying on the same data, recommended a limit of 10 ppm as a 10-hour TWA and noted that the eye irritation caused by mesityl oxide may be more serious than that caused by lower ketones. This belief was based on the observation that eye irritation generally becomes more severe as the molecular weight of the ketone increases.

Studies indicate that eye irritation occurs following exposure to 25 ppm of mesityl oxide, and nasal irritation is experienced at the 50-ppm level. Animal studies show liver and kidney damage in experimental animals exposed to 100 ppm. OSHA proposes that a PEL of a 15-ppm TWA and a 25-ppm STEL be adopted as a necessary and more protective limit than the REL of 10 ppm TWA to provide protection against these occupational risks.

METHYL 2–CYANOACRYLATE
CAS: 137–05–3; Chemical Formula: $CH_2=C(C=N)COOCH_3$
H.S. No. 1248

OSHA has no current limit for methyl 2-cyanoacrylate. The ACGIH recommends a limit of 2 ppm TLV–TWA with a TLV–STEL of 4ppm. Methyl 2-cyanoacrylate is a colorless, viscous liquid.

In a personal communication to the ACGIH TLV Committee in 1985, Eastman Kodak reported on the toxicity of methyl 2-cyanoacrylate in experimental animals. The oral LD_{50} in rats is reported to be 1.6 to 3.2 g/kg, and the dermal LD_{50} in guinea pigs is 10 ml/kg. The adverse effects reported in laboratory animals are slight irritation of the skin and corneal damage. An inhalation LC_{50} or 101 ppm has been reported in rats exposed for 6 hours to methyl 2-cyanoacrylate. Repeated exposures (6 hours/day for 5 days/week) at 31.3 ppm for a total of 12 exposures caused only a slight decrease in the rate of weight gain in rats and no nasal or tracheal lesions or systemic toxicity. No changes were observed in rats similarly exposed at 3.1 ppm (Eastman Kodak, as cited in a CGIH 1986, p. 383).

In a simulated workbench exposure, McGee and co-workers reported nasal irritation in humans at 3 ppm and eye irritation at 5 ppm (McGee, Oglesby, Raleigh, and Fassett 1968). There are no reports of occupational poisonings.

OSHA proposes of PEL of 2 ppm TWA and a 4-ppm STEL for this previously unregulated substance. The Agency preliminarily concludes that both of these limits are necessary to protect against the risk of eye, skin, and upper respiratory tract irritation in workers exposed at the uncontrolled levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methyl 2-cyanoacrylate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit substantially reduce significant risk.

METHYL ISOBUTYL CARBINOL
CAS: 108–11–2; Chemical Formula: $CH_3CHOHCH_2CH(CH_3)_2$
H.S. No. 1261

OSHA currently has an 8-hour TWA limit of 25 ppm, with a skin notation, for methyl isobutyl carbinol. The ACGIH recommends a TLV–TWA of 25 ppm and a TLV–STEL of 40 ppm, also with a skin notation. Methyl isobutyl carbinol is a colorless, stable liquid.

In rabbits, a 24-hour skin application of 3.56 ml/kg was lethal to half the animals, indicating toxic absorption through the skin (Smyth, Carpenter, and Weil 1951). Rats exposed by inhalation to 2000 ppm of methyl isobutyl carbinol vapor died, and the same authors report that the oral LD_{50} for rats is 2.6 g/kg (Smyth, Carpenter, and Weil 1951).

Humans volunteers exposed to methyl isobutyl carbinol reported eye irritation at 50 ppm (Silverman, Schulte, and First 1946).

OSHA proposes an 8-hour TWA of 25 ppm and a 15-minute STEL of 40 ppm for methyl isobutyl carbinol. The Agency preliminarily concludes that these limits will together protect workers from the risk of eye irritation potentially associated with exposure to this substance in the absence of a STEL. OSHA is retaining the skin notation for methl isobutyl carbinol because of its demonstrated dermal toxicity. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl isobutyl carbinol if the Agency determines that this limit will substantially reduce significant risk.

METHYL MERCAPTAN
CAS: 74–93–1; Chemical Formula: CH_3SH
H.S. No 1263

OSHA currently has a ceiling limit of 10 ppm for methyl mercaptan. The ACGIH recommends an 8-hour TLV–TWA of 0.5 ppm, and NIOSH recommends a 15-minute ceiling of 0.5 ppm. Methyl mercaptan is a flammable, water-soluble gas with a disagreeable odor like that of rotten cabbage.

Methyl mercaptan acts on the respiratory center, producing death by respiratory paralysis. DeRekowski (1893) and Frankel (1921) have reported that the acute toxicity of methyl mercaptan is similar to but somewhat lower than that of hydrogen sulfide; however, Ljunggren and Norberg (1943) have concluded that the two substances exhibit toxicities of the same magnitude. Pulmonary edema results from exposures to lower, less actue concentrations of methyl mercaptan (Fairchild, as cited in ACGIH 1986, p. 405).

Inhalation of (an unspecified concentration of) methyl mercaptan produced coma and death in one worker; acute hemolytic anemia and methemoglobinemia developed after this exposurer (Schultz, Fountain, and Lynch 1970).

OSHA is proposing a PEL of 0.5 ppm as an 8-hour TWA for methyl mercaptan. The Agency believes that this limit is necessary to reduce the risk of respiratory and pulmonary injury that exists for workers exposed to higher concentrations. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl mercaptan if the agency determines that this limit will substantially reduce significant risk.

METHYL n-AMYL KETONE
CAS: 110–43–0; Chemical Formula: $CH_{23}COC_6H_{11}$
H.S. No. 1264

The current OSHA limit for methyl n-amyl ketone is 100 TWA. NIOSH (1978j) also recommends a limit of 100 ppm as a 10-hour TWA, and the ACGIH recommends a TLV–TWA of 50 ppm.

Johnson et al. (1978) found no neurologic impairment in rats and monkeys exposed to 131 ppm or 1025 ppm methyl n-amyl ketone for 9 months. No gross or histopathologic changes were found. Because of the absence of any human data indicating the concentration of methyl n-amyl ketone that produces sensory irritation, ACGIH (1986) believed in prudent to reduce the TLV-TWA from 100 ppm to 50 ppm. NIOSH (1978j) concluded that there was no basis for revising the 100-ppm OSHA limit; they cited evidence that methyl n-amyl ketone was likely to be as irritating as 2-pentanone (which has a recommended limit of 150 ppm), and therefore the 100-ppm limit was probably sufficient for methyl n-amyl ketone.

No neurological or histopathological effects were observed at 131 ppm. The ACGIH's 50-ppm TLV applies an additional factor of safety to this no-observed-effect level, while the NIOSH REL is based on a judgment hat such a reduction is unnecessary. The health evidence for methyl n-amyl ketone may not be sufficient to support a revision to the existing limit, and OSHA accordingly is retaining the Z table limit. However, there may be other information on the health effects of occupational exposure to methyl n-amyl ketone, and OSHA is specifically requesting such information from the public. At the time of the final rule, OSHA will make a final determination, based on the best available evidence, of whether to retain or revise the limit for this substance.

a-METHYL STYRENE
CAS: 98-83-9; Chemical Formula: $C_6H_5C(CH_3)=CH_2$
H.S. No. 1267

OSHA currently has a ceiling limit of 100 ppm for a-methyl styrene. The ACGIH recommends a limit of TLV-TWA 50 ppm with a TLV-STEL of 100 ppm a-Methyl styrene is a polymerizable, colorless liquid.

OSHA's existing ceiling limit of 100 ppm is based on data developed in 1955 by the Dow Chemical Company (as cited in ACGIH 1986, p. 410) and by Wolf, Rowe, McCollister et al (1956). These data demonstrated that 7 hours/day, 5 days/week exposures to a-methyl styrene for 6 months produced no ill effects in rats, guinea pigs, rabbits, or monkeys.

In humans, however, these authors reported that a 2-minute exposure to 200 ppm caused eye irritation and complaints about this substance's unpleasant odor.

OSHA is proposing an 8-hour TWA of 50 ppm and a 15-minute STEL of 100 ppm for a-methyl styrene. The Agency preliminarily concludes that these limits will protect workers from the risk of eye irritation potentially associated with exposure to this substance at the current OSHA PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for a-methyl styrene if the Agency determines that this limit will substantially reduce significant risk.

o-METHYLCYCLOHEXANONE
CAS: 583-60-8; Chemical Formula: $CH_3C_6H_9CO$
H.S. No. 1270

OSHA currently has a limit of 100 ppm TWA for o-methylcyclohexanone with a skin notation. The ACGIH recommends lowering this limit to TLV-TWA 50 ppm and adding a TLV-STEL of 75 ppm; ACGIH also recommends a skin notation. ortho-Methylcyclohexanone is a somewhat viscous liquid with an acetone-like odor.

o-Methylcyclohexanone has both irritative and narcotic effects at relatively low concentrations. The commercial product contains a mixture of isomers; however, toxicity data describe effects of the ortho isomer only. Gross reported that 450 ppm had irritative effects on the eyes and respiratory systems of rabbits, and 2500 ppm produced narcotic effects (1943). Treor et al. reported the oral LD_{50} to be between 1 and 1.25 g/kg for rabbits. Eye problems were observed at about 500 ppm, but 182 ppm showed no adverse effects (1943).

Patty (1943) has reported that concentrations of 100 ppm have no narcotic effects in humans, but may cause irritation.

OSHA concludes that the current TWA of 100 ppm is insufficient to prevent eye and respiratory system irritation. A TWA limit of 50 ppm is proposed with a STEL of 75 ppm for o-methylcyclohexanone and a skin notation. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for o-methylcyclohexanone if the Agency determines that this limit will substantially reduce significant risk.

OSMIUM TETROXIDE
CASE: 20816-12-0; Chemical Formula: OsO_4
H.S. No. 1298

OSHA currently has a limit of 0.002 mg/m³ for osmium tetroxide. The ACGIH recommends a TLV-TWA of 0.0002 ppm (0.002 mg/m³) and a TLV-STEL of 0.0006 ppm (0.006 mg/m³). Osmium tetroxide is a noncombustible, colorless to pale yellow solid with a disagreeable, chlorine-like odor.

Exposure to osmium tetroxide is known to produce ocular effects and respiratory irritation. In 1933, Brunot reported that rabbits died from pulmonary edema four days after a 30-minute exposure to osmium tetroxide at 130 mg/m³ or higher. Visual problems (e.g. delayed lacrimation and "halo" effects) were reported by this investigator after a brief exposure to osmium tetroxide at a significantly lower concentration (Brunot 1933). A 4-hour LC_{50} value of 40 ppm has been reported in rats and mice (NIOSH 1977). Toxic effects to bone marrow have been reported in guinea pigs (Hardy 1974).

Industrial experience indicates that concentrations in a precious metal refining plant ranged from 0.1 to 0.6 mg/m³; intermittent exposures produced symptoms (sometimes delayed) of lacrimation, vision disturbances, headache, conjunctivitis, and cough (McLaughlin, Milton, and Perry 1946). Complaints of persistent and severe nose and throat irritation have been reported (Hardy and Hamilton 1974). Fairhall (1949) reported a human fatality resulting from inhalation exposure to OsO_4. Flury and Zernik (1931) reported that 0.001 mg/m³ is the highest concentration of osmium tetroxide that can be tolerated for 6 hours without harmful effects.

OSHA is proposing a TWA limit of 0.0002 ppm and a STEL of 0.0006 ppm for osmium tetroxide. The Agency preliminarily concludes that this combined limit will protect workers against the risk of ocular disturbances and respiratory irritation associated with exposure to this substance at the levels permitted in the absence of a short-term limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for osmium tetroxide if the Agency determines that this limit will substantially reduce significant risk.

PARAFFIN WAX FUME
CAS: 8002-74-2; Chemical Formula: C_nH_{2n+2}
H.S. No. 1302

OSHA currently has an 8-hour TWA limit for paraffin wax fume. The ACGIH recommends a TLV-TWA of 2 mg/m³. Paraffin is a white or slightly yellow odorless solid that is derived from petroleum.

Paraffin is considered nontoxic in its solid state, but fume generated when it is in the molten state may cause discomfort and nausea (Journal of American Medical Association, cited in ACGIH 1986, p. 455). In the most recent report of industrial exposure effects, paraffin fume is reported to cause no

discomfort in most cases when the concentration is maintained at or below 2 mg/m³, although one instance of mild discomfort was reported at concentrations between 0.6 and 1 mg/m³ (Massachusetts Division of Occupational Hygiene 1970, cited in ACGIH 1986, p. 455).

OSHA is proposing a PEL of 2 mg/m³ TWA for paraffin wax fume. The Agency preliminarily concludes that this limit will protect workers against the risk of nausea and irritation that exists in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for paraffin wax fume. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PHOSPHORIC ACID
CAS: 7664-38-2; Chemical Formula: H_3PO_4
H.S. No. 1322

OSHA currently has a limit of 1 mg/m³ as an 8-hour TWA for phosphoric acid. The ACGIH recommends a TLV-TWA of 1 mg/m³ and a TLV-STEL of 3 mg/m³. Phosphoric acid is a colorless, odorless solid at temperatures below 21°C, but it becomes a viscous, clear liquid at higher temperatures.

In humans, there have been reports of respiratory irritation from exposure to phosphorus pentoxide fume at concentrations of between 3.6 and 11.3 mg/m³; concentrations of 100 mg/m³ were unendurable except to workers who had developed a tolerance to the fume over time (Rushing 1957, as cited in the ACGIH 1986, p. 483). The AIHA Hygiene Guide reports that phosphoric acid is less hazardous than nitric or sulfuric acid (1957).

To protect unacclimatized workers from the risk of throat irritation, OSHA proposes a TWA limit of 1 mg/m³, with a STEL of 3 mg/m³, for phosphoric acid. The Agency preliminarily concludes that the combined 8-hour TWA and STEL limit is necessary to reduce this risk of irritation, which has been shown to occur at levels only slightly above those permitted by the TWA alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phosphoric acid if the Agency determines that this limit will substantially reduce sigificant risk.

PHOSPHORUS TRICHLORIDE
CAS: 7719-12-2; Chemical Formula: PCl_3.
H.S. No. 1325

OSHA currently has an 8-hour TWA limit of 0.5 ppm for phosphorus trichloride. The ACGIH recommends a TLV-TWA of 0.2 ppm and a TLV-STEL of 0.5 ppm for this fuming, colorless, noncombustible liquid.

The primary occupational hazards associated with exposure to phosphorus trichloride are respiratory irritation and intoxication involving cough, bronchitis, pneumonia, and conjunctivitis (Henderson and Haggard 1943; International Labour Office 1934; Sassi 1954).

Early studies indicate that severe symptoms did not occur in cats and guinea pigs until concentration levels reached 50 to 90 ppm for exposures lasting 1 hour, although slight illness was observed at 0.7 ppm after an exposure of 6 hours (Butjagin 1904). However, by 1934, the effects of phosphorus trichloride were considered to be 5 to 10 times as intense as those of hydrolyzed hydrochloric acid (International Labour Office 1934). More recently, Weeks and associates (1964) reported studies in which 4-hour LC_{50} values of 104 ppm for rats and 50 ppm for guinea pigs were obtained.

OSHA is proposing a PEL of 0.2 ppm TWA and a STEL of 0.5 ppm for phosphorus trichloride. The Agency preliminarily concludes that both a TWA and a STEL are required to reduce the risk of respiratory and eye irritation that exists for workers exposed to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phosphorus trichloride if the Agency determines that this limit will substantially reduce significant risk.

POTASSIUM HYDROXIDE
CAS: 1310-58-3; Chemical Formula: KOH
H.S. No. 1334

OSHA has no current limit for potassium hydroxide. The ACGIH recommends a ceiling limit of 2 mg/m³. Potassium hydroxide is a white, deliquescent material that occurs in the form of pellets, sticks, lumps, or flakes.

Potassium hydroxide is corrosive to tissues. The health hazards of potassium hydroxide are similar to those of the other strong alkalies, such as sodium hydroxide. These substances gelatinize tissue on contact, causing deep, painful lesions. Dust or mist exposures may cause eye or respiratory system irritation and nasal septum lesions (Kanpov 1971).

OSHA is proposing an 8-hour TWA limit of 2 mg/m³ for this previously unregulated substance. The Agency preliminarily concludes that this limit will protect workers against the risk of respiratory irritation and severe dermal lesions that exists in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for potassium hydroxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ROSIN CORE SOLDER PYROLYSIS PRODUCTS
CAS: None; Chemical Formula: None
H.S. No. 1350

OSHA currently has no limit for rosin core solder pyrolysis products. The ACGIH has established an 8-hour TLV-TWA of 0.1 mg/m³ for these compounds, measured as formaldehyde. This limit applies to the thermal decomposition products of gum rosin soldering flux (3 to 6 percent rosin and 30 to 700 percent tin-lead solder)(Lozano and Melvin, as cited in ACGIH 1986, p. 514).

A 2-week exposure of guinea pigs and rats to these products at average concentrations of 0.96 mg/m³ caused reduction in rate of weight gain in male guinea pigs, abnormal liver-to-body-weight ratios in guinea pigs of both sexes, and abnormal heart-to-body-weight ratios in male rats (Industrial Bio-test Lab, Inc., as cited in ACGIH 1986, p. 514). Lungs of the animals exposed in this same study were hyperemic.

In humans, slight bronchial irritation has been reported at 1 mg/m³ (Industrial Bio-test Lab, Inc., as cited in ACGIH 1986, p. 514). Several workers chronically exposed to levels as high as 0.15 mg/m³ had to be removed from exposure because of intractable upper respiratory tract irritation; when concentrations were kept below 0.1 mg/m³, such irritation was not reported (Christy 1965, as cited in ACGIH 1986, p. 514). In a study designed to quantify dose-response levels for irritation in human volunteers, subjects were exposed for 15 minutes to these products at aldehyde concentrations (as formaldehyde, which is the best indirect measure of rosin pyrolysis products) of 0.04 to 0.2 mg/m³ (U.S. Public Health Service 1965, as cited in ACGIH 1986, p. 514). Subjects detected the odor at 0.07 mg/m³, and 80 percent of subjects reported moderate to severe irritation of the eyes, nose, and throat at a concentration of 0.12 mg/m³ or above. At levels below 0.05 mg/m³, fewer than 10 percent of subjects experienced irritation. Mucous membrane irritation occurred in 30 percent of subjects exposed at 0.07 mg/m³. Some subjects reported severe irritation at 0.1 mg/m³ (U.S. Public Health Service 1965, as cited in ACGIH 1986, p. 514).

OSHA is proposing an 8-hour TWA limit of 0.1 mg/m³, measured as formaldehyde, for rosin core solder

pyrolysis products. The Agency preliminarily concludes that this limit will protect workers from the risk of eye, skin, and upper respiratory tract irritation demonstrated to occur at the higher levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for rosin core solder pyrolysis products. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SODIUM BISULFITE
CAS: 7631-90-5; Chemical Formula: $NaHSO_3$
H.S. No. 1365

OSHA's current Z tables have no limits for exposure to sodium bisulfite. The ACGHIH limit is 5 mg/m³ as an 8-hour TWA. Sodium bisulfite is a white crystalline powder, which has an odor like that of sulfur dioxide.

The oral LD_{50} in rats fed this substance is 2 g/kg (Dow Chemical Company 1977, as cited in ACGIH 1986, p. 534), and the intraperitoneal LD_{50} for rats is 115 mg/kg (Hoppe and Goble 1951). The ACGIH reports that sodium bisulfite is an eye, skin, and mucous membrane irritant; acute exposures have resulted in mild eye and respiratory effects (ACGIH 1986, p. 534).

OSHA is proposing an 8-hour TWA limit for sodium bisulfite, a level half that for the inert dusts, because the Agency has preliminarily concluded that this limit will protect exposed workers against the risk of eye, skin, and upper respiratory tract irritation potentially associated with exposure to this dust at the uncontrolled levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for sodium bisulfite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SODIUM HYDROXIDE
CAS: 1310-93-2; Chemical Formula: NaOH
H.S. No. 1367

The current OSHA standard for sodium hydroxide is 2 mg/m³ as an 8-hour TWA. NIOSH recommends a 2 mg/m³ 15-minute ceiling for sodium hydroxide and the ACGIH has established a 2-mg/m³ ceiling limit (maximum duration of 5 minutes in any 3 hours). Sodium hydroxide is a white, deliquescent solid.

Exposure to sodium hydroxide in the form of a caustic dust irritates the upper respiratory tract any may cause ulceration of the nasal passages (ACGIH 1986, p. 535). NIOSH states that rats exposed to unmeasured concentrations of sodium hydroxide for 30 minutes per day developed pulmonary damage after 2 to 3 months (Dluhos et al. 1969, as cited in NIOSH 1976).

Patty (1977) reported that a concentration of 2 mg/m³ sodium hydroxide represents a level that is noticeably irritating to exposed workers. Hervin et al. (1973) noted marked redness and burning sensations in the eyes, throats, and noses of workers exposed to concentrations of sodium hydroxide in the range of 0.005 to 0.7 mg/m³. A study by Lewis (1974, as cited in ACGIH 1986, p. 535) noted throat irritation or eye watering in those employees exposed briefly to concentrations of 0.24, 0.8, or 1.86 mg/m³ of sodium hydroxide; only those workers exposed to 0.24 mg/m³ showed no irritation.

The Agency preliminarily concludes that a 2-ppm ceiling is required to protect exposed workers against the risk of eye and upper respiratory irritation that has been shown to exist at the current 2-mg/m³ TWA. OSHA is proposing a ceiling limit of 2 mg/m³ for sodium hydroxide. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sodium hydroxide if the Agency determines that this limit will substantially reduce significant risk.

SODIUM METABISULFITE
CAS: 7681-57-4; Chemical Formula: $Na_2S_2O_5$
H.S. No. 1368

OSHA's current Z tables have no exposure limits for sodium metabisulfite. The ACGIH limit is 5 mg/m³ as an 8-hour TWA. Sodium metabisulfite can occur either in the form of a solid or as white crystals; this substance smells like sulfur dioxide.

A 2-year study at the Dow Chemical Company (1977, as cited in ACGIH 1986, p. 535), in which rats ingested 0.215 percent sodium metabisulfite, demonstrated no adverse effects in the rats. If the results of this study are extrapolated to humans, using a safety factor of 10, the equivalent air concentration would be 70 mg/m³ (Dow Chemical Company 1977, as cited in ACGIH 1986, p. 535). Other animal studies show a median lethal dose of 192 mg/kg for rabbits and 115 mg/kg for rats when sodium metabisulfite is injected intravenously (NIOSH 1973). Inhalation of sodium metabisulfite dust is irritating to the lungs, nose, and throat (ACGIH 1986, p. 535).

OSHA is proposing an 8-hour TWA of 5 mg/m³ for sodium metabisulfite. The Agency preliminarily concludes that establishing this limit is necessary and will reduce the risk of irritation of the skin and eyes to which workers are exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for sodium metabisulfite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SULFUR MONOCHLORIDE
CAS: 10025-67-9; Chemical Formula: S_2Cl_2
H.S. No. 1376

OSHA's existing PEL for sulfur monochloride is 1 ppm as an 8-hour TWA. The level established by the ACGIH is 1 ppm as a ceiling limit. Sulfur monochloride is an amber, oily, nonflammable, fuming liquid, which has a penetrating odor.

Sulfur monochloride is a primary irritant that affects the upper respiratory tract by releasing hydrochloric acid (HCl) on contact with moisture (Henderson and Haggard 1943). This same study noted that "undecomposed vapor [of sulfur monochloride] might reach the lungs, in which case it would be more toxic than an equivalent quantity of HCl." The ACGIH (1986, p. 545) considers these data indicative of a far greater acute toxicity for sulfur monochloride than for hydrochloric acid. Animal toxicity studies revealed that a dose of 150 ppm sulfur monochloride resulted in death to mice exposed for 1 minute (Flury and Zernik 1931). Cats exposed to 60 ppm sulfur monochloride for 15 minutes all died within a few days, but concentrations of 12 ppm for 15 minutes were tolerated (Henderson and Haggard 1943).

A study by Elkins (1959) of workers in the rubber industry found that concentrations of 2 to 9 ppm sodium monochloride were mildly irritating; however, the concentrations to which these workers were exposed may have included a high proportion of hydrochloric acid.

OSHA is proposing a ceiling of 1 ppm for sulfur monochloride because this substance is a primary irritant. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of primary irritation that could occur at the current 8-hour TWA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sulfur monochloride if the Agency determines that this limit will substantially reduce significant risk.

SULFUR PENTAFLUORIDE
CAS: 5714-22-7?; Chemical Formula S_2F_{10}
H.S. No. 1377

The current OSHA limit for sulfur pentafluoride is 0.025 ppm as an 8-hour TWA. The ACGIH (1986) has

recommended a ceiling limit of 0.01 ppm for this substance. Sulfur pentafluoride is a colorless gas or liquid with a sulfur-dioxide-like odor.

Sulfur pentafluoride's toxic effects include lung congestion and lesions, and pulmonary edema. In a study in which rats were exposed to sulfur pentafluoride for 16 to 18 hours, levels of 0.1 ppm caused lung irritation, 0.5 ppm resulted in severe pulmonary lesions, and 1 ppm proved fatal (Greenberg and Lester 1950). One-hour exposures to 10 ppm sulfur pentalfluoride resulted in diffuse hemorrhagic lesions in the lungs of rats, while rats exposed to 1 ppm for 1 hour had severe congestion of the lungs. Rats exposed for 1 hour at 0.1 ppm showed no effects. Subsequent examination of rats surviving the 10- and 1-ppm exposures revealed that the lungs had returned to normal after 24 hours (Greenberg and Lester 1950). Saunders, Shoshkes, De Carlo, and Brown (1953) established that the LD_{50} for sulfur pentafluoride in rabbits is 5.8 mg/kg, and that death was due to fulminant pulmonary edema. According to this study, sulfur pentafluoride does not injure the columnar epithelium of the respiratory tract, and exposure is not followed by bronchopneumonia.

OSHA is proposing a ceiling limit for this substance. The 0.01-ppm ceiling has been selected on the basis of evidence showing that even brief exposures to 1 ppm caused pulmonary effects in animals; 0.01 ppm provides a margin of safety against such effects. OSHA preliminarily concludes that this limit for sulfur pentafluoride will reduce the risks of irritation and pulmonary effects to which workers could be exposed in the absence of a ceiling limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sulfur pentafluoride if the Agency determines that this limit will substantially reduce significant risk.

TETRAHYDROFURAN
CAS: 109–99–9; Chemical Formula: $(C_2H_4)_2O$
H.S. No. 1387

OSHA's existing PEL for tetrahydrofuran is 200 ppm as an 8-hour TWA. This is the 8-hour TWA limit recommended by the ACGIH, which also has established a 15-minute STEL of 250 ppm for tetrahydrofuran. Tetrahydrofuran is a colorless liquid with an odor like that of ether.

This proposed limit was selected on the basis of extensive data from experimental animal studies. Lehmann and Flury (1943) reported irritation of the upper respiratory tract as well as kidney and liver injury in a number of animals exposed by inhalation to more than 3000 ppm tetrahydrofuran for 20 days, 8 hours daily. Aqueous solutions exceeding a concentration of 20 percent tetrahydrofuran proved irritating to the skin of rabbits. One study (Stoughton and Robbins 1936) found that amounts in excess of 25,000 ppm were needed to anesthetize dogs. The anesthesia process in these animals showed a delayed induction period and poor recovery. In other studies with dogs (Zapp, cited in ACGIH 1986, p. 564), 200 ppm tetrahydrofuran in daily, 6-hour inhalation exposures produced an observable effect on the pulse pressure of these animals within 3 to 4 weeks; despite an exposure of nine weeks at this dosage level followed by 3 weeks at nearly twice this concentation, no histopathologic changes were observed in the critical organs. Studies (Jochmann 1962) in which tetrahydrofuran was given orally and peritoneally to a variety of laboratory animals resulted in both liver and kidney damage; however, some of the effects observed by this author may have been caused by peroride contamination of the tetrahydrofuran. Oettel (as cited in ACGIH 1986, p. 564) observed no kidney or liver damage in cats, rabbits, rats, or mice exposed repeatedly by inhalation to tetrahydrofuran at concentrations of 3400 to 17,000 ppm for as long as 6 hours.

Technicians involved in the experiment of Stoughton and Robbins (described above) experienced severe headaches when conducting these experiments.

OSHA is proposing an 8-hour TWA of 200 ppm and a STEL of 250 ppm for tetrahydrofuran. The Agency preliminarily concludes that both of these limits are required to protect workers from the risk of headache and irritation potentially associated with exposure to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for tetrahydrofuran if the Agency determines that this limit will substantially reduce significant risk.

TETRASODIUM PYROPHOSPHATE
CAS: 7722–88–5; Chemical Formula: $Na_4P_2O_7$
H.S. No. 1389

The current OSHA Z tables do not include a limit for tetrasodium pyrophosphate. The ACGIH has established a limit of 5 mg/m³ as an 8-hour TWA. Tetrasodium pyrophosphate may occur either as a white powder or a crystalline substance.

Tetrasodium pyrophosphate is an alkaline dust and therefore causes irritation to the eyes and the respiratory tract (ACGIH 1986, p. 567). For this reason, the ACGIH recommends a time-weighted average TLV of 5 mg/m³, which is half the value recommended for the inert dusts.

OSHA is proposing a 5-mg/m³ 8-hour TWA for this substance. The Agency preliminarily concludes that establishing this limit for this previously unregulated chemical is necessary to reduce the risk of eye and respiratory tract irritation to workers exposed to this substance. The health evidence forms a reasonable basis for proposing a new limit for tetrasodium pyrophosphate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

THIOGLYCOLIC ACID
CAS: 68–11–1; Chemical Formula: $C_2H_4O_2S$
H.S. No. 1392

OSHA has no current PEL for thioglycolic acid. The ACGIH recommends a 1-ppm 8-hour TWA, with a skin notation, for this colorless liquid, which has an unpleasant odor.

A study by the Dow Chemical Company in which thioglycolic acid was instilled into the eyes of rabbits resulted in severe conjunctival inflammation and pain, dense opacity of the cornea, and severe inflammation of the iris. These effects had not improved 14 days after exposure and washing immediately after exposure did not modify the severity of this ocular response. A single dermal application of the thioglycolic acid to rabbit skin caused necrosis in 5 minutes and was accompanied by hyperemia and edema. The LD_{50} for a 10-percent solution applied percutaneously was 848 mg/kg for rabbits; further studies by Dow (1973) in which female rats were fed a single oral dose of a 10-percent solution of thioglycolic acid showed that this dose resulted in death at the level of 125 mg/kg. Autopsy revealed damage to the liver and gastrointestinal tract. Fassett (1963) reported that the oral LD_{50} for undiluted thioglycolic acid in rats in 50 mg/kg, and that a 10-percent solution applied to the skin of guinea pigs caused fatalities at doses of less than 5 ml/kg. Symptoms prior to death included gasping, convulsions, and weakness.

OSHA is proposing a 1-ppm 8-hour TWA limit for thioglycolic acid. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of eye and skin irritation as well as systemic effects, potentially associated with exposures at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for thioglycolic acid. At the time of

the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

1,2,4-TRICHLOROBENZENE
CAS: 120–82–1; Chemical Formula: $C_6H_3Cl_3$
H.S. No. 1405

OSHA currently has no limit for 1,2,4-trichlorobenzene. The ACGIH has established an exposure limit of 5 ppm as a ceiling for this substance. 1,2,4 trichlorobenzene is a colorless liquid.

The inhalation toxicity of trichlorobenzene was studied by Treon (1950), who determined that the target organs of exposure in cats, dogs, rats, rabbits, and guinea pigs included liver, kidneys, ganglion cells at all brain levels, and mucous membranes. Irritation of the lungs and changes in respiration were seen in animals that later died as a result of exposure. Brown et al. (1969) reported that 1,2,4-trichlorobenzene's single-dose oral LD_{50} for rats is 756 mg/kg and for mice is 766 mg/kg. The acute percutaneous LD_{50} for rats was 6139 mg/kg. Sublethal doses administered repeatedly to guinea pigs caused liver damage; acute and short-term (15 6-hour exposures to 70–200 ppm) inhalation studies failed to kill these animals (Gage 1970). In a separate study reported on by Rowe (1975, as cited in ACGIH 1986, p. 593), 20 male rats, 4 rabbits, and 2 dogs were exposed at levels of 30 or 100 ppm 1,2,4-trichlorobenzene 7 hours/day, 5 days/week for 30 exposures in 44 days. No adverse effects were detectable in exposed animals belonging to 30 species as a result of exposure to 30 ppm, with the exception of an elevation of urinary porphyrins in the rats at 15 and 30 exposure days. A second inhalation study was performed with 1,2,4-trichlorobenzene 7 hours/day, 5 days/week for 26 consecutive weeks (Coate, Schoenfisch, Busey, and Lewis n.d.). Thirty rats, 16 rabbits, and 9 monkeys, all males, were exposed at zero, 25, 50, and 100 ppm. Microscopic changes were seen in the parenchymal cells of livers and kidneys of all rats after 4 and 13 weeks of exposure to 1,2,4-trichlorobenzene, but no adverse effects were seen in any of the other species.

In workers, exposure to 1,2,4-trichlorobenzene caused dermal irritation, which may have been attributable to the defatting action of this chemical (Powers, Coate, and Lewis 1975), and in some cases, exposure levels of 3 to 5 ppm caused eye and throat irritation (Rowe 1975, as cited in ACGIH 1986, p. 593).

OSHA is proposing a 5-ppm ceiling limit for 1,2,4-trichlorobenzene. The Agency preliminarily concludes that this limit will protect workers from the risk of eye, throat, and dermal irritation to which they can potentially be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for 1,2,4-trichlorobenzene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TRIETHYLAMINE
CAS: 121–44–8; Chemical Formula: $(C_2H_5)_3N$
H.S. No. 1408

OSHA currently has a limit of 25 ppm TWA for triethylamine. The ACGIH recommends a TLV–TWA of 10 ppm and a TLV–STEL of 15 ppm for this colorless liquid with a strong ammonia-like odor.

Exposure to triethylamine is associated with pulmonary, skin, and eye irritation and central nervous system effects. Guinea pigs exposed for 30 minutes to a concentration of 2,000 ppm triethylamine survived, but four of six animals died when exposed to this level for 2 hours; two of six guinea pigs died during a 4-hour exposure to a concentration of 1,000 ppm, but all survived similar exposures at the 250- and 500-ppm levels (Carpenter, Smyth, and Shaffer 1948). The single-dose oral LD_{50} value in rats is 0.46 g/kg (range: 0.25 to 0.85) (Smyth, Carpenter, and Weil 1951). These investigators also report that triethylamine readily penetrated rabbit skin on contact, with an LD_{50} value of 0.57 ml/kg (range: 0.36 to 0.90); skin irritation and eye injury were also noted from contact with the liquid. One of the six rats died from an acute 4-hour inhalation exposure to 1,000 ppm triethylamine (Smyth, Carpenter, and Weil 1951). Rabbits exposed repeatedly to a level of 50 ppm exhibited marked irritation of the cornea and of pulmonary tissue (Brieger and Hodes 1951; Carpenter and Smyth 1946). The effects of repeated triethylamine exposure correspond to those of ethylamine and diethylamine (Brieger and Hodes 1951). Triethylamine was found to inhibit monoamine oxidase activity, resulting in central nervous system stimulation (DeBruin 1976).

OSHA is proposing an 8-hour TWA limit of 10 ppm and a 15-minute STEL of 15 ppm for triethylamine. The Agency preliminarily concludes that both of these limits are required to protect workers against the risk of CNS effects and acute irritation to the eyes and lungs potentially associated with occupational exposure to triethylamine at elevated levels. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for triethylamine if the Agency determines that this limit will substantially reduce significant risk.

VANADIUM (V_2O_5) DUST
CAS: 1314–62–1; Chemical Formula: V_2O_5
H.S. No. 1421

The current OSHA PEL for vanadium pentoxide dust is a ceiling of 0.5 mg/m³. The ACGIH has established 0.05 mg/m³ as an 8-hour TWA for the respirable dust as vanadium pentoxide. NIOSH recommends a 15-minute short-term limit of 0.05 mg/m³. Vanadium pentoxide is a yellow to rust-brown crystalline compound.

Several studies indicate that OSHA's current exposure limit is insufficient to protect exposed workers against vanadium dust's respiratory effects, which include bronchitis, emphysema, tracheitis, pulmonary edema, and bronchial pneumonia. According to Hudson (1964), vanadium is poisonous to all animals by all routes of administration. The LD_{50} in rabbits injected intravenously is 1.5 mg/kg, and rats fed 25 ppm demonstrated toxic responses within a short time (Hudson 1964).

Seven cases of upper respiratory tract irritation were reported in boiler cleaners exposed to concentrations of from 2 to 85 mg/m³ vanadium pentoxide dust (Sjoberg 1951). Williams (1952) reported eight cases of vanadium poisoning in workers cleaning boilers in an atmosphere ranging from 30 to 104 mg/m³. Gulko (1956) observed eye and bronchial irritation in workers exposed to 0.5 to 2.2 mg/m³. A study by Lewis (1959) indicated that workers exposed to levels of 0.2 to 0.5 mg/m³ experienced a higher incidence of respiratory symptoms than did controls. Tebrock and Machle (1968) reported that workers exposed to average concentrations of 1.5 mg/m³ vanadium pentoxide in a mixed dust developed conjunctivitis, tracheobronchitis, and dermatitis. A single average 8-hour exposure to 0.2 mg/m³ respirable vanadium dust caused severe upper respiratory tract irritation in five human volunteers, and two other subjects exposed to a 0.1-mg/ ³ concentration also developed a delayed cough and an increase in mucous production (Zenz and Berg 1967).

OSHA is proposing a limit of 0.05 mg/m³ as an 8-hour TWA for vanadium dust as vanadium pentoxide. The Agency preliminarily concludes that this limit will prevent or substantially reduce the risks of eye and bronchial irritation, respiratory symptoms, conjunctivitis, and coughing seen in exposed workers at levels ranging from 0.1 mg/m³ to 2.2 mg/m³. The health evidence forms a reasonable basis for proposing a

revision to this level. At the time of the final rule, OSHA will establish a new limit for vanadium dust if the Agency determines that this limit will substantially reduce significant risk.

VANADIUM (V_2O_5) FUME
CAS: 1314-62-1; Chemical Formula: V_2O_5
H.S. No. 1422

OSHA's present PEL for vanadium pentoxide fume is 0.1 mg/m³. The ACGIH has set a 0.05-mg/m³ 8-hour TWA limit for vanadium pentoxide fume, and NIOSH recommends 0.05 mg/m³ as a 15-minute short-term limit. Vanadium pentoxide is a yellow to rust-brown crystalline compound.

Vanadium pentoxide fume's chief toxic effects are manifested in the respiratory passages: Bronchitis, emphysema, tracheitis, pulmonary edema, and bronchial pneumonia result from exposure to vanadium pentoxide fume. According to Hudson (1964), vanadium is poisonous to all animals by all routes of administration. The LD_{50} in rabbits injected intravenously is 1.5 mg/kg, and rats fed 25 ppm demonstrated toxic responses within a short time (Hudson 1964).

Seven cases of upper respiratory tract irritation were reported in boiler cleaners exposed to concentrations of from 2 to 85 mg/m³ vanadium pentoxide fume (Sjoberg 1951). Williams (1952) reported eight cases of vanadium poisoning in workers cleaning boilers in an atomosphere ranging from 30 to 104 mg/m³. Gulko (1956) observed eye and bronchial irritation in workers exposed to 0.5 to 2.2 mg/m³. A study by Lewis (1959) indicated that workers exposed to levels of 0.2 to 0.5 mg/m³ experienced a higher incidence of respiratory symptoms than did controls. Tebrock and Machle (1968) reported that workers exposed to average concentrations of 1.5 mg/m³ vanadium pentoxide in a mixed dust developed conjunctivitis, tracheobronchitis, and dermatitis. A single average 8-hour exposure to 0.2 mg/m³ respirable vanadium dust caused severe upper respiratory tract irritation in five human volunteers, and two other subjects exposed to a 0.1-mg/m³ concentration also developed a delayed cough and an increase in mucous production (Zenz and Berg 1967).

OSHA is proposing an 8-hour TWA limit of 0.05 mg/m³ for vanadium fume as vanadium pentoxide. The Agency preliminarily concludes that this limit will protect exposed workers from the risks of eye, skin, and upper respiratory tract irritation, conjunctivitis, pulmonary damage, and systemic poisoning potentially associated with vanadium pentoxide fume exposures. OSHA believes that this limit will substantially reduce these risks. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for vanadium fume if the Agency determines that this limit will substantially reduce significant risk.

VINYL ACETATE
CAS: 108-05-4; Chemical Formula: $CH_3COOCH=CH_2$
H.S. No. 1424

There is no current OSHA limit for vinyl acetate. The ACGIH has recommended a 10-ppm TLV-TWA and a 20-ppm TLV-STEL. NIOSH (1978m) recommends a 4-ppm ceiling limit, measured over a 15-minute period.

The basis for the ACGIH-recommended limits is an epidemiologic report by Deese and Joyner (1969) describing 15 years of industrial experience with vinyl acetate production. They reported that vinyl acetate is not a significant irritant at exposure levels of 5 to 10 ppm but causes cough and hoarseness at around 22 ppm. They also found no evidence of adverse chronic effects resulting from exposure to 5 to 10 ppm, as determined from medical records and examinations. While conducting air sampling for the study, the primary author (Deese) experienced hoarseness at concentrations of 4.2 and 5.7 ppm, and eye irritation at 5.7 and 6.8 ppm. Three chemical operators and one technician did not report any subjective responses at these levels. The ACGIH also cited a personal communication from the Mellon Institute (1968) that vinyl acetate concentrations of less than 5 ppm are detectable by odor, although some individuals may detect the odor at concentrations of 0.5 ppm.

NIOSH (1978m) reviewed these data and concluded that the recommended exposure limit be designed to protect even the most sensitive individuals from sensory irritant effects. Since the lowest level reported to cause upper respiratory tract irritation was 4.2 ppm (Deese and Joyner 1969), NIOSH recommended that workplace exposures not exceed 4 ppm measured over a 15-minute period.

The NIOSH REL of 4 ppm (ceiling) relies on a report concerning a single individual and provides insufficient information as a basis for standardsetting. The ACGIH recommended TLVs are based on a 15-year epidemiology study that suggests that a 10-ppm TWA and 20-ppm STEL will provide protection against the risk of irritation associated with exposure to vinyl acetate at higher levels. Therefore, the Agency proposes this 8-hour TWA and STEL combination as the revised limits for vinyl acetate. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for vinyl acetate if the Agency determines that this limit will substantially reduce significant risk.

VM & NAPHTHA
CAS No. 8032-32-4; Chemical Formula: none
H.S. No. 1429

OSHA currently has no PEL for VM & P (Varnish Makers' and Printers') naphtha. The ACGIH has established an 8-hour TWA of 300 ppm and a STEL of 400 ppm, which is not to be exceeded in any 15-minute period, for this substance. NIOSH recommends a 10-hour TWA of 75 ppm and a 400-ppm 15-minute STEL. VM & P naphtha, also known as ligroin, is a colorless, flammable liquid.

A study in which rats and beagles received doses by inhalation of 500 ppm for 30 hours per week for 13 weeks resulted in no chronic or latent effects (Carpenter et al. 1975). These authors also noted that the acute toxicity of VM & P naphtha for rats and other species was 4 times greater than that of rubber solvent naphtha, which has a limit of 400 ppm. Carpenter and associates (1975) also reported on an experiment in which rats lost coordination and went into convulsions in 15 minutes during exposures to saturation concentrations at ambient room temperature. The 4-hour inhalation LC_{50} was 3400 ppm, and the acclimated rats survived 5800 ppm for 6 hours.

Seven human volunteers exposed to 880 ppm VM & P naphtha for 15 minutes reported upper respirator tract, eye, nose irritation, and olfactory fatigue (ACGIH 1986, p. 631). Elkins (1959) noted one case of a worker, exposed to levels of VM & P naphtha averaging 800 ppm, who developed unspecified chronic effects. Elkins also reported that the VM & P naphtha level producing significant irritation in human volunteers was about half as great for this form of naphtha as for rubber solvent naphtha.

OSHA is proposing limits of 300 ppm as an 8-hour TWA and 400 ppm as a 15-minute STEL for VM & P naphtha. The Agency preliminarily concludes that both of these limits are required to protect exposed workers against the risk of upper-respiratory effects, eye irritation, and possible chronic effects associated with naphtha exposure. The health evidence forms a reasonable basis for proposing a new limit for VM & P naphtha. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

XYLENE, o, m, and p ISOMERS

CAS: 1330-20-7; 95-47-6; 108-38-3; 106-42-3; Chemical Formula: $C_6H_4(CH_3)_2$
H.S. No. 1431

The current OSHA limit for xylene is 100 ppm as an 8-hour TWA. The ACGIH also recommends a TLV-TWA of 100 ppm, but adds a 15-minute STEL of 150 ppm. NIOSH recommends an exposure limit of 100 ppm TWA, with a 200-ppm 10-minute ceiling. Xylene and its isomers are clear, flammable liquids with an aromatic hydrocarbon odor.

Rats and rabbits exposed to a mixture of xylene isomers at a concentration of 690 ppm for 8 hours daily, six days per week showed no blood abnormalities, but rabbits exposed on the same regimen at 1150 ppm for 55 days showed a decrease in red and white blood cell counts and an increase in platelet count (Fabre and Truhaut 1954).

Studies of workers exposed to xylene revealed headache, fatigue, lassitude, irritability, and gastrointestinal disturbances as the most common symptoms (Gerarde 1960). At unspecified exposure levels, Browning (1965) also noted gastrointestinal disturbances, in addition to kidney, heart, liver, and neurological damage; blood dyscrasias, some of which result in death, were also reported in these workers. A study by Nelson, Ege, Ross et al. (1943), in which human volunteers were exposed to 200 ppm xylene, found eye, nose, and throat irritation in the subjects at this level of exposure.

NIOSH developed a Criteria Document for xylene in 1975, in which the work of Morley and his colleagues (1970) was discussed. These authors observed liver dysfunction and renal impairment in three workers overexposed to xylene (estimated concentration of 10,000 ppm). One of these workers died, but the others recovered slowly. Furniture polishers were reported by Matthaus (1964) to have suffered corneal damage as a result of exposure to xylene at unknown concentrations.

OSHA preliminarily concludes that both a TWA and STEL are necessary to prevent risk of narcosis, blood effects, and irritant effects at the elevated levels possible at the current exposure limit. To reduce this risk, OSHA is proposing a 150-ppm STEL and a 100-ppm TWA. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for xylene if the Agency determines that this limit will substantially reduce significant risk.

ZINC CHLORIDE (FUME)
CAS: 7646-85-7; Chemical Formula: $ZnCl_2$
H.S. No. 1435

OSHA's current PEL for zinc chloride is 1 mg/m³ as an 8-hour TWA. The ACGIH has established a TLV-TWA of 1 mg/m³, with a STEL of 2 mg/m³. Zinc chloride fume is white and has an acrid odor.

Zinc chloride fume is highly caustic and damages the mucous membranes of the nasopharynx and respiratory tract. Exposure to the fumes of zinc chloride may result in a severe pneumonitis that is caused by irritation of the respiratory tract (Gafafer 1964). One instance in which a worker inhaled zinc chloride fumes resulted in advanced pulmonary fibrosis that ended in death (Milliken, Waugh, and Kadish 1963), and 10 deaths and 25 non-fatal cases of pneumonitis occurred in workers caught in a tunnel when 79 smoke generators caught fire and generated zinc chloride fumes (Humter 1955). Other studies have shown that zinc chloride exposures cause skin ulceration (Sax 1957). It has also been suggested that zinc chloride exposure may have chronic effects (Hamilton and Hardy 1974). In an investigation of the adverse effects of zinc chloride fume exposures, Ferry (personal communication 1966, as cited in the ACGIH 1986, p. 643) reported that no sensory effects occurred when 30 minute exposures were limited to 0.07 and 0.4 mg/m³; however, this researcher noted that these levels did corrode metal.

OSHA preliminarily concludes that the risk of damage to the eyes, skin, and respiratory tract associated with exposure to zinc chloride fume should be substantially reduced by establishing a STEL and TWA to protect against elevated short-term and long-term exposures to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for zinc chloride if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

OSHA's preliminary finding is that sensory irritation poses an occupational health risk to workers exposed to these substances at the existing hazardous levels. Among the adverse health consequences of exposure to sensory irritants are acute breathing difficulty, eye tearing, conjunctivitis, sensitization, persistent coughing, and upper respiratory tract irritation. In addition to the pain and suffering associated with these signs and symptoms, workers experiencing irritant effects find it difficult if not impossible to concentrate on the job at hand; thus they work less safely and less productively than non-exposed employees. Reducing exposures from levels that have been associated with these effects to levels where such consequences are substantially less likely to occur will reduce the risk posed to workers at current levels.

The health evidence for these substances forms a reasonable basis for proposing revised or new limits. At the time of the final rule, OSHA will establish new or revised limits for these sensory irritants if the Agency determines that these limits will substantially reduce significant risks.

4. Substances for Which Proposed Limits Are Based on Avoidance of Liver or Kidney Effects

Introduction

The liver or kidneys are the primary target organs affected by toxic exposures to a number of industrial chemicals. In recognition of this target organ toxicity, OSHA is proposing new or revised limits for 17 hepato- or nephrotoxic compounds (12 hepatotoxins and five nephrotoxins). For these substances, the liver or kidney is probably the organ most sensitive to the effects of exposure. Thus, establishing permissible exposure limits that are low enough to prevent toxicity to these target organs generally also protects other organ systems.

Seventeen compounds for which revised limits are being proposed produce kidney or liver effects in overexposed individuals. For seven of these substances, OSHA is proposing to lower the PEL, and for one other substance, OSHA is also proposing the adoption of a short-term exposure limit. For five liver or kidney toxins, OSHA is proposing a PEL where none formerly existed, and in three cases, OSHA proposes to retain the current PEL but to add a STEL where none formerly existed. For four chemicals in this category, NIOSH recommends limits lower than those established by the ACGIH, and for one of these substances, OSHA proposes adoption of the NIOSH RELs; in three cases, the NIOSH and ACGIH limits are essentially the same. The sections below discuss liver and kidney toxins separately. Table C4-1 shows these hepatotoxic substances, their OSHA, ACGIH, and NIOSH limits, and their CAS and HS numbers; Table C4-2 provides the same information for the nephrotoxins in this group.

Liver Toxicity

Description of the Health Effects

Although the precise mechanisms by which these compounds cause liver damage are only partly understood, the development and manifestation of liver

toxicity are similar for all of them. In general, liver toxicity is a graded response, i.e., the severity of the lesion is directly proportional to the intensity/duration of exposure. Although many of the effects caused by exposure to these substances are reversible, some are not.

Liver damage is not a single entity; the manner in which it is manifested depends on the dose, duration, and particular chemical agent involved. For example, acute exposures may cause lipid to accumulate in the hepatocytes, cellular death, and/or hepatobiliary dysfunction. In contrast, chronic exposures may lead to cirrhotic changes and the development of neoplasms. Fatty accumulation and necrosis can be either localized or widespread, and chemical-induced lesions resulting from chronic exposures can cause marked changes of the entire liver (Plaa 1986).

Typically, the earliest and most sensitive indicators of liver toxicity are alterations in biochemical liver functions, such as changes in specific enzyme activities. These may be accompanied by changes in the morphology of specific organelles in hepatocytes. For example, relatively low doses of halogenated aliphatic hydrocarbons, such as allyl chloride, carbon tetrabromide, and 1,1-dichloroethane, cause an increase in the activity of microsomal mixed function oxidase enzymes. This increase is ordinarily accompanied by proliferation of the endoplasmic reticulum.

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Table C4-1. List of Substances For Which Limits Are Based Primarily on Avoidance of Liver Toxicity

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1011 Allyl chloride	107-05-1	1 ppm TWA	1 ppm TWA 2 ppm STEL	1 ppm TWA 3 ppm Ceiling (15 min)
1072 Carbon tetrabromide	558-13-4	-	0.1 ppm TWA 0.3 ppm STEL	-
1089 o-Chlorostyrene	2039-87-4	-	50 ppm TWA 75 ppm STEL	-
1108 Cyclohexanone	108-94-1	50 ppm TWA	25 ppm TWA, Skin	25 ppm TWA
1145 Dioxane	123-91-1	100 ppm TWA, Skin	25 ppm TWA, Skin	1 ppm Ceiling (30 min)
1168 Ethylene dichloride+	107-06-2	50 ppm TWA 100 ppm STEL 200 ppm Ceiling	10 ppm TWA	1 ppm TWA 2 ppm Ceiling (15 min)
1205 Hydrazine	302-01-1	1 ppm TWA, Skin	0.1 ppm TWA, Skin	0.03 ppm Ceiling (120 min)
1269 Methylcyclohexanol	25639-42-3	100 ppm TWA	50 ppm TWA	-
1295 Octachloro-naphthalene	2234-13-1	0.1 mg/m^3 TWA, Skin	0.1 mg/m^3 TWA 0.3 mg/m^3 STEL Skin	-

Table C4-1. List of Substances For Which Limits Are Based Primarily on Avoidance of Liver Toxicity (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1341 Propylene dichloride	78-87-5	75 ppm TWA	75 ppm TWA 110 ppm STEL	—
1385 1,1,2,2-Tetrachloroethane	79-34-5	5 ppm TWA, Skin	1 ppm TWA, Skin	Lowest feasible level
1407 1,2,3-Trichloropropane	96-18-4	50 ppm TWA	10 ppm TWA, Skin	—

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed limit is the NIOSH REL.

Table C4-2. List of Substances For Which Limits are Based Primarily on Avoidance of Kidney Toxicity

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1129 1,3-Dichloropropene	542-75-6	-	1 ppm TWA, Skin	--
1132 Dicyclopentadiene	77-73-6	-	5 ppm TWA	--
1166 Ethyl silicate	78-10-4	100 ppm TWA	10 ppm TWA	--
1195 Hexachlorobutadiene	87-68-3	-	0.02 ppm TWA, Skin	--
1203 Hexone (Methyl isobutyl ketone)	108-10-1	100 ppm TWA	50 ppm TWA 75 ppm STEL	50 ppm TWA

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

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Many compounds that damage the liver, such as 1,1,2,2-tetrachloroethane, also cause an abnormal accumulation of fat, especially triglycerides, in liver cells. In experimental animals this effect is manifested as an accumulation of microscopic vacuoles in liver cells. In humans, however, the only grossly detectable manifestation of this effect is increased liver size, which is an indication of severe fat accumulation in the liver.

At sufficiently high doses, most substances that damage the liver cause cell death that leads to tissue necrosis or gangrene. This necrosis may initially be localized, but at higher or more sustained exposure levels the entire liver may be involved. Moderate to severe liver necrosis is usually accompanied by increased concentrations of marker enzymes such as glutamate-pyruvate transaminase or glutamate-oxaloacetate transaminase in the serum; the detection of these substances in the serum of exposed individuals can thus be a useful diagnostic tool.

Dose-Response Characteristics

The development of liver and other organ damage in humans and animals is progressive; it begins with subcellular changes, progresses to the cellular level, and is finally manifested as whole-organ damage. This progression is related to the intensity/duration of dose; i.e., as dose increases, cellular death becomes widespread and eventually causes liver dysfunction. The extent to which liver damage is reversible follows a similar continuum; since the liver can regenerate, minor cellular damage or transient disease states are usually reversible if exposure ceases. However, if exposure continues, the capacity of the liver to regenerate is exceeded and permanent damage results.

As is the case for some chemically induced toxic effects, there appears to be a NOE level below which hepatotoxic effects do not occur.

The following paragraphs describe OSHA's preliminary results for all of the substances in this group of hepatotoxins and discuss the nature of the risk experienced by exposed workers.

ALLYL CHLORIDE
CAS: 107–05–1; Chemical Formula: $CH_2=CHCH_2Cl$
H.S. No. 1011

The current OSHA PEL for allyl chloride is a 1 ppm (3 mg/m³) 8-hour TWA; the ACGIH-recommended TLV–TWA is also 1 ppm, with a 15-minute STEL of 2 ppm. NIOSH has recommended a 1 ppm 10-hour TWA and a 3 ppm 15-minute STEL for this substance. Allyl chloride is a colorless liquid with an unpleasant, pungent odor.

Studies of animal exposures to allyl chloride indicate that the chemical is among the most toxic of the halogenated aliphatic hydrocarbons, producing mucous membrane irritation, mild narcosis, and, at higher concentrations, histologic lesions of the lungs and kidneys (Adams, Spencer, and Irish 1940). Even single exposures lasting only a few minutes at concentrations between 1 and 100 mg/liter (332 to 32,000) caused mucous membrane irritation in various laboratory animals (Adams, Spencer, and Irish 1940). Further animal studies have confirmed liver and kidney pathology in many species (Torkelson, Wolf, Oyen, et al. 1959) and female rats exhibited kidney pathology after exposure to 3 ppm for 6 months.

Human exposures to concentrations of 1 to 113 ppm caused abnormal liver test results (Hausler and Lenich 1968). OSHA therefore proposes that both a STEL of 2 ppm and a 1 ppm TWA are required. The Agency preliminarily concludes that a combined limit is necessary to protect employees from the risk of mucous membrane irritation potentially associated with the elevated short-term exposures to allyl chloride currently permitted by the 8-hour TWA alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for allyl chloride if the Agency determines that this limit will substantially reduce significant risk.

CARBON TETRABROMIDE
CAS: 558–13–4; Chemical Formula: CBr_4
H.S. No. 1072

OSHA's current Z tables have no limits for exposure to carbon tetrabromide. The ACGIH limit is a 0.1 ppm TWA and a 0.3 ppm STEL. Carbon tetrabromide's hepatotoxic effects include both fatty infiltration and necrosis. The 0.1 ppm and 0.3 ppm levels were selected based on an observed no-effect level at 0.1 ppm; this finding derives from a study in which rats were exposed to carbon tetrabromide by inhalation for 7 hours per day, 5 days per week for 6 months (Torkelson and Rowe 1981). OSHA believes that controlling workplace exposures to these levels will prevent adverse effects in exposed workers. OSHA preliminarily concludes that establishing a limit for this previously unregulated chemical will protect workers against the risk of experiencing its hepatotoxic effects and will achieve a substantial reduction in this risk. The health evidence forms a reasonable basis for proposing a new limit for carbon tetrabromide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

o-CHLOROSTYRENE
CAS: 2039–87–4; Chemical Formula: C_8H_7Cl
H.S. No. 1089

OSHA has no current limit for o-chlorostyrene. The ACGIH recommends a TLV–TWA of 50 ppm with a TLV–STEL of 75 ppm. o-Chlorostyrene is a liquid.

In an unpublished report, the Dow Chemical Company (1973) describes the results of an o-chlorostyrene inhalation study in rats, rabbits, guinea pigs, and dogs. Dow exposed the animals to an average concentration of 101 ppm for 7 hours daily, 5 days a week, for a total of 130 exposures in 180 days. No adverse effects were observed in any species in terms of appearance, growth, behavior, mortality, hematology, BUN, alkaline phosphatase, SGPT, BSP, organ weights, or gross pathology (Dow Chemical Company, unpublished report, 1973). Microscopic examination of animal tissue revealed a somewhat higher incidence of pathological liver and kidney changes. There is evidence indicating that the warning properties of o-chlorostyrene do not permit workers to recognize concentrations of o-chlorostyrene of 100 ppm. Based on o-chlorostyrene's structural analogy to styrene, for which short-term exposures of 100 ppm have been demonstrated to produce neuropathic and narcotic effects (Stewart, Dodd, Baretta, and Schaffer 1968), a short-term limit is necessary (ACGIH 1986, p. 136).

OSHA is proposing a PEL of 50 ppm as an 8-hour TWA and a 15-minute STEL of 75 ppm for o-chlorostyrene. The Agency preliminarily concludes that both of these limits will protect against the risk of narcosis and neuropathy to which workers could potentially be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for o-chlorostyrene if the Agency determines that this limit will substantially reduce significant risk.

CYCLOHEXANONE
CAS: 108–94–1; Chemical Formula: $C_6H_{10}O$
H.S. No. 1108

OSHA has a current limit of 50 ppm TWA for cyclohexanone. Both the ACGIH and NIOSH recommend a time-weighted average of 25 ppm, and the ACGIH also recommends a skin notation. Cyclohexanone is a white to pale yellow oily liquid with an odor

similar to that of acetone and peppermint.

Cyclohexanone has a low order of acute toxicity in animals. A concentration of 2000 ppm inhaled for 4 hours was lethal to 1 of 6 rats; at 4000 ppm, all of the exposed animals died. In rabbits, the dermal LD_{50} was 1000 mg/kg (Smyth et al. 1969). Rabbits showed marked irritation and some corneal injury when undiluted cyclohexanone was instilled in the eye (Carpenter and Smyth 1946). Guinea pigs exposed to 4000 ppm for 6 hours showed narcotic symptoms, lacrimation, salivation, depression of body temperature and heart rate, and corneal opacity (Specht et al. 1940). Rabbits exhibited degenerative changes of the liver and kidneys after 50 daily 6-hour inhalation exposures to 190 ppm (Treon, Crutchfield, and Kitzmiller 1943). Exposures to 309 ppm cyclohexanone on the same regimen caused conjunctival congestion, while exposures to 3000 ppm were lethal to some of the exposed animals (Treon, Crutchfield, and Kitzmiller 1943). In humans, Nelson and co-workers (1943) report that irritation caused by exposure to cyclohexanone was intolerable at 50 ppm, however, 25 ppm was not objectionable to most subjects in 3- to 5-minute exposures.

OSHA is proposing a 25-ppm 8-hour TWA and a skin notation for cyclohexanone. The Agency preliminarily concludes that these two limits will prevent the risk of respiratory and skin irritation associated with cyclohexanone exposures at levels below the existing PEL of 50 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for cyclohexanone if the Agency determines that this limit will substantially reduce significant risk.

DIOXANE
CAS: 123-91-1; Chemical Formula: $O(CH_2CH_2)_2O$
H.S. No. 1145

OSHA's current PEL for dioxane is 100 ppm as an 8-hour TWA, with a skin notation. NIOSH recommends a 1-ppm 30-minute ceiling for dioxane, and the ACGIH has established a 25-ppm TLV-TWA, with a skin notation. The proposed 25-ppm PEL reflects new toxicological data for this substance. A 2-year drinking water study conducted by the Dow Chemical Company, in which male and female rats were given water containing 1.0, 0.1, or 0.01 percent dioxane, showed that animals given the highest dose developed liver and nasal tumors, as well as pathological changes in the liver and kidney. Rats in the 0.1-percent group showed renal tubular sloughing and hepatocellular degeneration but no significant increase in neoplasms. Because this study demonstrated hepato- and nephrotoxic effects at doses 10 times lower than the dose causing cancer in animals, the ACGIH established the TLV based on dioxane's liver and kidney effects rather than its carcinogenicity. A study by Torkelson et al. (1974) in four species of animals exposed to multiple daily airborne exposures of dioxane at 50 ppm showed no gross or histopathologic organ changes, leading the ACGIH to recommend 25 ppm as an appropriate level to protect against liver and kidney effects in exposed workers (ACGIH 1986). In this case, the ACGIH is using a safety factor to establish the 8-hour limit, i.e., is applying a safety factor of 2 to the results of an animal study in four species that showed no gross or histopathological changes at 50 ppm.

The 25-ppm TLV is based on hepato- and nephrotoxic effects, since the ACGIH evaluation determined that these effects were more severe than the potential for carcinogenicity. OSHA does not generally accept such a rationale; however, OSHA is unable to perform the necessary risk assessment to evaluate the question of carcinogenicity in time for this rulemaking. The 1-ppm (ceiling) REL is based on cancer potential and appears to represent the "lowest concentration reliably measured," a criterion that would not satisfy OSHA feasibility requirements. OSHA therefore proposes that a PEL of 25 ppm TWA, with a skin notation, be adopted at the present time to reduce the risk that currently exists. As future priorities permit, OSHA will consider the need for a more stringent PEL.

ETHYLENE DICHLORIDE
CAS: 107-06-2; Chemical Formula: $ClCH_2CH_2Cl$
H.S. No. 1168

The current OSHA standard for ethylene dichloride is 50 ppm as an 8-hour TWA, a 100-ppm ceiling (maximum duration of 5 minutes in any 3 hours), and a 200-ppm peak; these limits were derived from limits recommended by the American National Standards Institute in 1969. In 1980, the ACGIH reduced its TLV to 10 ppm as an 8-hour TWA. NIOSH (1978) has concluded that ethylene dichloride should be considered a potential human carcinogen and has recommended 1-ppm 10-hour TWA and 2-ppm 15-minute short-term limits. Several studies indicate that the current OSHA PELs are insufficient to protect workers against hepatotoxic and other adverse effects. A paper by Kozik (1957) reported that workers generally exposed below 16 ppm but occasionally exposed to levels between 30 and 50 ppm experienced adverse liver and nervous system effects. In addition, Brzozowski (1954) reported abnormal changes in the blood of 50 percent of workers (8 of 16) exposed to between 10 and 37 ppm of ethylene dichloride. The ACGIH also cited numerous animal studies that consistently show hepatotoxic effects caused by exposure to ethylene dichloride; the ACGIH concluded that ethylene dichloride "clearly belongs in the group of hepatotoxic halogenated hydrocarbons" (ACGIH 1986). Based on these findings, the ACGIH (1986) recommended a reduction in the 8-hour TLV-TWA to 10 ppm.

In August 1978, NIOSH recommended that exposure to ethylene dichloride be minimized in response to an NCI bioassay (1978) showing that ethylene dichloride induced liver cancer in both sexes of mice and rats. NIOSH (1978) subsequently recommended a 1-ppm 10-hour TWA and a 2-ppm 15-minute short-term limit.

OSHA preliminarily concludes that the studies of Kozik (1957) and Brzozowski (1954) clearly indicate that a risk of hepatotoxicity, nervous system effects, and hematopoietic effects exists at the current 50-ppm 8-hour TWA PEL. The 10-ppm TLV recommended by the ACGIH does not afford protection at the levels (10 to 37 ppm) where abnormal blood changes were measured in 50 percent of the workers studied. Therefore, OSHA believes it necessary to reduce its current limits for ethylene dichloride to reduce this risk (as well as to protect against potential carcinogenic effects) and is proposing to revise these limits to 1 ppm as a TWA and 2 ppm as a STEL. The Agency's preliminary feasibility analysis is based on limited data at these levels; OSHA requests additional feasibility information from the public. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethylene dichloride if the Agency determines that this limit will substantially reduce significant risk.

HYDRAZINE
CAS: 302-01-2; Chemical Formula: H_2N-NH_2
H.S. No. 1205

The current OSHA limit for hydrazine is 1 ppm as an 8-hour TWA, with a skin notation. The ACGIH (1986) has recommended a TLV-TWA of 0.1 ppm, also with a skin notation. Because of its potential carcinogenic hazard, NIOSH (1978a) has recommended that

workplace exposure to hydrazine not exceed 0.03 ppm as determined by a 2-hour air sample; this level represents the lowest detectable level over this sampling period.

A hepatotoxic response in mice and anemia and weight loss in dogs were reported to occur following a 6-month exposure to 1 ppm for 6 hours per day, 5 days per week or to 0.2 ppm continuously (Haun and Kinkead 1973). It was this finding that led the ACGIH to conclude that the former TLV of 1 ppm was too high. The ACGIH has also assigned an A2 designation (suspect human carcinogen), based on a study by MacEwen et al. (1979) showing significant increases in nasal tumors in rats exposed to 1 or 5 ppm hydrazine, in thyroid adenocarcinoma in rats exposed to 5 ppm, and in lung adenoma among mice exposed to 1 ppm. Other studies are cited by NIOSH (1978a) that demonstrate the carcinogenicity of hydrazine in rodents by a variety of dose routes. Because of this evidence, NIOSH has recommended a workplace exposure limit equal to the limit of detection for a 2-hour sample (0.03 ppm).

The animal studies conducted by Haun and Kinkead (1973) and by MacEwen et al. (1979) clearly demonstrate that exposure to the current 1 ppm PEL presents a risk of respiratory cancer, liver disease, and adverse blood effects; animals exposed to airborne concentrations at the current PEL have exhibited all of these effects. Therefore, OSHA preliminarily concludes that a reduction in the PEL for hydrazine is warranted to reduce this risk and is proposing to revise its PEL to 0.1 ppm as an 8-hour TWA, with a skin notation. The Agency has selected this limit rather than the 0.03-ppm REL recommended by NIOSH because it does not have sufficient feasibility data or risk assessment information regarding use of the 0.03-ppm level. Furthermore, the NIOSH REL appears to be based on the sampling and analytical limits of detection, and OSHA cannot base its limits on such criteria. The Agency believes that the 0.1-ppm limit will control hepatotoxic effects and reduce potential carcinogenic risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for hydrazine if the Agency determines that this limit will substantially reduce significant risk.

METHYLCYCLOHEXANOL
CAS: 25639-42-3; Chemical Formula: $CH_3C_6H_{10}OH$
H.S. No. 1269

OSHA currently has an 8-hour TWA limit of 100 ppm for methylcyclohexanol. The ACGIH recommends a limit of 50 ppm TWA. Methylcyclohexanol is a colorless, viscous liquid with an aromatic odor.

Exposure to methylcyclohexanol produces narcotic effects, liver and kidney impairment, and eye and respiratory irritation. Treon, Crutchfield, and Kitzmiller (1943) have reported the oral LD_{50} in rabbits to be between 1.25 and 2 g/kg; liver damage was observed in surviving animals. Repeated inhalation exposures to the vapor caused salivation, eye irritation and lethargy in rabbits exposed at 500 ppm, but exposures to 230 ppm caused no observable effects. Fifty 6-hour exposures at a level of 120 ppm caused "barely discernible" microscopic changes in the liver and kidney tissue of rabbits (Treon, Crutchfield, and Kitzmiller 1943).

In humans, headaches and eye and respiratory irritation have been reported to occur from prolonged exposure to high concentrations of methycyclohexanol (Fillipi 1914). Smyth (1956) considered an exposure limit of 100 ppm to be sufficiently low to prevent narcotic effects and, perhaps, significant liver and kidney damage.

OSHA is proposing an 8-hour TWA of 50 ppm for methylcyclohexanol. The Agency preliminarily concludes that this limit will protect workers against the risk of narcosis and hepatic and renal effects that potentially exists at the levels permitted by the current 100-ppm limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methylcyclohexanol if the Agency determines that this limit will substantially reduce significant risk.

OCTACHLORONAPHTHALENE
CAS: 2234-13-1; Chemical Formula: $C_{10}Cl_8$
H.S. No. 1295

OSHA currently has a limit of 0.1 mg/m³ TWA, with a skin notation, for octachloronaphthalene. The ACGIH recommends a TLV-TWA of 0.1 mg/m³ and a TLV-STEL of 0.3 mg/m³, also with a skin notation. Octachloronaphthalene is a nonflammable, pale yellow, and waxy solid containing 70 percent chlorine.

Inhalation toxicity data for octachloronaphthalene fumes or dust are lacking, but exposure to the chloronaphthalenes causes acne-like lesions that itch severely. Repeated exposure to the fumes of molten chlorinated naphthalenes can cause severe and sometimes fatal systemic poisoning and is especially damaging to the liver (Patty 1963). Ingestion studies of cattle have shown different toxicities for different naphthalenes, with the toxicity increasing with the degree of chlorination (Sikes, Wise, and Bridges 1952). However, these data are controverted by another report in which octachloronaphthalene was found to be less toxic than the hexachloro derivative (Bell 1953). This divergence in the data may be due to differing methods of administration (suspension versus solution) or may reflect the soluble form's greater capacity for absorption (ACGIH 1986, p. 447).

OSHA proposes a PEL of 0.1 mg/m³ TWA and a STEL of 0.3 mg/m³, with a skin notation, for octachloronaphthalene. The Agency preliminarily concludes that this combined limit will protect workers against the risk of dermal effects and serious liver damage potentially associated with exposure to this substance at the levels permitted by the 8-hour limit alone. The skin notation is retained because of octachloronaphthalene's severe dermal effects. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for octachloronaphthalene if the Agency determines that this limit will substantially reduce significant risk.

PROPYLENE DICHLORIDE
CAS: 78-87-5; Chemical Formula: $CH_3CHClCH_2Cl$
H.S. No. 1341

OSHA currently has a limit of 75 ppm TWA for propylene dichloride. The ACGIH recommends a 75-ppm TLV-TWA and a TLV-STEL of 110 ppm. Propylene dichloride is a colorless, flammable, mobile liquid with an odor like that of chloroform.

The primary hazards associated with exposure to propylene dichloride are inhalation toxicity to liver tissue and mild skin and eye irritation. Repeated inhalation exposures to 1000 ppm have been reported to kill dogs (after 24 exposures), guinea pigs (after 22 exposures), and rats (in some cases after 7 exposures); some animals survived more than 100 7-hour exposures. Necropsy showed severe liver damage; the hepatotoxicity of propylene dichloride appears to be greater than that of carbon tetrachloride and less than that of ethylene dichloride (Heppel, Neal, Highman, and Porterfield 1946). Animals of these same species (rats, dogs, and guinea pigs) survived 128 to 140 7-hour exposures to 400 ppm for 5 days/week without histologic effects, while mice died from similar exposures; surviving mice displayed hepatomas (Heppel, Highman, and Peake 1948). The

oral LD_{50} for rats has been reported as 1.19 ml/kg (Smyth et al. 1969); the acute 8-hour inhalation LC_{50} for rats is 3000 ppm (Pozzani et al. 1959).

OSHA proposes an 8-hour TWA PEL for propylene dichloride of 75 ppm and a 15 minute STEL of 110 ppm. The Agency preliminarily concludes that this combined limit will protect workers against the risk of hepatotoxic effects potentially associated with exposures at the levels permitted by the absence of a short-term limit above the 8-hour TWA PEL for even brief periods. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for propylene dichloride if the Agency determines that this limit will substantially reduce significant risk.

1,1,2,2–TETRACHLOROETHANE
CAS: 79–34–5; Chemical Formula: $CHCl_2CHCl_2$
H.S. No. 1385

OSHA's existing PEL for 1,1,2,2–tetrachloroethane is 5 ppm with a skin notation; a 1-ppm 8-hour TWA, also with a skin notation, is the level established by the ACGIH. The NIOSH recommendation is that exposure be reduced to the lowest feasible level. One study by Jevey et al. (1957) revealed identifiably adverse effects on the liver, including hepatitis, in humans exposed to concentrations of tetrachloroethane ranging from 1.5 to 247 ppm; liver damage was still evident after exposures were reduced to 15 ppm. An animal study by Schmidt et al. (1972) found "barely detectable" fatty infiltration of the liver in rats exposed to 2 ppm tetrachloroethane for 11 months.

Based on this evidence, OSHA preliminarily concludes that the current level does not protect against fatty infiltration of the liver and probably does not protect against more serious liver damage; these health consequences clearly pose an occupational risk. OSHA believes that reducing the 8-hour TWA for tetrachloroethane to 1 ppm will substantially reduce the risk posed to workers exposed at the current PEL and thus proposes adoption of a 1-ppm 8-hour TWA, with a skin notation. The proposed limit was selected on the basis of relatively extensive data from health surveys conducted among occupationally exposed workers, supplemented by results from experimental animal studies. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 1,1,2,2–tetrachloroethane if the Agency determines that this limit will substantially reduce significant risk.

1,2,3–TRICHLOROPROPANE
CAS: 96–18–4; Chemical Formula: $C_3H_5Cl_3$
H.S. No. 1407

OSHA's existing PEL for 1,2,3–trichloropropane is 50 ppm as an 8-hour TWA, and the ACGIH has a TLV–TWA of 10 ppm and a skin notation. 1,2,3–Trichloropropane is a colorless to straw-colored, combustible liquid with an odor similar to chloroform.

1,2,3-Trichloropropane is not irritating to intact skin, but it is absorbed through the skin. It is highly irritating to the eyes (Smyth, Carpenter, Weil et al. 1962). Five of six rats exposed to 1000 ppm died after 4-hour exposures. Rats and guinea pigs exposed at 800, 2100, or 5000 ppm for 30 minutes showed central nervous system depression, which progressed at the higher levels to narcosis and convulsions (Lewis, as cited in ACGIH 1986, p. 602). Several mice exposed for 20 minutes to 5000 ppm died, some as long as several days later from liver damage. Daily 10-minute exposures at 2500 ppm for 10 days killed 7 of 10 mice (McOmie and Barnes 1949). Animals exposed once for 4 hours to 1,2,3-trichloropropane at concentrations of 125, 340, 700, or 2150 ppm showed dose-related signs of irritation, which included, at 700 or 2150 ppm, labored respiration, inactivity, and eye and nose irritation; at autopsy, however, no organ or other damage was apparent (McOmie and Barnes 1949).

Human volunteers found exposure to 1,2,3-trichloropropane objectionable because of eye and upper respiratory tract irritation, and many found 50 ppm an unacceptable level for a full-shift exposure (Silverman, Schulte, and First 1946). Drew and colleagues (1978) noted changes in liver enzymes after a single 4-hour exposure to 500 ppm, and Russian studies indicate that morphologic changes and metabolic lesions of the liver, kidney, and lungs occurred in mice exposed continuously to concentrations of 0.007 to 0.3 ppm (Siderenko, Tsulaya, Bonashevskaya, and Shaipak 1979; Siderenko, Tsulaya, Koreneveskaya, and Banashevskaya 1976; Tsulaya, Bonashevskaya, Zykova et al. 1977).

A National Toxicology Program prechronic study in which rats were gavaged daily with 1,2,3-trichloropropane at 8, 16, 32, 63, 125, and 250 mg/kg body weight for 120 days showed good survival in all but the highest dose group (National Toxicology Program 1983). Statistically significant changes in the liver and kidney, and necrosis and irritation of the nasal passages, occurred in the 63 and 125 mg/kg dose groups. Decreases in the red blood cell count and hematocrit were seen even in the 16-mg/kg dose group. 1,2,3-Trichloropropane did not affect sperm count or morphology or testicular weight. The NTP found this substance to be genetically active in three bioassays. However, Hardin, Bond, Silkov et al. (1981) did not find 1,2,3-trichloropropane to be fetotoxic or teratogenic.

The ACGIH (1986, p. 602) concluded that the most sensitive sex and species, female rats, had a no-adverse-effect level for kidney or liver effects of 8 mg/kg/day, and extrapolated from this level to humans to establish a TLV–TWA of 10 ppm.

OSHA is proposing an 8-hour PEL of 10 ppm and a skin notation for 1,2,3-trichloropropane. The Agency preliminarily concludes that these limits are necessary to protect exposed workers against the risks of liver and kidney damage, eye and throat irritation, and systemic toxicity via inhalation or skin absorption that are potentially associated with exposures to this substance at levels considerably below the Agency's current PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 1,2,3-trichloropropane if the Agency determines that this limit will substantially reduce significant risk.

Kidney Toxicity

Introduction

Kidney damage is the basis for revising the PELs for five of the compounds in this group. These compounds, their CAS and HS numbers, and their current OSHA, ACGIH, and NIOSH limits are shown in Table C4–2. Three of these substances will be regulated by OSHA for the first time, and in the other two cases, the 8-hour TWA will be reduced. In one of the latter cases, a STEL will also be added.

Description of the Health Effects

The precise mechanism by which these chemicals damage the kidneys is unknown. Typically, these compounds are selectively toxic to cells in the renal tubule, perhaps because impaired transport causes the chemical to collect in these cells. In addition to the excretion of wastes, the kidney plays an important role in the regulation of total body homeostasis. This organ regulates extracellular volume, controls electrolyte and acid-base balance, and forms several hormones that control systemic metabolism. Depending on their particular site of action,

nephrotoxicants thus can interfere with the proper excretion of the body's wastes, hydration, electrolytic balance, metabolism, and the maintenance of the correct acid-base balance.

Like the hepatotoxic effects previously described, the least severe lesions caused by nephrotoxic compounds are graded and reversible. The earliest changes are usually alterations in the activities of specific enzymes in the tubular cells. These changes may be accompanied by minor morphological alterations of the cells that are visible only with an electron microscope. Higher doses or more sustained exposures are required to cause cellular necrosis that might be visible with light microscopy. Because of the reserve capacity of the kidneys, a significant degree of tubular cellular necrosis must occur before it is reflected by measurable alterations in kidney function. Thus, indicators of impaired renal function that can be measured in humans, such as proteinuria, glucosuria, and increased BUN, are relatively insensitive indicators of kidney damage. Other indicators of significant kidney damage include increased kidney weight, swelling of the tubular epithelium, fatty degeneration of tubular epithelium, and the presence of tubular casts in the urine.

OSHA is proposing to establish or revise occupational exposure limits for five nephrotoxic agents. NIOSH has a REL for one of these substances (hexone), and OSHA is currently regulating two chemicals in this group. These limits were selected based primarily on the results of studies in experimental animals. For example, the limit for hexone is based on results from a study in which rats were continuously exposed by inhalation to 100 or 200 ppm of hexone for 90 days. The lowest effects observed in this study were degeneration and necrosis of the renal tubules, which were associated with the 100 ppm exposures (MacEwen 1971). In a study of effects caused by exposure to ethyl silicate at 88, 50 or 23 ppm, no decrease in kidney weight was seen in rats exposed to this substance 7 hours per day, 5 days per week for 90 days (Pozzani and Carpenter 1951). OSHA preliminarily concludes that the 10-ppm level will provide protection against any nephrotoxic effects, and will reduce the significant risk associated with exposure to these hazardous substances.

Dose-Response Characteristics

Kidney damage, like liver damage, is progressive; only at earlier stages are nephrotoxic effects reversible. The toxicity of the kidney-damaging chemicals included in the group for which OSHA is proposing limits also increases as dose increases. For most nephrotoxins there appears to be a NOEL. Workplace exposures to concentrations of these substances at levels at or below the proposed limits are unlikely to cause kidney effects in most workers. OSHA believes that the nephrotoxic risks being protected against are significant at the current PELs for these substances, because the PELs are often at levels well above the concentration demonstrated to produce the toxic effect. In addition, for three of the chemicals, there have previously been no OSHA limits, and workers could therefore be exposed to levels well above the NOEL.

1,3-DICHLOROPROPENE
CAS: 542–75–6; CHEMICAL FORMULA: $CHCl=CH—CH_2Cl$
H.S. No. 1129

OSHA currently has no limit for 1,3-dichloropropene. The ACGIH has established an 8-hour TLV–TWA of 1 ppm, with a skin notation, for this straw-colored clear liquid with a chloroform-like odor. This compound occurs in the form of two isomers, cis and trans.

In male and female rats, the acute oral LD_{50}'s for a 92-percent mixture of the cis and trans isomers of 1,3-dichloropropene were 713 and 470 mg/kg, respectively; post mortem examination showed liver and kidney damage and, perhaps, evidence of lung injury (Torkelson and Oyen 1977). The dermal LD_{50} in rabbits for a 92-percent undiluted mixture was 504 mg/kg, but a 10-percent solution administered by gavage at a dose of 125 or 250 mg/kg was lethal to some of the animals (Torkelson and Oyen 1977). Contact with the liquid was irritating to the eyes and skin of rabbits (Torkelson and Oyen 1977).

Inhalation exposures to 1,3-dichloropropene vapor concentrations above 2700 ppm produced eye and nasal irritation and severe lung, nasal, kidney, and liver damage in rats (Torkels,n and Oyen 1977). Exposure to 1000 ppm caused eye and nasal irritation, lacrimation, and, if prolonged, unconsciousness; rats exposed to 1000 ppm for 2 hours died, but those exposed for 1 hour survived (Torkelson and Oyen 1977). Guinea pigs exposed to 400 ppm for a single 7-hour period died, while rats exposed similarly survived but had obvious lung con9estion (Torkelson and Oyen 1977). Rats, rabbits, guinea pigs, and dogs were exposed 7 hours/day' 5 days/week for 6 months to 1-ppm or 3-ppm concentrations of 1,3-dichloropropene (Torkelson and Oyen 1977). No adverse effects were observed in any of the animals exposed at 1 ppm. Of the animals exposed at 3 ppm, only male rats showed adverse effects; these animals had reversible cloudy swelling of the renal tubular epithelium (Torkelson and Oyen 1977).

In humans, acute exposures to 1,3-dichloropropene cause skin, eye, and respiratory irritation (Torkelson and Oyen 1977). There are no data on the effects in humans of chronic exposure to this substance.

OSHA is proposing an 8-hour TWA limit of 1 ppm, with a skin notation, for 1,3-dichloropropene. The A9ency preliminarily concludes that this limit will protect workers against the risk of eye and mucous membrane irritation and lung, kidney, and liver damage potentially associated with exposure to this substance at the levels permitted by the absence of any OSHA limit. A skin notation is proposed to protect against 1,3-dichloropropene's ability to be absorbed through the skin. The health evidence forms a reasonable basis for proposing a new limit for 1,3-dichloropropene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DICYCLOPENTADIENE
CAS: 77–73–6; Chemical Formula: $C_{10}H_{12}$
H.S. No. 1132

OSHA currently has no limit for dicyclopentadiene (DCPD). The ACGIH recommends a TLV–TWA of 5 mg/m^3. DCPD is a solid at room temperature and has a disagreeable odor.

The health effects associated with exposure to DCPD include mild eye, skin, and respiratory irritation, as well as possible pulmonary and renal damage. By the oral and intraperitoneal routes, DCPD is extremely toxic, with an oral LD_{50} value of 0.35 ml/kg and an intraperitoneal LD_{50} value of 0.31 ml/kg in rats: rat fatalities occurred within 60 minutes of exposure to an unspecified concentration of the saturated vapor (Kinkead, Pozzani, Geary, and Carpenter 1971). However, Gage (1970) regards approximately 660 ppm as the 4-hour LC_{50} in rats and reports that ten 6-hour daily exposures to DCPD at a concentration of 250 ppm were survived only by three of four rats; when the animals were subjected to a concentration of 100 ppm for 15 similar exposures, all survived (Gage 1970). Other species were less susceptible than mice to the effects of DCPD exposure, but they exhibited eye irritation, incoordination, and convulsions preceding death (Kinkead, Pozzani, Geary, and Carpenter 1971).

Kinkead and associates (1971) report that rats exposed repeatedly for 10 days

survived concentrations of 72 or 146 ppm but succumbed at the 332 ppm level, with convulsions, lung hemorrhage and blood in the intestines; female rats also suffered hemorrhage of the thymus. Mice similarly exposed succumbed at all three concentration levels (Kinkead, Pozzani, Geary, and Carpenter 1971). Chronic exposures of 7 hours/day for 89 days produced kidney damage and some pulmonary effects in rats exposed at levels of 35 and 74 ppm; a no-effect level for rats was determined to be below 19.7 ppm. Dogs exposed at concentrations of 9, 23, or 32 ppm on the same regimen exhibited only minimal effects (Kinkead, Pozzani, Geary, and Carpenter 1971).

Human sensory response tests resulted in findings of mild eye and throat irritation in 7 minutes on exposure to 1 ppm DCPD vapor and olfactory fatigue in 24 minutes; a 30-minute exposure to 5.5 ppm produced no olfactory fatigue (ACGIH 1986, p. 194). Subjective complaints of headache during the first 2 months of occupational exposure disappeared during the following 3 months of exposure, suggesting a developed tolerance for this substance (ACGIH 19B6, p. 194).

OSHA is proposing a PEL of 5 ppm TWA for dicyclopentadiene. The Agency preliminarily concludes that this limit will protect workers against the potential risk of kidney injury, pulmonary effects, and irritation potentially associated with workplace exposure to DCPD at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for dicyclopentadiene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ETHYL SILICATE
CAS: 78–10–4; Chemical Formula: $Si(OC_2H_5)_4$
H.S. No. 1166

OSHA's current permissible exposure limit for ethyl silicate is 100 ppm as an 8-hour TWA. The ACGIH recommends a limit of 10 ppm TWA for this colorless, flammable liquid with a faint odor.

Ethyl silicate has been reported to cause both irritation and systemic toxicity. In guinea pigs and rats, a 60-minute exposure of 2000 ppm was reported as the maximal time-concentration that did not cause serious disturbances; 500 ppm was the maximal no-effect exposure level for an exposure of several hours' duration (Smyth and Seaton 1940). Thirty-day exposures to 400 ppm ethyl silicate for 7 hours/day caused significant mortality in rats and damage to the lungs, liver, and kidney in the surviving animals. Exposures of rats, guinea pigs, and mice to 88, 50, or 23 ppm for 90 days (7 hours/day, 5 days/week) resulted only in decreased kidney weights in mice exposed at the 88-ppm level (Pozzani and Carpenter 1951). In another study, Kasper, McCord, and Frederick (1937) showed that animals exposed to 164 ppm ethyl silicate for 17 8-hour days showed less weight gain than did controls. Rowe and associates (1948) reported that three 7-hour exposures at 1000 ppm were fatal to 4 of 10 rats; similar exposures to 500 ppm caused pronounced kidney changes and slight lung irritation. Four to 10 similar exposures at 250 ppm caused slow weight loss and some lung and renal changes; at 125 ppm, slight to moderate kidney damage was observed (Rowe, Spencer, and Bass 1948).

Smyth and Seaton (1940) reported that exposure to a concentration of 1200 ppm causes lacrimation in humans and that 250 ppm causes eye and nose irritation.

OSHA is proposing a PEL of 10 ppm TWA for ethyl silicate. The Agency preliminarily concludes that this limit is required to protect exposed workers from the risk of renal damage potentially associated with exposures to higher concentrations. OSHA believes that this reduced limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for ethyl silicate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

HEXACHLOROBUTADIENE
CAS: 87–68–3; Chemical Formula: $CCl_2=CCl-CCl=CCl_2$
H.S. No. 1195

OSHA has no current limit for hexachlorobutadiene (HCBD). The ACGIH recommends a TLV–TWA of 0.02 ppm with a skin notation, and classifies this substance as a suspected human carcinogen (A2). Hexachlorobutadiene is a heavy, clear liquid.

Hexachlorobutadiene has a moderate-to-high acute oral toxicity. The LD_{50}s reported for mice, rats, and guinea pigs are 87, 350, and 90 mg/kg, respectively (Murzakev 1964). Gulko and co-workers reported LD_{50} values of 116 mg/kg for mice and 270 mg/kg for rats (Gulko, Zimina, and Shroit 1965). Skin absorption has been demonstrated in rabbits (Kociba et al. 1977). The dose range reported to be lethal via skin absorption is comparable to that which is lethal via the oral administration route. A single exposure of 133 to 150 ppm via inhalation has been fatal in rats when the exposure lasts for 4 to 7 hours. All rats survived exposures at 161 ppm for 0.88 hour or 34 ppm for 3.3 hours; similar exposure of guinea pigs and cats to the same concentrations resulted in the death of most animals (Kociba et al. 1977). Another inhalation study in rats showed eye and nose irritation, respiratory difficulty, and damage to kidney tissue and adrenal cortex after two 4-hour exposures at 250 ppm; twelve 6-hour exposures to 100 ppm caused eye and nose irritation, respiratory difficulty, weight loss, anemia in the female animals, and kidney and adrenal damage; fifteen 6-hour exposures at 25 ppm caused retarded weight gain in females, respiratory difficulty, and kidney damage; fifteen 6-hour exposures at 10 ppm caused retarded weight gain in females but no systemic injury; and fifteen 6-hour exposures at 5 ppm resulted in no adverse effects (Gage 1970).

Reproductive studies in male and female rats demonstrated multiple toxicological effects, including kidney damage in both sexes and increased liver weight in males, at the high dose level of 20 mg/kg/day. Dietary administration of 20, 2, or 0.2 mg/kg daily had no effect on conception percentages, gestational survival, neonatal survival, neonatal sex ratio, neonatal morphology, or neonatal body weights (except for the high-dose neonates) (Schwetz et al. 1977). Results of lifetime dietary studies suggest that the no effect level for hexachlorobutadiene in rats is 0.2 mg/kg/day, that a clear dose-response relationship exists for HCBD-induced toxicity affecting primarily the kidney, and that carcinogenic effects (i.e., renal neoplasms) result from ingestion of 20 mg/kg/day (Kociba et al. 1977). These authors also reported that HCBD-induced neoplasms occur only at HCBD doses higher than those causing discernible renal injury. The ACGIH states that "HCBD would seem to qualify as a carcinogen of intermediate potency" (ACGIH 1986, p. 299).

OSHA is proposing an 8-hour TWA limit of 0.02 ppm, with a skin notation, for this hazardous substance. Assuming a 10-m^3 per day breathing volume per 8-hour workshift and a 70-kg body weight for humans, this limit corresponds to a daily intake of approximately 0.03 mg/kg. This is about 10 times below the observed no-effect level in rats fed hexachlorobutadiene. The Agency preliminarily concludes that the proposed limit of 0.02 ppm will protect workers exposed to HCBD from the risks of eye, skin, and pulmonary irritation, kidney damage, and renal neoplasms potentially associated with exposure to HCBD at the levels

permitted in the absence of any OSHA limit. In addition, the proposed skin notation will prevent the systemic toxicities that can occur as a result of dermal absorption of HCBD. The health evidence forms a reasonable basis for proposing a new limit for hexachlorobutadiene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL ISOBUTYL KETONE
CAS: 108-10-1; CHEMICAL FORMULA: $CH_3COCH_2CH(CH_3)_2$
H.S. No. 1203

OSHA's current 8-hour TWA standard for methyl isobutyl ketone (MIBK) is 100 ppm. The ACGIH has established a TLV-TWA of 50 ppm and a 15-minute STEL of 75 ppm for this substance. NIOSH recommends a TWA of 50 ppm for MIBK, which is a clear liquid with a characteristic odor.

A 4-hour exposure to 4000 ppm killed all exposed rats, but a similar exposure to 2000 ppm was not fatal to these animals (Smyth et al. 1951). Guinea pigs exposed to a MIBK concentration of 10,000 ppm immediately showed signs of irritation (Specht et al. 1940, as cited in ACGIH 1986, p. 402).

MacEwen, Vernst, and Haun (1971) exposed rats, mice, dogs, and monkeys to 100 or 200 ppm MIBK for two weeks and noted no signs of intoxication; however, rats exposed to 100 ppm had heavier kidneys and higher kidney-to-body-weight ratios, and, at 200 ppm, livers were heavier as well. Postmortem examination revealed nephrosis of the proximal tubules.

The same authors (MacEwen, Vernst, and Haun 1971), exposed rhesus monkeys, dogs, and rats continuously for 90 days to MIBK concentrations of 100 ppm. These authors observed no significant changes in clinical chemistry or blood test results, although the rats had heavier kidneys and livers, reversible hyaline dioplet degeneration of the proximal tubules of the kidneys, and some necrosis of the tubules.

Silverman and co-workers (1946) determined that the maximum dose of MIBK tolerable to human volunteers for 8 hours was 100 ppm; at 200 ppm, these subjects found the odor of MIBK objectionable and the vapor irritating. Linair and co-workers (1964) reported that more than half of all workers exposed to 500 ppm of MIBK for 20 to 30 minutes daily, and perhaps to 80 ppm for the remainder of the shift, experienced weakness, loss of appetite, headache, burning eyes, nausea, vomiting, and sore throat; several of these workers also reported insomnia, somnolence, heartburn, and intestinal pain. Some workers had enlarged livers and others had colitis. Clinical test results on these workers were normal.

In a follow-up study on this same group of centrifuge operation workers, Armeli and co-workers (1968) determined that reduction of MIBK levels during the 15 to 30 minutes of centrifuge operation to 100 to 105 ppm, and, for the remainder of the shift, to 50 ppm, had also significantly reduced the symptomatology reported earlier by these workers. However, liver enlargement persisted in two workers, and a few workers continued to report gastrointestinal and nervous system effects.

Elkins (1959) noted that exposure to 100 ppm during boot waterproofing operations caused workers to develop headache and nausea; another similarly exposed group experienced only irritation at 100 ppm.

OSHA is proposing an 8-hour TWA of 50 ppm and a 15-minute STEL of 75 ppm for methyl isobutyl ketone. The Agency preliminarily concludes that these limits will work together to protect workers from the risk of headache, nausea, and irritation, as well as potential kidney and liver effects, determined to be associated with exposures to the levels permitted at a 100-ppm TWA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl isobutyl ketone if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusion for Both Liver and Kidney Toxins

The health effects associated with occupational exposure to the hepato- and nephrotoxins shown in Tables C4–1 and C4–2 can be acute or chronic, reversible or irreversible, temporarily disabling or threatening to life. Workers experiencing chemically induced hepatotoxic or nephrotoxic effects may have enlarged livers, high blood pressure, hormonal imbalances, and/or organ necrosis. The health evidence forms a reasonable basis for proposing new or revised limits for the substances in this section. At the time of the final rule, OSHA will establish new or revised limits if the Agency determines that significant risk will be thereby reduced.

5. Substances for Which Proposed Limits Are Based on Avoidance of Ocular Effects

Introduction

Five of the chemicals for which OSHA is proposing limits have the potential to cause serious ocular effects. Certain chemicals in this group are also sensory irritants and are distinguished from other such irritants by their ability to cause permanent damage to the corneas, lenses, or optic nerves of exposed individuals.

Table C5–1 lists these five chemicals, along with OSHA's current PEL, the NIOSH REL, the ACGIH TLV, and the chemical's CAS number and HS number. In two cases, the proposed 8-hour PELs correspond to the current ACGIH TLV-TWAs for these substances. For one substance, methyl alcohol, OSHA is proposing to retain the existing 8-hour TWA and to add a STEL. In the case of methyl silicate, the Agency proposes to add an 8-hour PEL where none formerly existed. For N-ethylmorpholine, the PEL is being reduced from 20 to 5 ppm.

In two instances, the ACGIH and NIOSH limits differ in some respects. For methyl alcohol, the ACGIH recommends a 200-ppm TWA and a 250-ppm STEL, while NIOSH recommends a 200-ppm TWA and an 800-ppm STEL (15-minute ceiling). For hydrogen sulfide, the ACGIH has established both a STEL and a TWA, while NIOSH recommends only a 10-minute STEL. These differences, and the Agency's decision with regard to them, are discussed further below.

Description of the Health Effects

Damage to the eye caused by exposure to the five chemicals in this group can occur in the form of corneal, lens, retinal, ganglion cell layer, or optic nerve effects. Depending on the severity of the exposure, individual susceptibility, and the particular chemical involved, this damage may be transient, temporarily disabling, or permanently blinding.

Corneal effects. The cornea and conjunctiva are the outer surfaces of the eye and are thus directly exposed to external insults. Since the cornea must maintain transparency to remain functional, scar formation after injury to the cornea can destroy visual function completely. Recent evidence suggests that the transparency of the cornea is maintained by thin inner and outer

boundary layers and that the death of these layers leads to loss of transparency (Potts 1986). The corneal epithelium (outer layer) sometimes regenerates, depending on the depth of the burn or insult and the nature of the toxicant.

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Table C5-1. Substances for Which Limits Are Based on Avoidance of Ocular Effects

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1172 N-Ethylmorpholine	100-74-3	20 ppm TWA, Skin	5 ppm TWA, Skin	--
1209 Hydrogen sulfide	7783-06-4	20 ppm STEL 50 ppm Ceiling	10 ppm TWA 15 ppm STEL	10 ppm Ceiling (10 min)
1252 Methyl alcohol	67-56-1	200 ppm TWA	200 ppm TWA 250 ppm STEL, Skin	200 ppm TWA 800 ppm Ceiling (15 min)
1266 Methyl silicate	681-84-5		1 ppm TWA	--
1282 Naphthalene	91-20-3	10 ppm TWA	10 ppm TWA 15 ppm STEL	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

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Some chemicals, including methyl silicate, produce painful corneal epithelial injuries that have a delayed symptom onset. These substances can continue to cause pain and loss of corneal epithelial cells for several hours after exposure. Typically, there is no discomfort during the actual exposure, but several hours later, the eyes begin to burn, vision blurs, and conjunctival hyperemia, tearing, photophobia, and squinting occur (Grant 1986). Possible mechanisms are enzyme inhibition, denaturing of other proteins, alteration of the DNA, and interference with the mitotic process, so that after a period of exposure, the affected cells die. Although the damaged epithelium may regenerate after this type of injury, the damage can also involve the corneal stroma and endothelium, leading to scarring, vascularization, opacity, and loss of vision. These substances' poor warning properties, i.e., absence of immediate effect, make the establishment of protective exposure limits especially critical for these chemicals.

Exposure to some chemical vapors produces painless edema of the corneal epithelium, which is accompanied by the delayed onset of visual haloes. A chemical that produces these effects is N-ethylmorpholine, a catalyst used to manufacture urethane foam. Painless edema generally occurs in workers who have been exposed for several hours to levels that do not produce discomfort during the exposure itself. The visual effect produced by such exposures consists of the appearance of colored haloes around lights, an effect that is caused by the diffraction of light through the swollen epithelial cells of the eye. Visual haloes are severely distracting and restrict activity substantially, and the mechanism underlying this effect is not well understood (Grant 1986).

Lens effects. The lens is a transparent, avascular tissue surrounded by a thin, collagenous capsule. The major portion of the lens is composed of long, thin fibers that form closely packed, onion-like layers. Transparency is dependent on several factors: A highly ordered cellular arrangement; fiber size, shape, and uniformity; molecular structure; and regularity of fiber packing (Potts 1986). Interference with lens metabolism, transport across cell boundaries, or the integrity of the lens capsule itself can cause a loss of lens transparency and lead to decreased visual acuity (Potts 1986). All such changes in lens transparency are referred to as cataracts.

Retinal effects. The retina is a compact neural structure that is responsible for converting the ocular light image to neural impulses. Because the retina is an internal structure, it is not generally affected by exposure to dust, splashes of liquids, or vapors. However, exposure to certain internally absorbed substances, such as methyl alcohol, may cause changes or lesions in the retina, including retinal edema or hemorrhage. Exposure to a few of these substances can cause acute narrowing of the retinal arteries themselves, which can lead, in turn, to damage to the optic nerve and loss of vision.

Effects on ganglion cell layer and optic nerve. Below the retinal surface layer lies the ganglion cell layer, which is composed of the cell bodies of neurons that extend to the midbrain via the optic nerve. Ganglion cells may be damaged directly when the chemical acts on the cell bodies themselves or secondarily when the toxin destroys the optic nerve. Depending on the severity of the exposure, loss of visual acuity or vision may ensue.

Dose-Response Relationships and Ocular Effects. For most of the chemicals on this list, limits have been established on the basis of health surveys and case reports of occupationally exposed populations. These studies indicate that exposures to concentrations of these substances at levels above the NOE level cause damage or pain to the eyes of exposed workers. In some cases only limited human data are available, and evidence from animal studies or knowledge of a chemical's structural analogy to another chemical known to have ocular effects provides the basis for proposing the limit. Animal models are generally good predictors of ocular effects in humans because the eyes of rodents, especially those of guinea pigs and rabbits, closely resemble human eyes. Thus, animal studies of the effects of acid burns on the eye can be relied on to predict accurately how the chemicals that produce these effects in animals will behave in workers exposed in industrial situations. OSHA's preliminary findings and the available toxicologic data for the chemicals in this group are described below.

N-ETHYLMORPHOLINE
CAS: 100-74-3; Chemical Formula: $C_6H_{13}NO$
H.S. No. 1172

The current OSHA 8-hour TWA PEL is 20 ppm, and the ACGIH TLV is an 8-hour TWA of 5 ppm; both limits have skin notations. NIOSH has no REL for ethylmorpholine. N-Ethylmorpholine is a severe eye irritant. Prolonged exposure to fairly low concentrations of ethylmorpholine causes corneal edema, blue-gray vision, and colored haloes. Typically, vision becomes misty and haloes appear a few hours after workers have been exposed to vapors for a period of hours. Distortion of vision can occur even at levels considerably lower than those that cause irritation (Mastromatteo 1965).

Reversible corneal edema has been observed in workers exposed to 40 ppm or more of ethylmorpholine for several hours (Dernehl 1966). Workers routinely exposed to 3 to 4 ppm and never exposed to concentrations above 11 ppm complained of haloes and foggy vision as well as drowsiness (ACGIH 1987). The irritant effects of N-ethylmorpholine were also seen in a controlled- exposure experiment on volunteer subjects. Ten subjects exposed for 2.5 minutes to 100 ppm experienced irritation of the eyes, nose, and throat; those exposed for 2.5 minutes to 50 ppm experienced slight irritation; and no irritation was reported after exposure for 2.5 minutes to 25 ppm (ACGIH 1986).

OSHA's current 20-ppm PEL for N-ethylmorpholine does not protect exposed workers against the occurrence of corneal edema, workers are especially likely not to be aware of the danger of exposure to N-ethylmorpholine because corneal edema is painless as it is developing and has a delayed onset, and thus no warning occurs during the actual exposure itself. In addition, the effects on visual function of repeatedly exposing the eyes to episodes of corneal edema are not known. OSHA therefore preliminarily concludes that reducing the PEL to 5 ppm as an 8-hour TWA (with a skin notation) is necessary to improve the protection of occupationally exposed individuals from ethylmorpholine's injurious effects on the eyes. This reduction in the PEL will reduce the risk of corneal edema, visual distraction, and impaired vision associated with exposure to this substance. The health evidence forms a reasonable basis for proposing a new limit for N-ethylmorpholine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

HYDROGEN SULFIDE
CAS: 7783-06-4; Chemical Formula: H_2S
H.S. No. 1209

OSHA's current limits (based on an earlier ANSI standard) for hydrogen sulfide are a 20-ppm STEL (10-minute maximum duration) and a 50-ppm peak limit. The ACGIH has established a TLV of 10 ppm TWA and a 5-ppm STEL for hydrogen sulfide. NIOSH has recommended a 10-minute limit of 10 ppm. Hydrogen sulfide is widely used as

an analytical reagent and in the manufacture of heavy water. However, occupational exposure to hydrogen sulfide occurs most frequently when it is encountered in natural oil or gas deposits or as a byproduct in chemical reactions.

The ACGIH cites several reports (Brieger 1964; Kranenburg and Kessner 1941; Elkins 1950; Masure 1963) of the occurrence of adverse ocular effects, including conjunctivitis, associated with exposure to 20 ppm or less of hydrogen sulfide. The ACGIH also cites a publication by Poda (1966), who reported that the voluntary adoption of 10 ppm as a limit in two heavy-water plants proved to be a satisfactory limit. Based on this information, the ACGIH recommended 10 ppm as a TLV–TWA and 15 ppm as a TLV–STEL.

In recommending a 10-minute limit of 10 ppm for hydrogen sulfide, NIOSH also cited the Poda (1966) report. In addition, NIOSH relied on many of the same studies cited by the ACGIH (1986) to demonstrate the occurrence of ocular damage and eye irritation at exposure levels below 20 ppm. In discussing the ocular effects of hydrogen sulfide exposure, NIOSH (1977i) points out that the effects are predominately acute and, although there are no reports of permanent eye damage, recovery may require several days' absence from work. NIOSH also cites a study done by Flury and Zernik (1931) that reported a case of enduring conjunctivitis in a person exposed to 10 to 15 ppm hydrogen sulfide for 6 hours.

OSHA preliminarily concludes that the current 20-ppm (10-minute) short-term limit and 50-ppm peak limit are inadequate to ensure worker protection against the adverse ocular effects associated with exposure to concentrations of less than 20 ppm hydrogen sulfide, as reported in several studies. OSHA believes that the eye irritation and conjunctivitis associated with such exposures represent a risk to workers, who will be forced to seek medical treatment after exposure and who may also be absent from work. OSHA is proposing to reduce its current limits for hydrogen sulfide to 10 ppm as a TWA and 15 ppm as a STEL. The limit being proposed by OSHA for hydrogen sulfide is a level that has been found to be effective in preventing such effects in the workplace (Poda 1966). Promulgating the proposed limit for hydrogen sulfide will substantially reduce the risk of adverse ocular effects that can occur as a consequence of exposure at the Agency's existing Z table limits. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for hydrogen sulfide if the Agency determines that this limit will substantially reduce significant risk.

METHYL ALCOHOL
CAS: 67–56–1; Chemical Formula: CH_3H
H.S. No. 1252

The OSHA 8-hour TWA limit for methyl alcohol is 200 ppm. The ACGIH has established a 200-ppm TWA and a 250-ppm STEL for methyl alcohol, with a skin notation. NIOSH recommends the same 8-hour limit as the ACGIH, but would supplement the TWA with an 800-ppm rather than a 250-ppm STEL (15-minute ceiling). Methyl alcohol is a widely used industrial solvent whose principal toxic effects are headaches, loss of vision, conjunctivitis, and other adverse effects.

Workers exposed to concentrations of methyl alcohol between 200 and 375 ppm experience severe recurrent headaches, and at levels between 1200 and 8300 ppm, studies by Kingsley and Hirsch (1954; 1955) report that their visual capacity is diminished. The ACGIH recommends the addition of a 250-ppm STEL because it believes that an 8-hour PEL of 200 ppm does not ensure that workers may not be exposed to short-term peaks above the 200 to 375 ppm levels that have been shown to cause severe recurrent headaches in exposed workers.

OSHA believes that observance of the current 200-ppm TWA, supplemented by the proposed STEL of 250 ppm and a skin notation, will eliminate or substantially reduce the risk of severe and recurring headaches and other symptoms potentially associated with industrial exposures to methyl alcohol at such peaks. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

METHYL SILICATE
CAS: 681–84–5; Chemical Formula: $(CH_3O)_4Si$
H.S. No. 1266

Methyl silicate damages the cornea and produces a delayed response. The current Z tables have no limit for methyl silicate. The ACGIH recommends a 1 ppm 8-hour TWA TLV, and NIOSH has no REL for this substance.

In many cases of methyl silicate exposure, the eyes recover completely, but there are reports of damage to the deep layers of the cornea that caused permanent opacification and, in one worker, loss of the vision in one eye (Grant 1986). It is estimated that exposing humans to methyl silicate at concentrations of 200 to 300 ppm for 15 minutes will produce minimal lesions, and that exposure to 1000 ppm for this period will produce injury requiring hospitalization (ACGIH 1986).

Rabbits exposed to 1000 ppm of methyl silicate in dry air experienced delayed eye burns (ACGIH 1986). Exposure of these animals to approximately 15,000 ppm for 5 minutes caused eye burns, but exposure to this level for 4 minutes caused no appreciable effect. Guinea pigs, which are the test animals with the most sensitive eyes, showed maximum no-effect levels of 135 ppm for 15 minutes, 90 ppm for 1 hour, and 20 ppm for eight 1-hour periods. The latency period for ocular changes was 16 hours for serious effects and up to 3 days for mild involvement (ACGIH 1986). The ACGIH applied a safety factor to the NOEL observed in guinea pigs and established a 1-ppm TWA.

OSHA is proposing a 1-ppm 8-hour limit to reduce the risk of potentially severe ocular effects associated with the uncontrolled occupational exposures currently permitted in the workplace. The health evidence forms a reasonable basis for proposing a new limit for methyl silicate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

NAPHTHALENE
CAS: 91–20–3; Chemical Formula: $C_{10}H_8$
H.S. No. 1282

OSHA's current exposure limit for naphthalene is 10 ppm as an 8-hour TWA. The ACGIH has established a 10-ppm 8-hour TWA and a 15-ppm 15-minute STEL for this substance, which occurs as a colorless-to-brown solid and has the odor of mothballs.

The oral LD_{50} in rats is 1760 mg/kg (Flury and Zernik 1931).

In humans, the inhalation of naphthalene vapor causes headache, loss of appetite, and nausea (Flury and Zernik 1931; Patty 1949). These authors also report that exposure causes optical neuritis, corneal damage, and kidney injury. Eight of 21 workers exposed for 5 years to unspecified levels of naphthalene developed opacities of the lens of the eye (Ghetti and Mariani 1956). Ingestion of large amounts of naphthalene causes severe hemolytic anemia and hemoglobinuria (Stokinger and Mountain 1963).

The lethal dose in humans has been reported as 50 mg/kg (NIOSH 1977). Concentrations somewhat above 15 ppm are reported to cause marked eye irritation (Robbins 1951).

OSHA is proposing an 8-hour TWA of 10 ppm and a 15-minute STEL of 15 ppm for naphthalene. The Agency preliminarily concludes that these limits will protect workers from the risks of eye irritation and serious ocular effects potentially associated with exposure to the levels permitted by an 8-hour limit alone. The health evidence forms a reasonable basis for proposing a new limit for naphthalene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

OSHA believes that adoption of the limits being proposed for this group of chemicals, which have the potential to cause adverse ocular effects ranging from transient discomfort to permanent blindness, will substantially reduce the risk of visual impairment associated with exposure to these substances. The toxicological bases for the proposed limits include evidence derived from occupationally exposed workers, results obtained in animal models that have been shown to be excellent predictors of human responses, and, in a few instances, evidence that a chemical having a similar chemical structure produces serious adverse ocular effects. The risks being protected against have serious consequences, both in terms of the health and functional capacity of the exposed workers themselves and the safety and well-being of these workers and their co-workers.

The available health evidence for the substances described in this section forms a reasonable basis for proposing the revision or addition of these limits. At the time of the final rule, OSHA will promulgate revised or new limits for these substances if the Agency determines that these limits will reduce significant risk.

6. Substances for Which Proposed Limits Are Based on Avoidance of Respiratory Effects

Introduction

Limits are being proposed for a total of 32 substances or materials for which exposure has been shown to cause adverse respiratory effects. The chemicals in this group cause acute pulmonary edema, alveolar damage, or chronic respiratory damage through the general mechanisms of cellular damage or fibrosis. At sufficient doses, these effects can be permanent, disabling, and life-threatening.

Some of the materials in this group are composites of naturally occurring minerals, and for these, the Agency is proposing limits based on the most hazardous component. For several materials (coal dust, crystalline tripoli, silica, and graphite), OSHA proposes that the TWA be measured as the respirable quartz fraction of the dust, because it is exposure to this fraction that presents the greatest risk to exposed workers. In cases where only a portion of the dust is in the form of a respirable dust, OSHA is proposing limits that are to be measured as the respirable fraction rather than as total dust.

Table C6–1 lists the 32 substances in this group, along with the current OSHA PELs, ACGIH TLVs, NIOSH RELs, CAS numbers, and OSHA HS numbers. There is no current OSHA PEL for ten of these substances. For 15 substances, OSHA is proposing to replace its existing TWA–PELs with different TWA–PELs. For one substance, OSHA is proposing to establish a ceiling limit to replace an existing 8-hour TWA, and for three substances, a lower TWA and a new STEL are proposed. In three instances, OSHA is proposing to establish a STEL to augment its current TWA–PELs. NIOSH has recommended limits for 7 substances in this group.

Description of the Health Effects

The respiratory system is a major route of occupational exposure for toxic substances. Because of the vital nature of pulmonary function, respiratory toxicants present a serious health hazard both from acute and chronic exposures. Acute respiratory disease can be life threatening; however, in most cases, such severe effects are associated only with high exposure levels. (One exception to this general rule is exposure to chemicals that can cause allergic sensitization reactions that lead, in turn, to anaphylactic shock; these substances are discussed in a different section of this preamble describing sensitization reactions.)

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C6-1. Substances for Which Limits Are Based on Avoidance of Respiratory Effects

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1017 Aluminum (pyro powders)	7429-90-5	--	5 mg/m^3 TWA	--
1034 Bismuth telluride (Se-doped)	1304-82-1	--	5 mg/m^3 TWA	--
1080 Chlorine dioxide	10049-04-4	0.1 ppm TWA	0.1 ppm TWA 0.3 ppm STEL	--
1093 Chromium metal	7440-47-3	1 mg/m^3 TWA	0.5 mg/m^3 TWA	--
1096 Coal dust, < 5% quartz	None	2.4 mg/m^3 TWA[a]	2 mg/m^3 TWA[a]	--
1097 Coal dust, > 5% quartz	None	$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	0.1 mg/m^3 TWA[b]	--
1161 Ethyl acrylate	140-88-5	25 ppm TWA, Skin	5 ppm TWA 25 ppm STEL, Skin	--
1177 Ferrovanadium dust	12604-58-9	1 mg/m^3 TWA	1 mg/m^3 TWA 3 mg/m^3 STEL	1 mg/m^3 TWA
1190 Grain dust (oat, wheat, barley)	None	--	4 mg/m^3 TWA	--

C6-1. Substances for Which Limits Are Based on Avoidance of Respiratory Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1191 Graphite, natural, respirable < 1% quartz	7782-42-5	15 mppcf TWA	2.5 mg/m^3 TWA	—
1213 Indium & compounds	7440-74-6	—	0.1 mg/m^3 TWA	—
1215 Iron oxide (dust and fume)	1309-37-1	10 mg/m^3 TWA	5 mg/m^3 TWA	—
1272 Methylene bis (4-Cyclohexyliso-cyanate)	5124-30-1	-	0.01 ppm Ceiling	—
1276 Mica	12003-38-2	20 mppcf TWA	3 mg/m^3 TWA	—
1289 Nitrogen dioxide+	10102-44-0	5 ppm Ceiling	3 ppm TWA 5 ppm STEL	1 ppm Ceiling (15 min)
1300 Oxygen difluoride	7783-41-7	0.05 ppm TWA	0.05 ppm Ceiling	—
1301 Ozone	10028-15-6	0.1 ppm TWA	0.1 ppm TWA 0.3 ppm STEL	—
1303 Paraquat, respirable dust	4685-14-7	0.5 mg/m^3 TWA, Skin	0.1 mg/m^3 TWA	—

C6-1. Substances for Which Limits Are Based on Avoidance of Respiratory Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1354 Silica, crystalline cristobalite	14464-46-1	1/2 value calculated for quartz	0.05 mg/m^3 TWA	50 ug/m^3 TWA
1355 Silica, crystalline quartz, respirable	14808-60-7	$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	0.1 mg/m^3 TWA	50 ug/m^3 TWA
1356 Silica, crystalline tridymite	15468-32-3	1/2 value calculated for quartz	0.05 mg/m^3 TWA	50 ug/m^3 TWA
1357 Silica, crystalline tripoli (as quartz dust)	1317-95-9	$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	0.1 mg/m^3 TWA	50 ug/m^3 TWA
1358 Silica, fused	60676-86-0	$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	0.1 mg/m^3 TWA	—
1363 Soapstone, total dust	None	20 mppcf TWA	6 mg/m^3 TWA	—
1363A Soapstone, respirable dust	None	20 mppcf TWA	3 mg/m^3 TWA	—
1375 Sulfur dioxide	7446-09-5	5 ppm TWA	2 ppm TWA 5 ppm STEL	0.5 ppm TWA
1378 Sulfur tetrafluoride	7783-60-0	—	0.1 ppm Ceiling	—
1381 Talc (non-asbestiform)	14807-96-6	20 mppcf TWA	2 mg/m^3 TWA	—

C6-1. Substances for Which Limits Are Based on Avoidance of Respiratory Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1395 Tin oxide	18282-10-5	-	2 mg/m^3 TWA	--
1409 Trimellitic anhydride	552-30-7	-	0.005 ppm TWA	--
1430A Wood dust, hard wood	--	-	1 mg/m^3 TWA	--
1430B Wood dust, soft wood	--	-	5 mg/m^3 TWA 10 mg/m^3 STEL	-- --

[a] For coal dust, respirable fraction less than 5 percent SiO_2.

[b] For coal dust, respirable fraction more than 5 percent SiO_2.

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed limit is the NIOSH REL.

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Chronic pulmonary disease can result from long-term exposure to respiratory toxicants and is potentially crippling because it greatly reduces the quality of life and the productivity of its victims. In addition, the onset of respiratory disease can be insidious, because it may be indicated only by the gradual development of a few nonspecific signs (Petersdorf et al. 1983).

The difficulties of detecting irreversible respiratory effects complicate the prevention of pulmonary disease. Pulmonary function can be evaluated with a variety of tests, including measurements of the vital capacity and of the resting and forced expiratory volumes. However, certain conditions, including emphysema and fibrosis, are difficult to diagnose even with such tests. In addition, these same diseases often continue to progress even after the affected individual has recognized the problem and obtained medical assistance. Furthermore, these diseases may continue to progress even after exposure has ceased, which makes prevention even more vital.

In addition to the threat posed to the general occupational population by respiratory toxins, certain subpopulations, such as persons with impaired lung function caused by asthma, bronchitis, emphysema, and pulmonary fibrosis, are at special risk from the adverse effects of respiratory toxins. Tobacco smoking can cause or aggravate all of the respiratory conditions discussed above and can interact additively or synergistically with respiratory toxins to increase their adverse effects on the pulmonary system. For example, tobacco smoking acts additively with coal dust to diminish pulmonary function. Because tobacco smoke contains nitrogen oxides, cadmium, and ammonia, occupationally exposed workers who smoke have an additional source of exposure to these respiratory toxins (U.S. HEW 1979).

Two general categories of lung injuries are relevant to the group of substances under consideration:

- Damage to cells lining the airways, which results in necrosis (localized areas of dead cells), increased permeability, and edema.
- Production of fibrosis, which may become massive and greatly reduce lung capacity.

Cellular damage resulting in edema and emphysema. A number of substances cause damage to cells lining the airways. This can result in increased permeability of cell membranes and subsequent edema, hemorrhage, and localized necrosis (areas of dead cells). Chronic inhalation of certain chemicals causes destruction of the alveolar septa and results in emphysema. Cellular damage may be either localized or diffuse, depending on the distribution of the toxicant in the lung.

Edema is the release of fluid into the lumen (open spaces of the airways) or alveoli. Serious edema can take several hours to develop so that, in some cases, life-threatening or even fatal exposures can take place without the individual's being aware at the time of exposure of the extent of the damage. Ozone, nitrogen dioxide, and paraquat all cause localized cellular damage leading to edema (Klaassen et al. 1986). Fatalities from pulmonary edema have resulted from exposures to concentrations of nitrogen dioxide of about 200 ppm (Sax 1984). Paraquat is unusual in that it can cause delayed pulmonary damage following exposure, even when exposure occurs via routes other than inhalation (Klaassen et al. 1986).

Necrotic changes can reduce the functional surface area of the lung. One type of lesion often noted in persons exposed to respiratory toxins is benign granulomas, which are localized masses formed when the immune system attempts to sequester a foreign object. Depending on the extent of the damage, these masses may reduce the functional capacity of the lung. Exposure to selenium-doped bismuth telluride has been associated with the production of benign granulomas without fibrosis (Wagner et al. 1974).

Emphysema is caused by a gradual destruction of the cells of the alveolar septa, which causes a loss of elasticity in the lung. A slight degree of emphysema is present in much of the adult population and does not cause any functional impairment. As the disease progresses, however, serious and life-threatening reductions in functional capacity can occur. Once the disease has advanced to the point of serious functional impairment, it is, for the most part, irreversible (Petersdorf et al. 1983). There is evidence that a number of the substances in this group cause emphysema, including sulfur tetrafluoride (ACGIH 1986), ozone, and nitrogen dioxide (Klaassen et al. 1986).

Fibrotic changes. Pulmonary fibrosis was one of the earliest recognized forms of occupational disease. Fibrosis should be distinguished from pneumoconiosis, although these terms are often used interchangeably. Pneumoconiosis is a more general term indicating the presence of a foreign substance in the lung, as determined by radiographic (X-ray) analysis. This definition encompasses a variety of conditions and does not by itself necessarily indicate functional damage (Petersdorf et al. 1983). In contrast, fibrosis is a seriously debilitating disease. One type of fibrosis is interstitial fibrosis, which is a kind of pneumoconiosis characterized by deposition of fibrous tissue in the interstitial spaces between the alveolar membrane and the pulmonary capillary membrane. Interstitial fibrosis greatly reduces the diffusing capacity of the lung and thus causes oxygen deprivation in the body (Guyton 1981). Like emphysema, fibrosis is largely irreversible; it sometimes progresses even in the absence of further exposure (Petersdorf et al. 1983).

Silicosis is a form of interstitial fibrosis that is caused by exposure to respirable silica particles (Klaassen et al. 1986). Exposure to coal dust causes a pneumoconiosis with fibrosis that can be severely debilitating (Petersdorf et al. 1983). In addition, exposure to graphite, mica, and grain dust have all been associated with fibrosis in workers (ACGIH 1986).

Dose-Response Relationships and Respiratory Effects

For most of the substances in this group, permissible exposure limits have been based on health surveys and case reports of occupationally exposed populations. In some cases, animal studies provide the evidence of a substance's toxicity. As is the case for most of the substances for which OSHA is proposing new, reduced, or revised limits, the dose-response curve for respiratory irritants tends to be S-shaped.

Table C6–2 presents dose-response data on the adverse pulmonary effects of representative chemicals in this group, the populations exposed, and the endpoints observed. The following discussions of respiratory toxins present OSHA's preliminary findings for all the substances on Table C6–1 and describe the nature of the risks faced by workers exposed to them.

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TABLE C6-2. Summary of Dose-Response Evidence for Adverse Respiratory Effects

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***	Dose-Response Data: Dose/Duration Associated With Observed Effects	Species	Comments
1034 Bismuth telluride (Se-Doped)	1304-82-1		5 mg/m^3 TWA	-	15 mg/m^3 1 year	Dogs Rats Rabbits	Granulomatous lesions in lungs seen after 6 months of exposure.
1096 Coal Dust, < 5% quartz	None	2.4 mg/m^3 TWA	2 mg/m^3 TWA	-	4 mg/m^3 35 years	Humans	Calculated estimate of 10 percent probability of developing pneumoconiosis with fibrosis after 35 years of exposure to coal dust. (Quartz content not identified.)
1097 Coal Dust, > 5% quartz	None	$\frac{10 \text{ mg/m}^3}{\% \text{ SiO}_2+2}$	0.1 mg/m^3 TWA	-			
1190 Grain Dust (oat, wheat, barley)	None		4 mg/m^3 TWA	-	20 mg/m^3	Humans	Chronic bronchitis, shortness of breath, reduced pulmonary function.
					13.9 mg/m^3	Humans	Increased incidence of respiratory symptoms.
					4 mg/m^3	Humans	No increased incidence of respiratory symptoms.
						Humans	Fibrosis and mottling, pneumoconiosis.
1191 Graphite, natural, respirable	7782-42-5	15 mppcf TWA	2.5 mg/m^3 TWA	-	N/A	Humans	Anthracosilicosis, similar to that seen in coal miners.

N/A = Not available.

TABLE C6-2. Summary of Dose-Response Evidence for Adverse Respiratory Effects (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***	Dose-Response Data: Dose/Duration Associated With Observed Effects	Species	Comments
1213 Indium & compounds	7440-74-6	-	0.1 mg/m^3 TWA	-	24-97 mg/m^3	Rats	Widespread alveolar edema following exposure to In_2O_2.
1276 Mica[1]	12003-38-2	20 mppcf TWA	3 mg/m^3 TWA	-	N/A	Humans	Signs and symptoms resembling silicosis and pneumoconiosis in 8 of 57 workers.
1289 Nitrogen dioxide*	10102-44-0	5 ppm Ceiling	3 ppm TWA 5 ppm STEL	1 ppm ceiling (15 min)	N/A	Humans	Fatal pulmonary edema.
					0.4-2.7 ppm Chronic	Humans	Change in pulmonary vital capacity.
1300 Oxygen difluoride	7783-41-7	0.05 ppm TWA	0.05 ppm Ceiling	-	0.5 ppm two 7-hr exposures	Lab. Animals	Lethal to a wide variety of laboratory species, causing pulmonary edema and hemorrhage after several hours of exposure.
1301 Ozone	10028-15-6	0.1 ppm TWA	0.1 ppm TWA 0.3 ppm STEL		1.5 ppm 3 hrs/day	Humans	Significant reduction in pulmonary vital capacity.
					1 ppm 1 day	Mice	Damage to alveolar tissue.
1303 Paraquat, respirable dust	4685-14-7	0.5 mg/m^3 TWA, Skin	0.1 mg/m^3 TWA	-	N/A	Humans	69 accidental deaths from pulmonary injury reported through 1972.

[1]Measured as total dust.

TABLE C6-2. Summary of Dose-Response Evidence for Adverse Respiratory Effects (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***	Dose-Response Data: Dose/Duration Associated With Observed Effects	Species	Comments
1354 Silica, crystalline Cristobalite	14464-46-1	1/2 value for quartz	0.05 mg/m^3 TWA	50 ug/m^3 TWA	0.5 mg/m^3 (as total dust) 2.5 years	Dogs	Cellular infiltration of lung and fibrotic nodules in pulmonary lymph nodes.
1355 Silica, crystalline quartz, respirable	14808-60-7	$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	0.1 mg/m^3 TWA	50 ug/m^3 TWA	0.1 mg/m^3 chronic	Humans	Accelerated loss of pulmonary function over effects of aging alone.
1356 Silica, crystalline Tridymite	15468-32-3	1/2 value for quartz	0.05 mg/m^3 TWA	50 ug/m^3 TWA	N/A	Rats	Most active form of free silica when administered by intratracheal injections.
1357 Silica, crystalline Tripoli (as quartz dust)	1317-95-9	$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	0.1 mg/m^3 TWA	50 ug/m^3 TWA	N/A	Lab. Animals	Progressive nodular fibrosis.
1375 Sulfur dioxide	7446-09-5	5 ppm TWA	2 ppm TWA 5 ppm STEL	0.5 ppm TWA	1 ppm	Humans	Accelerated loss of pulmonary function predicted based on data in smelter workers.

TABLE C6-2. Summary of Dose-Response Evidence for Adverse Respiratory Effects (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***	Dose-Response Data: Dose/Duration Associated With Observed Effects	Species	Comments
1378 Sulfur tetrafluoride	7783-60-0	--	0.1 ppm Ceiling	-	4 ppm 4 hrs/day/ 10 days	Rats	Emphysema, marked clinical signs of respiratory impairment.
1409 Trimellitic anhydride	552-30-7	-	0.005 ppm TWA	-		Rats	Intra-alveolar hemorrhage. (No exposure duration indicated.)

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed limit is the NIOSH REL.

BILLING CODE 4510-26-C

ALUMINUM (PYRO POWDERS)
CAS: 7429-90-5; Chemical Formula: Al
H.S. No. 1017

OSHA currently has no permissible exposure limits for aluminum pyro powders. The ACGIH recommends an 8-hour TLV-TWA of 5 mg/m³.

Aluminum pyro powders have a higher reported toxicity than aluminum metal dusts (Stokinger 1981). Several British studies have examined the effects of this finely flaked aluminum on workers in paints and pyrotechnics plants. Their findings revealed that pulmonary fibrosis may result from exposure to pyro powders, although epidemiologic evidence indicated that additives used to prevent oxidation and agglomeration may have contributed to the incidence and nature of the disease (Edling 1961; Jordan 1961; Mitchell 1961). The ACGIH observes that exposures that have previously caused lung changes in workers are presumed to have been extremely high (ACGIH 1986, p. 22).

OSHA preliminarily concludes that the proposed permissible exposure limit of 5 mg/m³ TWA for aluminum pyro powders will prevent the occurrence of lung changes in exposed workers. The health evidence forms a reasonable basis for proposing a new limit for aluminum pyro powders. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BISMUTH TELLURIDE (DOPED)
CAS: 1304-82-1; Chemical Formula: Bi_2Te_3
H.S. No. 1034

OSHA has no current limit for doped bismuth telluride. The ACGIH recommends a TLV-TWA of 5 mg/m³ for Bi_2Te_3 that has been doped with selenium sulfide. Bismuth telluride appears as gray, hexagonal platelets; it is also available as ingots or single crystals.

Wagner and co-workers conducted a 1-year study in which rabbits, dogs, and rats were exposed 6 hours/day, 5 days/week to doped bismuth telluride dust (containing 80.04 mol % Bi_2Te_3 and 0.20 mol % SnTe, plus a small stoichiometric excess of Te) of 1.04 um particle diameter at a mean concentration of 15 mg/m³. Small, granulomatous lesions without fibrosis appeared in the lungs of dogs at 6 months. In dogs that were sacrificed 4 months after an 8-month exposure, the lesions had regressed, and the affected lymph nodes were without cellular reaction. Rabbits exhibited similar histologic effects, but with decreased numbers of pulmonary macrophages, no fibrous tissue proliferation, and no cellular or fibrous tissues reaction around the dust deposits in the lymph nodes. The rats showed fewer granulomas but some areas of epithelialization of the alveolar walls. As was true for the other species, the rats showed neither fibrosis nor cellular reaction in the lymph nodes, despite accumulation of the intermetallic dust (Wagner, Madden, Zimber et al. 1974).

A PEL of 5 mg/m³ TWA is proposed for Se-doped bismuth telluride to prevent the occurrence of pulmonary lesions seen in experimental animals. OSHA believes this limit will reduce the risk of these pulmonary effects. The health evidence forms a reasonable basis for proposing a new limit for doped bismuth telluride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CHLORINE DIOXIDE
CAS: 10049-04-4; Chemical Formula: ClO_2
H.S. No. 1080

OSHA currently has an 8-hour TWA limit of 0.1 ppm for chlorine dioxide. The ACGIH recommends the same time-weighted average and a 15-minute STEL of 0.3 ppm. Chlorine dioxide is a red-yellow gas at ordinary temperatures.

Rats exposed to 0.1-ppm concentrations of chlorine dioxide for 10 weeks at 5 hours daily showed no adverse effects from exposures. Other data in animals are not available (Dalhamn 1957).

Data on human exposures indicate that marked irritation occurs on inhalation of 5 ppm (no time specified) and that one death occurred at 19 ppm (Elkins 1959). Repeated exposures in an exposed individual have been linked to bronchitis and pronounced emphysema (Petry 1954). Clinical studies conducted by Gloemme and Lundgren (1957) revealed that the majority of workers who had been exposed for 5 years to average concentrations of chlorine dioxide below 0.1 ppm, in combination with about 1.0 ppm chlorine, experienced eye and respiratory irritation and slight bronchitis. Some gastrointestinal irritation was also observed in these workers. Gloemme and Lundgren (1957) attributed all of these effects to elevated short-term exposures involving excursions above the 0.1 ppm level. Ferris et al. (1964) have shown that concentrations occasionally ranging as high as 0.25 ppm were associated with respiratory effects in workers concomitantly exposed to chlorine.

OSHA proposes a 0.1-ppm 8-hour TWA and a 15-minute STEL of 0.3 ppm for chlorine dioxide. The Agency preliminarily concludes that both of these limits are necessary to protect exposed workers against the risk of respiratory, skin, and eye irritation known to occur as a result of short-term exposures above the TWA of 0.1 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for chlorine dioxide if the Agency determines that this limit will substantially reduce significant risk.

CHROMIUM, METAL
CAS: 7440-47-3
H.S. No. 1093

OSHA currently has an 8-hour TWA of 1 mg/m³ for chromium metal. The ACGIH has established an 8-hour TWA of 0.5 mg/m³ for this element. NIOSH has no REL for the elemental form of chromium. Chromium is a steel-grey metal.

The ACGIH (1986, p. 139) reports that exposure to chromium metal does not cause pulmonary fibrosis or pneumoconiosis. The ACGIH has established the 0.5-mg/m³ TLV-TWA for this metal on the basis of its low order of toxicity (ACGIH 1986, p. 139), and states that this limit "should be adequate to prevent pulmonary disease or other toxic effects."

OSHA is proposing an 8-hour TWA limit of 0.5 mg/m³ for chromium metal. The Agency preliminarily concludes that this limit will protect against the risk of pulmonary or other toxic effects potentially associated with exposure to chromium. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for chromium metal if the Agency determines that this limit will substantially reduce significant risk.

COAL DUST, <5% QUARTZ
COAL DUST, >5% QUARTZ
CAS: None; Chemical Formula: None
H.S. Nos. 1096 and 1097

OSHA has a current formula limit of 10 mg/m³/% SiO_2 + 2 for coal dust containing a respirable quartz fraction greater than 5 percent, and a 2.4-mg/m³ limit for coal dust containing a respirable quartz fraction of less than 5 percent. The ACGIH recommends a TLV-TWA of 0.1 mg/m³ for the respirable quartz fraction of coal dust containing more than 5 percent quartz, and 2 mg/m³ for the respirable dust fraction of coal dust containing less than 5 percent quartz. Coal is a natural dark brown to black-colored solid formed from fossilized plants.

The National Coal Board of the United Kingdom has calculated the

probabilities of developing pneumoconiosis from various concentrations of coal dust, based on statistical data from the first 10 years of an epidemiologic study (1969). The study involved 4,122 men from 20 coal pits, for whom radiologists compared pairs of chest X-rays taken at 10-year intervals. The radiologists classified the degree of pneumoconiosis observed in the X-rays in accordance with the International Labour Office's (ILO) pneumoconiosis classification scheme. For each of the 20 collieries, data concerning mean respirable dust concentrations at the coal face were analyzed. Mean coal, carbon, and quartz content of the dust from each of the collieries were also analyzed. Results indicated that the progression of pneumoconiosis correlates significantly with mean respirable dust concentrations and with the respirable quartz fraction of that dust. The carbon content of the dust did not correlate with the development of pneumoconiosis. Estimates of the risk of developing ILO category 2 or greater pneumoconiosis after a 35-year exposure to coal dust containing a respirable quartz fraction of greater than 5 percent quartz were projected to be a 10-percent probability of disease at a concentration of 6.5 mg/m^3, and a zero probability at a concentration of 2.2 mg/m^3. For exposures to coal dust containing a respirable quartz fraction of less than 5 percent quartz, a 10-percent probability of developing ILO category 1 or greater disease was projected at a concentration of 4 mg/m^3, and a zero probability of disease was projected at 1.6 mg/m^3. In 1979, Gormley confirmed these calculations, but reduced the concentration of dust containing more than 5 percent respirable quartz associated with a zero probability of developing pneumoconiosis to 1 mg/m^3 (ACGIH 1986, p. 142).

OSHA proposes an 8-hour TWA PEL of 0.1 mg/m^3, measured as respirable silica, for coal dust with a respirable quartz fraction containing more than 5 percent quartz, and an 8-hour TWA PEL of 2 mg/m^3 TWA for coal dust with a respirable quartz fraction containing less than 5 percent quartz. The Agency's current formula limit is similar to the 0.1 mg/m^3 limit and, thus, does not represent a change in the limit (see discussion for crystalline silica-quartz below). OSHA is proposing to revise its formula limit for coal dust containing more than 5 percent quartz to 0.1 mg/m^3 to simplify employee exposure monitoring. OSHA also concludes that the reduction in the 8-hour TWA PEL for coal dust containing less than 5 percent quartz will protect exposed workers from the risk of pneumoconiosis at the existing limit for coal dust with this quartz content. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for coal dust if the Agency determines that this limit will substantially reduce significant risk.

ETHYL ACRYLATE
CAS: 140-88-5; Chemical Formula: $CH_2=CHCOOC_2H_5$
H.S. No. 1161

OSHA has a current 8-hour TWA of 25 ppm for ethyl acrylate, with a skin notation. The ACGIH recommends a TLV-TWA of 5 ppm and a TLV-STEL of 15 ppm for ethyl acrylate, which is a colorless liquid. The ACGIH also recommends a skin notation for this substance.

Ethyl acrylate produces irritation of the skin, eyes, mucous membranes, gastrointestinal tract, and respiratory system (Dreisbach 1974). The oral LD_{50} in rats fed this substance is 1020 mg/kg and the 4-hour inhalation LC_{50} for these animals ranges between 1000 ppm and 2000 ppm. In rabbits, the dermal LD_{50} is 1790 mg/kg (Pozzani et al. 1949), and the minimum oral LD_{50} is 280 to 420 mg/kg (Treon et al. 1949). Animal studies also indicate that severe chronic effects may result from exposure to this substance. Rats exposed to levels of 70, 300, or 540 ppm of ethyl acrylate for up to 30 days showed accelerated mortality and pathologic changes in the lungs, liver, and kidneys. In those animals that developed pneumonia, renal and hepatic lesions were also seen. In a parallel study, rats, rabbits and guinea pigs who were subjected to ethyl acrylate concentrations in excess of 75 ppm for fifty, 7-hour inhalation periods exhibited pulmonary edema, degenerative changes in the heart, liver, and kidneys, and death (Treon et al. 1949). Miller et al. (1980) reported that rats and mice exposed to 75 or 225 ppm, 6 hours per day for 30 days, developed nasal lesions and other degenerative inflammatory changes in the nasal structure. In other studies, rats and mice administered 100 or 200 mg/kg ethyl acrylate by gavage 5 times per week for 103 weeks developed inflammation and hyperplasia of the forestomach, in addition to squamous cell carcinomas and papillomas in the same area (NTP 1983, as cited in ACGIH 1986, p. 240). Based on a study by Miller et al. (1985) in which rats and mice exposed to 25 or 75 ppm ethyl acrylate for 6 hours per day, 5 days per week for 27 months developed lesions in the nasal cavity even at the lowest dose, the ACGIH (1986, p. 240) concurs with the American Industrial Hygiene Association (1966) that a 25-ppm limit for ethyl acrylate is too high to prevent irritating effects in exposed humans.

In a study by Nemec and Bauer (1978), human volunteers experienced drowsiness, headache, and nausea after prolonged inhalation exposures at 50 to 75 ppm. Opdyke (1975) reported that the application of a 4-percent concentration of ethyl acrylate produced skin sensitization reactions in 10 out of 24 volunteers.

OSHA is proposing an 8-hour TWA of 5 ppm, a 15-minute STEL, and a skin notation, for ethyl acrylate. The Agency preliminarily concludes that these limits will protect workers from the risk of severe nasal irritation and eye and skin irritation associated with exposure to this substance at the level permitted by OSHA's current limit. The skin notation is necessary to protect against skin sensitization and skin absorption. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethyl acrylate if the Agency determines that this limit will substantially reduce significant risk.

FERROVANADIUM DUST
CAS: 12604-58-9; Chemical Formula: FeV
H.S. No. 1177

OSHA currently has a limit of 1 mg/m^3 for ferrovanadium dust. The ACGIH recommends a TLV-TWA limit of 1 mg/m^3 with a TLV-STEL of 3 mg/m^3. The NIOSH-recommended exposure limit for metallic vanadium is 1 mg/m^3 as a 10-hour TWA. Ferrovanadium dust exists as dark, odorless, solid particles.

Soviet studies in animals showed ferrovanadium dust to be less toxic than vanadium pentoxide. Roshchin (1952) reported that no acute intoxication occurred in animals exposed to ferrovanadium dust at concentrations as high as 10,000 mg/m^3, serious chronic pulmonary changes were observed after short-term exposures (one hour) on alternate days for two months to concentrations in the 1000- to 2000-mg/m^3 range. These pulmonary changes consisted of chronic bronchitis and chronic lung inflammation.

OSHA proposes a PEL of 1 mg/m^3 TWA and a STEL of 3 mg/m^3 for ferrovanadium dust, in order to reduce the risk of chronic pulmonary damage potentially associated with exposures to this substance at the elevated short-term levels permitted by the TWA limit alone. The Agency preliminarily concludes that the proposed TWA and STEL will substantially reduce this risk. The health evidence forms a reasonable

basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ferrovanadium dust if the Agency determines that this limit will substantially reduce significant risk.

GRAIN DUST (OAT, WHEAT, AND BARLEY)
CAS: None; Chemical Formula: None
H.S. No. 1190

A judicial decision has held that there is no OSHA exposure limit for grain dust, and NIOSH also has no REL for this substance. The ACGIH has recommended that worker exposure to grain dust (oat, wheat, and barley) not exceed 4 mg/m³ as total dust.

Exposure to grain dust was reported to result in radiographic changes consistent with pneumoconiosis and fibrosis in 11 of 57 workers handling grain. No exposure information was available (Dunner et al. 1946). Chronic bronchitis was reported in an epidemiologic investigation of workers exposed to concentrations of oat dust ranging from 214 mg/m³ to 308 mg/m³ and of wheat dust ranging from 20.2 to 4:06 mg/m³ (Williams et al. 1964). In a third study by Rankin and do Pico (1980), respirable grain dust concentrations of 20 mg/m³ caused pre- to post-workshift changes of more than 20 percent in the forced expiratory volumes of exposed individuals, indicating reduced lung function. In contrast, lung function changes were infrequent among workers exposed to total grain dust concentrations below 15 mg/m³ (Rankin and do Pico 1980). These same authors reported that grain fever occurred among volunteers exposed to 15 mg/m³ of grain dust for 1 to 3 hours. They also reported a higher incidence of respiratory symptoms among workers exposed to 13.9 mg/m³ TWA. However, acute bronchial symptoms did not appear among workers exposed at or below 4 mg/m³. Although dose response data for grain dusts other than wheat are not available' two recent studies (Darke et al. 1976; Cockcroft et al. 1983) have demonstrated the appropriateness of applying the same PEL to all three of these grain dusts. The work of these authors showed that exposure to any of these dusts produced the same type and degree of respiratory distress.

Based on the observed no-effect level reported by Rankin and do Pico (1966), OSHA is proposing an 8-hour TWA of 4 mg/m³ for grain dust. OSHA preliminarily finds that this PEL for grain dust will greatly reduce the risk of chronic bronchitis, reduced pulmonary function, grain fever, and respiratory symptoms currently faced by workers exposed at uncontrolled levels. The health evidence forms a reasonable basis for proposing a new limit for grain dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

GRAPHITE, NATURAL
CAS: 7782-42-5; Chemical Formula: None
H.S. No. 1191

The current OSHA limit for natural graphite (total dust) is 15 million particles per cubic foot (mppcf), which is equivalent to 2.5 mg/m³ as respirable dust (assuming that respirable mass is one-half total particle mass). The ACGIH has recommended a graphite TLV of 2.5 mg/m³ for respirable dust containing less than 1 percent quartz. Graphite is a mineral substance that is best known for its use as the "lead" in pencils.

Early reports established that graphite deposited in the lungs of occupationally exposed workers caused pneumoconiosis (Koopman 1924). Subsequent research described the condition produced by exposure to graphite as anthracosilicosis, a pulmonary condition similar to that seen in coal miners, based on radiographic and histologic examinations in exposed individuals (Harding and Oliver 1949). The fibrotic changes seen in graphite workers appear to be related to the silica content of the graphite; experimental animals that were administered graphite that did not contain silica did not develop fibrotic changes (Ray et al. 1951), while another study found that graphite containing only a small amount of silica produced fibrotic changes in exposed animals (Ottowicz and Paradowski 1961). Radiologic changes were also observed among graphite mine and production workers exposed to graphite containing from 3.6 to 10 percent silica (Pendergass et al. 1967).

Although the role of silica in the development of pneumoconiosis among graphite workers remains unclear, OSHA preliminarily concludes that the current limit of 15 mppcf (2.5 mg/m³ for the respirable fraction of graphite containing less than 1 percent quartz) will protect employees from pneumoconiosis that may develop from exposure to graphite, whether silica-containing or not. However, OSHA is proposing to revise its limit to 2.5 mg/m³ as respirable dust to simplify the monitoring of employee exposures, because the use of impingers and microscopic analyses are not required to measure exposures that are expressed in mg/m³ rather than mppcf.

INDIUM AND COMPOUNDS
CAS: 7440-74-6; Chemical Formula: In
H.S. No. 1213

There is no current OSHA limit for indium and compounds, and NIOSH does not have a REL for these substances. The ACGIH has recommended that exposures to indium not exceed 0.1 mg/m³ as an 8-hour TWA.

Although there is no direct human evidence of the effects of indium compounds, severe effects have been produced by indium exposures in experimental animals. Rats that inhaled the sesquioxide form of indium at airborne concentrations ranging from 24 to 97 mg/m³ daily for a total of 224 hours developed widespread alveolar edema; these histologic lesions did not change after a 12-week post-exposure period. Exposure of animals to indium reduces alveolar clearance and may be associated with chronic respiratory insufficiency, recurrent acute pneumonitis, and death.

Because of the severity of indium-induced injury and the persistence of such injuries, OSHA preliminarily concludes that, in the absence of an exposure limit, exposed employees are placed at risk of developing chronic lung function impairment. The health evidence forms a reasonable basis for proposing a new limit for indium and compounds. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

IRON OXIDE (DUST AND FUME)
CAS: 1309-37-1; CHEMICAL FORMULA: Fe_2O_3
H.S. No. 1215

OSHA currently has an 8-hour TWA limit of 10 mg/m³ for iron oxide fume. The ACGIH has established a limit of 5 mg/m³, measured as iron, total particulate. The appearance of iron oxide depends on the shape and size of the particles and the amount of combined water (Merck Index 1983, p. 579). The fume of iron oxide is red-brown in color.

Animals exposed to iron oxide or to iron oxide mixed with less than 5 percent silica by inhalation or by intratracheal injection did not develop pulmonary fibrosis (Naeslund 1940; Harding, Grout, Durkan et al. 1950). Inhalation of iron oxide dust did not produce lung cancer in mice (Muller and Erhardt 1956).

The evidence in humans is conflicting. Drinker, Warren, and Page (1935) concluded that exposures to iron oxide fume should be maintained below 10 mg/m³, and a U.S. Department of Labor study (1941) found that exposures below 30 mg/m³ were without adverse effect.

There are several studies, on the other hand, that report chest X-ray abnormalities in miners, welders, silver polishers, electrolytic iron oxide workers, foundry workers, and boiler scalers (Doig and McLaughlin 1936; Stewart and Faulds 1934; Doig and McLaughlin 1948; McLaughlin, Grout, Barries, and Harding 1945; Davidson, as cited in ACGIH 1986, p. 325; Prendergass and Leopold 1945; Dunner and Herman 1944) exposed to iron oxide dust or fume. However, the exposures of many of these workers were mixed and included exposure to varying amounts of silica; some of these workers developed disabling penumoconiosis.

McLaughlin (1951), whose opinion on the subject is widely accepted, found that the presence of iron oxide dust or fume in the lung caused a pigmentation (termed siderosis) that was responsible for the changes seen in exposed individuals' chest X-rays. Siderosis is believed not to progress to fibrosis (Fawcitt 1943; Fleischer, Nelson, and Drinker 1945; Hamlin and Weber 1950).

It is believed that 6 to 10 years of exposure to about 15 mg/m³ of iron oxide is needed before siderosis develops (Fawcitt 1943; Fleischer, Nelson, and Drinker 1945; Hamlin and Weber 1950), although no studies are available to correlate exposure levels with X-ray changes.

Some studies have shown that workers with exposures to iron oxide and such other substances as silica, radon gas, diesel exhaust, core oils, and the thermal decomposition products of synthetic resins (Faulds 1957; Dreyfus 1936; Bidstrup 1959; Boyd, Doll, Faulds, and Leiper 1970; Braun, Guillorm, Pierson, and Sadoul 1960; Monlibert and Roubille 1960; Jorgensen 1973; Muller and Erhardt 1956; Kosela, Hernberg, Karava et al. 1976; Gibson, Martin, and Lockington 1978) have a greater risk of developing lung cancer.

The ACGIH states that, "at this time, it is not generally accepted that exposure to iron oxide dust or fume causes cancer in man" (1986, p. 325). A review of the world literature by Stokinger (1984) concluded that exposure to iron oxide *per se* was not carcinogenic.

OSHA is proposing an 8-hour TWA of 5 mg/m³ for iron oxide dust and fume, measured as total particulate (Fe). The Agency preliminarily concludes that this limit will protect workers from the risk of siderosis and its accompanying generalized pulmonary densities associated with exposure at the existing PEL. The Agency believes that this limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for iron oxide if the Agency determines that this limit will substantially reduce significant risk.

METHYLENE BIS-(4-CYCLOHEXYLISOCYANATE)
CAS: 5124-30-1; Chemical Formula: $C_{15}H_{22}N_2O_2$
H.S. No. 1272

OSHA has no current limit for methylene bis-(4-cyclohexylisocyanate). The ACGIH recommends a TLV ceiling of 0.01 ppm for this alicyclic diisocyanate compound.

Methylene bis-(4-cyclohexylisocyanate) is a pulmonary, skin, and eye irritant. The oral LD_{50} in rats is 9.9 g/kg. A 5-percent solution applied to the skin of guinea pigs produced strong erythema and edema, and rabbits treated with 0.1 mg showed severe skin reactions (Younger Laboratories 1965, as cited in ACGIH 1986, p. 392).

Rats inhaling a lethal concentration of 20 ppm for 5 hours exhibited marked respiratory irritation, tremors, and convulsions during exposure, and their lungs revealed severe congestion and edema after death (E.I. du Pont de Nemours and Company 1976, as cited in ACGIH 1986, p. 392). Repeated inhalation exposure at 0.4 ppm produced initial weight loss in rats; exposure at 1.2 ppm caused respiratory irritation and decreased growth (E.I. du Pont de Nemours and Company 1978). Guinea pigs exposed to 0.12 ppm and mice exposed to 0.65 ppm did not exhibit dermal sensitivity (Stadler and Karol 1984). Unlike toluene diisocyanate, which is a sensory irritant, methylene bis-(4-cyclohexylisocyanate) depresses respiration by producing pulmonary irritation, e.g., an exposed mouse showed a 50-percent decrease in respiration rate, along with lung irritation, when exposed to 3.7 ppm of this substance (weyel and Schaffer 1985).

Human exposures to this compound have resulted in skin sensitization but only infrequently in pulmonary sensitization (Emmett 1976; Israeli et al. 1981).

OSHA is proposing a ceiling limit of 0.01 ppm for methylene bis-(4-cyclohexylisocyanate). The Agency preliminarily concludes that this limit will protect workers against the risk of eye, skin, and pulmonary irritation potentially associated with occupational exposures to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methylene bis-(4-cyclohexylisocyanate). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MICA
CAS: 12001-26-2; Chemical Formula: $K_2Al_4(Al_2Si_6O_{20})(OH)_4$
H.S. No. 1276

OSHA currently has a PEL of 20 mppcf TWA for mica containing less than 1 percent crystalline silica; this limit is equivalent to a 3-mg/m³ limit. The ACGIH recommends a limit of 3 mg/m³ TWA for the respirable dust of mica containing less than 1 percent quartz. Mica is a colorless, odorless, nonflammable, nonfibrous, water-insoluble silicate occurring in plate form and containing less than 1 percent quartz; it includes nine different species.

OSHA proposes an 8-hour TWA limit of 3 mg/m³ for respirable mica dust containing less than 1 percent quartz; this limit corresponds to the existing 20 mppcf PEL and is in keeping with the Agency's decision to delete mppcf values in favor of respirable dust values expressed in mg/m³. The Agency is proposing to express this and other similar limits as mg/m³ to facilitate employee exposure monitoring.

NITROGEN DIOXIDE
CAS: 10102-44-0; Chemical Formula: NO_2
H.S. No. 1289

Both the ACGIH and NIOSH have recommended occupational limits for nitrogen dioxide. The current ACGIH recommendation is for a 3-ppm TWA and a 5-ppm STEL. The NIOSH REL is 1 ppm as a 15-minute short-term limit. OSHA's current PEL is 5 ppm as a ceiling value.

The previous ACGIH TLV of 5 ppm as a ceiling concentration (the basis for the current OSHA limit) was based primarily on the animal studies of Gray et al. (1952 1954) and Wagner et al. (1965). Gray et al. (1952 1954) demonstrated lung injury among rats exposed for 8 or more weeks to an 8 ppm concentration of a mixture of NO_2 and nitric acid, but these authors did not see such lesions in rats exposed for 6 months to 4 ppm concentrations of this mixture. Wagner et al. (1965) reported transient, mild acute effects and no adverse chronic effects in rats exposed to 1 ppm, 5 ppm, or 25 ppm pure NO_2 for 18 months. The ACGIH's recommendation that the 5 ppm TLV be defined as a ceiling rather than an 8-hour TWA was based on reports that NO_2 accelerated lung tumor development among lung-tumor susceptible mice; in the late 1960s, the ACGIH believed that a TLV-ceiling

value would minimize the risk of accelerating lung tumor development.

The current ACGIH TLVs for NO_2 of a 3-ppm 8-hour TWA and a 5-ppm STEL are based on human studies that indicate that normal respiratory function may be compromised at exposures below the current OSHA ceiling limit of 5 ppm NO_2. In particular, Kosmider et al. (1972) reported a slight reduction in vital capacity and maximum respiratory volume in 70 men exposed to 0.4- to 2.7-ppm concentrations of the oxides of nitrogen 6 to 8 hours daily for 4 to 6 years. These authors also reported an unspecified number of cases of chronic bronchitis among men in this group. Another study by Vigdortschik et al. (1937) reported possible cases of chronic bronchitis and emphysema among 127 workers generally exposed below 2.8 ppm NO_2; these workers were also believed to be exposed to sulfuric acid mist at levels sufficient to cause dental erosion.

The NIOSH REL for NO_2 of 1 ppm as a 15-minute STEL is based on the two human studies discussed above, as well as some human studies involving short-term exposure. Abe (1967) found a 40-percent decrease in effective lung compliance among healthy adult males 30 minutes after a 10-minute exposure to 4- to 5-ppm NO_2. Expiratory and inspiratory maximum viscous resistance also increased after exposure. NIOSH (1976c) concluded that Abe's results "document a definite and undesirable effect" at exposures approaching the current OSHA limit. A significant decrease in carbon monoxide diffusing capacity was observed by Von Nieding et al. (1973) in healthy adults exposed to 5 ppm for 15 minutes. NIOSH also cites the work of Von Nieding et al. and Krekeler (1971), who reported significant increases in airway resistance among 88 chronic bronchitis patients after a 15-minute exposure to a concentration of NO_2 as low as 1.5 ppm. NIOSH (1976c) concluded that the specific concentration of NO_2 required to produce pulmonary changes in normal, healthy adults is unknown, but is "likely to be about the same or perhaps a slightly higher concentration than the one inducing pulmonary changes in humans with existing chronic bronchitis" (1.5 ppm). Therefore, NIOSH recommended a 1-ppm 15-minute short-term limit for nitrogen dioxide. To provide additional support for a short term rather than a TWA limit, NIOSH cites several animal studies that indicate that the toxic effects associated with exposure to NO_2 are primarily determined by peak, and not average, concentrations of exposure.

After reviewing the evidence cited by ACGIH (1986) and NIOSH (1976c), OSHA preliminarily concludes that the current 5-ppm ceiling limit for nitrogen dioxide is not sufficient to protect workers against impairment of pulmonary function. The studies by Abe (1967) and by Von Nieding et al. (1973) clearly show that even brief exposures to levels at or just below the current OSHA limit are associated with measurable declines in pulmonary function. The work of Von Nieding et al. and Krekeler (1971) suggests that workers whose respiratory systems are already compromised will be adversely affected during exposures even to lower concentrations of NO_2. Therefore, OSHA believes it necessary to reduce the current occupational exposure limit of NO_2 to reduce this risk, and is proposing to change the limit for nitrogen dioxide to 1 ppm as a 15-minute short-term limit. Human health studies indicate respiratory effects at levels ranging from 0.4 to 2.8 ppm. Health effects have also been observed following short-term exposures ranging from 1.5 to 5.0 ppm. OSHA therefore concludes that the 3-ppm TWA), 5-ppm (STEL) TLV is not sufficiently protective and proposes that a 1-ppm (STEL) be adopted as the PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for nitrogen dioxide if the Agency determines that this limit will substantially reduce significant risk. OSHA's preliminary feasibility analysis is based on limited data at this exposure level; additional feasibility information is requested from the public.

OXYGEN DIFLOURIDE
CAS: 7783-41-7; Chemical Formula: OF_2
H.S. No. 1300

The current PEL for oxygen difluoride is 0.05 ppm as an 8-hour TWA. NIOSH has no REL for this substance. The ACGIH has established a limit of 0.05 ppm as a ceiling value. The revision of the TLV for oxygen difluoride from an 8-hour TWA to a ceiling value reflects the general position of the ACGIH that ceiling TLVs are more appropriate for chemicals that cause acute but not chronic health effects.

Oxygen difluoride is a substance having extremely high acute toxicity; it is an acute irritant and causes fatal pulmonary edema and hemorrhage in animals exposed to 0.5 ppm for a few hours (ACGIH 1986). A single exposure to 0.1 ppm also had an effect on the lung as evidenced by development in animals of a tolerance to the acute effects of this substance after an isolated exposure. Animals acutely exposed to oxygen difluoride have also exhibited gross changes in the kidney and internal genitalia (LaBelle et al. 1945; Lester and Adams 1965).

Because of the extreme acute toxicity of this compound, OSHA believes that the current TWA-PEL of 0.05 ppm is not sufficiently protective of workers, in that this limit would permit brief periods of high exposure (i.e., at 0.5 ppm or more) that have been associated with severe lung damage. Therefore, to reduce the risk of acute lung damage associated with brief excursion exposures to oxygen difluoride, OSHA proposes to revise its 0.05 TWA-PEL to a ceiling value. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for oxygen difluoride if the Agency determines that this limit will substantially reduce significant risk.

OZONE
CAS: 10028-15-6; Chemical Formula: O_3
H.S. No. 1301

The current OSHA PEL for ozone is 0.1 ppm TWA. In the interval since this limit was adopted in 1971, the ACGIH has recommended that 15-minute short-term exposures to ozone not exceed 0.3 ppm. NIOSH has no REL for ozone.

Ozone is highly injurious and lethal in experimental animals at concentrations as low as a few parts per million (Stokinger 1957). A study in which young mice were exposed to 1 ppm ozone for 1 or 2 days reported damage to alveolar tissue (Bils 1970). Human populations chronically exposed to lower concentrations of ozone have been observed to have changes in lung function. In one study, human volunteers exposed to 0.5 ppm ozone for 3 hours a day, 6 days a week, for 12 weeks showed significant changes in lung function (Jaffe 1967). Other authors reported a 20 percent reduction in timed vital capacity in persons exposed to average concentrations of ozone of 1.5 ppm (range not indicated) for 2 hours (Griswold et al. 1957). Welders exposed to maximal ozone concentrations of 9 ppm were observed to have pulmonary congestion (Kleinfeld and Giel 1956).

OSHA is proposing a STEL based on observations that significant declines in pulmonary function can result from repeated intermittent exposures or even from a single short term exposure (Bils 1970; Jaffe 1967; Griswold et al. 1957). OSHA believes that, in the absence of a STEL, employees will continue to be at risk of the impairment in pulmonary functional capacity associated with short-term exposures that could occur if exposures are controlled only by an 8-hour TWA. Thus the Agency

preliminarily concludes that it is necessary to supplement the existing PEL with the proposed STEL of 0.3 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ozone if the Agency determines that this limit will substantially reduce significant risk.

PARAQUAT
CAS: 4685–14–7; Chemical Formula:
H.S. No. 1303

OSHA's current limit for paraquat is 0.5 mg/m³ as an 8-hour TWA, with a skin notation. The ACGIH has established a limit of 0.1 mg/m³ as an 8-hour TWA. Paraquat refers to a group of compounds that are odorless, yellow solids. The principal compounds are: 1,1'-dimethyl–4,4'-bipyridinium; 1,1'-dimethyl-4,4'-bipyridinium bis (methyl sulfate); and 1,1'-dimethyl 4,4'-bipyridinium dichloride.

The toxicity of these compounds depends on the compound's cationic moiety. Acute oral toxicity is reported as 30 mg/kg ion as cation for guinea pigs and 127 mg/kg ion for female rats, while the dermal LD_{50} in rabbits is 240 mg/kg ion (Clark 1964; Clark, McElligott, and Hurst 1966; Elligott 1965). Paraquat can penetrate broken skin after it has broken down the skin's usual barriers (Swan 1969; Clark 1966). By inhalation or intratracheal injection, paraquat is very toxic because of its irritant properties (Gage 1968). Rats exposed once for 6 hours to a concentration of 1 mg/m³ died if the aerosol contained particles with diameters of 3 to 5 microns (Gage 1968). Rats exposed 6 hours/day for 3 weeks to the same aerosol at 0.4 mg/m³ exhibited signs of pulmonary irritation; no effects were observed for the same exposure regimen at 0.1 mg/m³ (Gage 1968).

When the diameter of the particles in the aerosol are not of respirable size, toxicity is greatly reduced. The 4-hour LC_{50} for rats is 6400 mg/kg, and dogs, rats, and guinea pigs tolerated 3 weeks of daily exposures to 100 mg/m³ without apparent pulmonary effect (although nosebleeds were observed) (Palazzolo 1965, as cited in ACGIH 1986, p. 456).

Dietary administration, for 90 days, of doses ranging from 300 to 700 ppm showed dose-related effects ranging from pulmonary edema to intraalveolar hemorrhage and death (Kimbrough and Gaines 1970).

Paraquat's teratogenic potency in mice is low (Bus et al. 1975), although 100 ppm administered in the drinking water of pregnant rats increased postnatal mortality significantly (Bus and Gibson 1975).

In humans, 69 accidental deaths and 81 suicides were attributed to the effects of paraquat exposure up to 1972 (Chipman Chemicals 1972, as cited in ACGIH 1986, p. 456). Bouletreau, Ducluzeau, Bui-Xuan et al. (1977) reported 31 cases of renal insufficiency, and a spray applicator was killed when he absorbed a lethal dose of inadequately diluted paraquat through the skin (Jeros 1978). Workers using a 0.05- to 1-percent solution of paraquat developed skin and mucous membrane irritation but experienced no symptoms of systemic poisoning (Howard 1978). Fugita, Suzuki, and Ochiai (1976) reported 5 cases of reversible kerato-conjunctivitis, with corneal injury, after a month of exposure to paraquat.

OSHA is proposing an 8-hour TWA limit of 0.1 mg/m³ for paraquat, with a skin notation. The Agency preliminarily concludes that this limit will protect workers from the risk of skin, eye, and pulmonary irritation observed in animals exposed to aerosols of respirable size at levels below OSHA's existing PEL for paraquat. The Agency believes that this reduction in permissible exposure level will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for paraquat if the Agency determines that this limit will substantially reduce significant risk. OSHA is retaining the skin notation for this substance because of its capacity to penetrate the skin.

SILICA, CRYSTALLINE-CRISTOBALITE
CAS: 14464–46–1; Chemical Formula: SiO_2
H.S. No. 1354

The current OSHA PEL for respirable cristobalite is expressed by the formula 5 mg/m³/% SiO_2 measured as total respirable dust (i.e., one-half the value calculated for respirable quartz dust). This formula corresponds to a range of 0.04 to 0.05 mg/m³, measured as silica, for dusts containing 10 to 100 percent tridymite. The ACGIH recommends an 8-hour TWA limit of 0.05 mg/m³, measured as silica dust. The ACGIH limit is based on a study by Gardner (1938) that was confirmed by King, Mahanty, Harrison, and Nagelschmidt (1953). Experimental animals injected with cristobalite showed a more severe response than that produced by quartz, and the fibrosis that followed was diffuse rather than nodular.

Although expressed in different units, the current ACGIH and OSHA limits for cristobalite are comparable. The ACGIH's mg/m³ limit, adopted in 1985, does not reflect a re-evaluation of cristobalite's toxicity but was adopted merely to simplify the monitoring of cristobalite dust concentrations.

OSHA is proposing to replace its limit for cristobalite, which is expressed as the formula presented above, with a numerically equivalent limit of 0.05 mg/m³; the Agency is making this change to simplify employee exposure monitoring.

SILICA, CRYSTALLINE—QUARTZ
CAS: 14808–60–7; Chemical Formula: None
H.S. No. 1355

The current OSHA limit for silica-containing dusts is a respirable dust limit expressed as the following formula:

(10 mg/m³)/(% respirable quartz + 2).

The ACGIH formerly also expressed its silica limit in terms of this formula. However, the current ACGIH TLV is 0.1 mg/m³, measured as respirable quartz dust. The ACGIH does not see this change in the value of its limit for occupational exposure to silica as significant; instead, the ACGIH made this change to conform its limit for this dust to its TLVs for other dusts. If the OSHA formula is used to calculate a limit for a dust containing 100 percent quartz, the limit would be 0.098 mg/m³, not appreciably different from the ACGIH's revised limit of 0.1 mg/m³ for respirable quartz dust. For quartz dusts containing less than 100 percent free silica, the current OSHA formula would yield a limit of, for example, 0.83 mg/m³ for respirable dust containing 10 percent quartz. This result is only slightly more stringent than the ACGIH's TLV of 0.1 mg/m³. For cristobalite and tridymite, the OSHA formula and the ACGIH limits yield approximately the same results: both are approximately one-half the limit established by these two entities for quartz dust (see discussions below).

Occupational exposure to free silica has been known for many years to produce silicosis, a chronic, disabling lung disease characterized by the formation of silica-containing nodules of scar tissue in the lungs. Simple silicosis, in which the nodules are less than 1 cm in diameter (as measured on chest x-ray films) is generally asymptomatic but can be slowly progressive, even in the absence of continued exposure. Complicated silicosis (i.e., nodules greater than 1 cm in diameter) is more often associated with disability and can also progress in the absence of continuing exposure.

The health basis underlying the ACGIH's limit for crystalline silica is the work of Russell (1929), which suggested that a limit of 10 mppcf would protect workers from the effects of exposure to granite dust; a study by Ayer (1969) demonstrated that 10 mppcf of granite

dust is approximately equal to 0.1 mg/m³ of respirable quartz dust (ACGIH 1986).

NIOSH has recommended an exposure limit of 0.05 mg/m³ as respirable free silica for all crystalline forms of silica. As applied to cristobalite and tridymite, the NIOSH REL is 0.05 mg/m³, the same as the ACGIH TLV, but NIOSH's 0.05 mg/m³ REL for quartz dust is one-half the value of the ACGIH TLV for quartz dust. To support its more stringent REL for quartz dust, NIOSH cites the work of Hosey et al. (1957), which reported that no new cases of silicosis occurred in workers in Vermont granite sheds who were generally exposed to 0.05 mg/m³ or less of granite dust. The recommendation was also partly based on studies by Theriault, Burgess et al. (1974); Theriault, Peters and Fine (1974); and Theriault, Peters and Johnson (1974) that found that annual declines in pulmonary function and abnormal chest x-rays occurred among 192 granite shed workers exposed to an average quartz concentration of 0.05 mg/m³. NIOSH noted that the exposure estimates reported in the Theriault studies probably failed to account for the higher exposures that probably occurred in the years before exposure sampling was initiated and thus that Theriault's exposure data may have understated average exposures to quartz. Thus, NIOSH believes that the exposures responsible for the declines in pulmonary function were actually above 0.05 mg/m³. The ACGIH (1986) found NIOSH's reasoning unpersuasive, citing a report by Graham et al. (1981), who measured the pulmonary function of the same group of workers studied by Theriault et al., and found, in contrast to Theriault, that these workers experienced "an overall increase in FVC and FEV" (ACGIH 1986).

The 0.1-mg/m³ TLV represents no real change from the existing PEL. However, the use of an mg/m³ unit will simplify sampling procedures by using recently developed technologies which in turn will reduce the cost of air sampling to evaluate potential silica exposures. NIOSH admits to significant error in the exposure estimates used to establish its 0.05-mg/m³ REL, and OSHA believes that use of this limit will introduce feasibility problems. Before this REL can be considered, for adoption as an OSHA limit, a more detailed analysis would be required. OSHA therefore proposes that 0.1 mg/m³ be adopted as the PEL.

SILICA, CRYSTALLINE-TRIDYMITE
CAS: 15468-32-3; Chemical Formula: SiO_2
H.S. No. 1356

The current OSHA PEL for respirable tridymite is expressed by the formula 5 mg/m³/% SiO_2 measured as total respirable dust (i.e., one-half the value calculated for respirable quartz dust). This formula corresponds to a range of 0.04 to 0.05 mg/m³, measured as silica, for dusts containing 10 to 100 percent tridymite. The ACGIH recommends an 8-hour TWA limit of 0.05 mg/m³, measured as silica dust. The ACGIH limit is based on a study conducted by King, Mahanty, Harrison, and Nagelschmidt (1953) that found tridymite to be the most active of the free silica forms when injected intratracheally into rats.

Although expressed in different units, the current ACGIH and OSHA limits for tridymite are comparable. The ACGIH's mg/m³ limit, adopted in 1985, does not reflect a re-evaluation of tridymite's toxicity but was adopted merely to simplify the monitoring of tridymite dust concentrations. OSHA is proposing to replace its limit for tridymite, which is expressed as the formula presented above, with a numerically equivalent limit of 0.05 mg/m³; the Agency is making this change to simplify employee exposure monitoring.

SILICA, CRYSTALLINE-TRIPOLI
CAS: 1317-95-9; Chemical Formula: SiO_2
H.S. No. 1357

Tripoli is a colorless microcrystalline form of quartz. Although OSHA's Table Z-2 does not specifically indicate a limit for tripoli, OSHA currently 10 mg/m³/% SiO_2+2 specifies a limit for crystalline quartz based on the formula measured as total respirable dust. Expressed as mg/m³, this limit corresponds to a limit in the range of 0.08 to 0.1 mg/m³ for respirable dust containing from 10 to 100 percent silica. The 8-hour TWA ACGIH limit for tripoli is 0.1 mg/m³, measured as respirable silica dust. This limit was adopted by the ACGIH in 1985 to simplify the monitoring of quartz dust concentrations. Thus, this revision does not represent a re-evaluation of toxicity data for tripoli.

OSHA is proposing to replace its limit for quartz, which is expressed as the formula presented above, with a numerically equivalent limit of 0.1 mg/m³ as total respirable dust, and to add the same limit for tripoli.

SILICA, FUSED
CAS: 60676-86-0; Chemical Formula: SiO_2
H.S. No. 1358

Fused silica is a colorless, odorless solid that is a form of quartz. As such, it is currently covered by OSHA's limit for quartz (Table Z-3). Exposure to fused silica has long been known to cause the fibrogenic lung disease, silicosis. OSHA's current limit for quartz dust is the formula 10 mg/m³/% SiO_2+2 measured as total respirable dust. This limit corresponds to a respirable quartz concentration ranging from 0.08 to 0.1 mg/m³, measured as free silica. The ACGIH recommends an 8-hour TWA limit of 0.1 mg/m³, measured as free silica; the ACGIH adopted this limit in 1985 to simplify the monitoring of quartz dust concentrations. Thus, this revision does not represent a re-evaluation of the toxicity data for fused silica.

OSHA is proposing to replace its limit for fused silica, which is expressed as the formula presented above, with a numerically equivalent limit of 0.1 mg/m³ as total respirable dust; the Agency is making this change to simplify employee exposure monitoring.

SOAPSTONE, TOTAL DUST
SOAPSTONE, RESPIRABLE DUST
CAS: None; Chemical Formula: 3 Mg-4 SiO_2-H_2O
H.S. No. 1363 (total dust)
H.S. No. 1363A (respirable dust)

OSHA's current exposure limit for soapstone total dust is 20 mppcf (6 mg/m³), and the Agency has no separate limit for the respirable fraction. The ACGIH has established two TLV-TWAs for these two forms of soapstone: 6 mg/m³ for total dust, and 3 mg/m³ for the respirable fraction, both measured as total dust or respirable dust containing less than 1 percent quartz. Because the ratio of total dust mass to the mass of the respirable fraction is 2:1 (ACGIH 1984, p. 480), the 6-mg/m³ total dust limit automatically implies a 3-mg/m³ limit for the respirable fraction.

A study by Dreessen and DallaValle (1935) of mill workers exposed to soapstone showed lung changes in these workers, but it is believed that the dusts involved in these exposures were actually steatite talc, which had a tremolite content of 10 percent. Experiments by Miller and Sayers (1941) showed no measurable toxic effects in guinea pigs injected intraperitoneally with various samples of soapstone.

OSHA is proposing to express the limit for soapstone total dust in mg/m³, rather than mppcf, to simplify employee sampling and analysis. The total dust limit of 6 mg/m³ is equivalent to the previous limit of 20 mppcf, and the new limit of 3 mg/m³ for respirable dust is actually implicit in the total dust limit.

SULFUR DIOXIDE
CAS: 7446-09-5; Chemical Formula: SO_2
H.S. No. 1375

OSHA's current limit for sulfur dioxide is 5-ppm TWA. ACGIH has recommended a 2-ppm TLV-TWA and a 5-ppm STEL. In its written testimony at

OSHA's 1977 hearing on sulfur dioxide, NIOSH recommended a 10-hour TWA of 0.5 ppm (NIOSH 1977).

ACGIH cites one epidemiologic study (Scalpe 1964) showing an increased incidence of respiratory symptoms among pulpmill workers exposed to 10 to 20 ppm sulfur dioxide. Another study by Ferris et al. (1967) found a high incidence (30 percent) of respiratory disease among pulpmill workers exposed to 2 to 13 ppm; however, this was not statistically different from the incidence of disease in a group of workers at a nearby papermill. Kehoe et al. (1932) also found an increased incidence of respiratory irritation among refrigeration workers exposed to 20 to 30 ppm. Weir et al. (1972) exposed 12 healthy subjects to sulfur dioxide continuously for 120 hours. No subjective complaints or decline in respiratory function was found in subjects exposed to 0.3 or 1 ppm. Slight increases in airway resistance resulted from exposure to 3 ppm. Based on these data, the ACGIH recommended a TLV–TWA of 2 ppm and a STEL of 5 ppm.

In recommending a 0.5-ppm TWA limit. NIOSH (1977j) cited four epidemiological studies that became available after publication of their criteria document (NIOSH 1974b). Archer and Gillam (1977) found increases in the incidence of respiratory disease and reductions in pulmonary function among workers exposed to 0.4 to 4 ppm (mean = 2 ppm) for many years. Smith et al. (1977) reported pulmonary function decrements among workers exposed to between 1 and 4 ppm sulfur dioxide; the decrements were statistically significant compared to workers whose mean exposures were less than 1 ppm. A third study (Ministry of Health 1976) also reported increases in respiratory disease incidence among smelter workers exposed to an average of 2.5 ppm for 10 years or more. A fourth study reported finding no definite effects among 10,000 workers exposed to mean sulfur dioxide levels of 0.35 ppm. Based on these studies, NIOSH (1977j) revised its original recommendation from 2 ppm TWA to a 0.5-ppm TWA.

The 2-ppm TLV–TWA is based on limited data showing no effects from exposures at levels less than 1 ppm. The 0.5-ppm REL is based on additional information indicating respiratory disease associated with exposures ranging from 0.4 to 4 ppm, with no observed effects at 0.35 ppm. Although these findings suggest that the ACGIH TLV may not be sufficiently protective, OSHA is concerned that the NIOSH limit may present feasibility problems. The Agency's preliminary feasibility analysis has considered only a PEL of 2 ppm. At this time, OSHA tentatively proposes that a 2-ppm 8-hour TWA, supplemented by a 5-ppm STEL, be adopted as the PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sulfur dioxide if the Agency determines that this limit will substantially reduce significant risk. The Agency specifically solicits comments on feasibility and on any evidence related to adverse health effects at exposures at or below these levels. The proposed 2-ppm limit will be reconsidered in light of the feasibility and health effects data obtained prior to the final rulemaking.

SULFUR TETRAFLUORIDE
CAS: 7783–60–0; Chemical Formula: SF_4
H.S. No. 1378

OSHA's current Z tables have no exposure limits for sulfur tetrafluoride. The ACGIH recommends 0.1 ppm as a ceiling limit. Sulfur tetrafluoride is a colorless, non-combustible gas.

On contact with moisture, sulfur tetrafluoride produces sulfur dioxide and hydrogen fluoride (HF) (Lester 1971, as cited in ACGIH 1986, p. 546), and it is the release of HF that is primarily responsible for sulfur tetrafluoride's toxic effects (Zapp 1971, as cited in ACGIH 1986, p. 546). A du Pont (1961) study of rats exposed for 4 hours to 4 ppm sulfur tetrafluoride over a period of 10 days reported that the animals demonstrated nasal discharge, difficulties in breathing, and weakness. Autopsies of these animals revealed evidence of emphysema, but those rats surviving exposure and given a 2-week rest period after exposure showed no significant pathological changes. In the same study by du Pont, a 4-hour exposure to 20 ppm sulfur tetrafluoride proved lethal to one of two rats. In a study by Clayton (1962), irregular breathing and signs of irritation were observed at exposures of 20 ppm and lower; animals receiving lethal amounts of sulfur tetrafluoride showed pulmonary edema on autopsy, and those with sub-lethal exposures demonstrated no pathologic changes 14 days later.

OSHA is proposing a 0.1-ppm ceiling limit for this highly toxic gas. The Agency preliminarily concludes that establishing this limit for this previously unregulated chemical will reduce the risk of chronic respiratory effects potentially associated with exposure to the chemical at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for sulfur tetrafluoride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TALC (non-asbestiform)
CAS: 14807–96–6: Chemical Formula: H_2O_3Si 3/4Mg
H.S. No. 1381

The current OSHA PEL for non-asbestiform talc is 20 million particles per cubic foot of air (mppcf) as an 8-hour TWA; this is roughly equivalent to 3 mg/m^3. The ACGIH recommends a TLV–TWA of 2 mg/m^3 (15 mppcf) for talc, measured as respirable dust. Talc is a white to gray-white, fine powder.

The health effects evidence for talc is complicated by the fact that talcs contain amphiboles and other minerals, in addition to platiform talc crystals; adverse health effects appear to be related to the non-platiform content (that is, to the fiber content) of the talc in question (ACGIH 1986, p. 550). There are conflicting views over the extent to which the non-platiform constituents are asbestos; however, no health effects information is available that is specifically related to non-asbestiform talc (ACGIH 1986, p. 550).

Numerous epidemiological studies have documented the effects on workers of long-term exposures to talc. In 1942, Porro et al. (cited in Patty 1981) published a report in which 15 cases of talc pneumoconiosis, including 5 postmortem examinations, showed that asbestotic bodies were almost always present in fibrotic areas of the lungs of those workers with talcosis. Siegal and his colleagues (1943, as cited in Patty 1981) noted that an advanced fibrosis incidence rate of 14.5 percent existed among a group of 221 talc miners and millers. These workers were primarily exposed to fibrous talc, which was held to be responsible for the pathology of the asbestos-like lung lesions. A study by McLaughlin et al. (1949, as cited in Patty 1981) revealed that talc-induced pneumoconiosis was caused by the fibrous varieties of talc; in animal studies by Schepers and Durkin (1955, as cited in Patty 1981), the degree of fibrosis in the lung tissue was found to be a function of the length of the talc fibers, rather than of the composition of the talc itself. A paper by Kleinfeld et al. in 1963 (as cited in Patty 1981) reported that postmortem examinations on 6 talc industry workers showed that bodies found in the lung bronchioles or embedded in fibrous tissue were indistinguishable from the asbestos bodies seen in cases of asbestosis.

Kleinfeld et al. (1967) later conducted a cohort study of 220 workers employed in a mine that produced talc with a

tremolite and anthophyllite content. Of the 91 deaths in this group, 10 resulted from respiratory cancer and 28 were attributed to pneumoconiosis. The proportional mortality from respiratory cancer was four times the expected rate. In 1974, when Kleinfeld performed a follow-up study of this group, which at that time consisted of 260 workers (108 deaths), he found significant differences between expected and observed mortality in the period 1950 to 1954, but not during 1960 to 1969. This investigator attributed this finding to the reduction in talc dust counts (from averages of 25 to 73 mppcf in the years 1948 to 1965 to averages of 9 to 43 mppcf in the period 1966 to 1969). This study also showed a decrease of greater than 50 percent in deaths due to pneumoconiosis in the 1965-to-1969 time period.

Studies by NIOSH (Dement and Zumwald 1978) of 398 white male workers employed between 1947 and 1959 in the talc industries found that 74 of these men had died. Bronchogenic cancer was the cause of death in 9 men, whereas only 3.3 deaths from this cause would have been expected. Non-malignant respiratory disease (NMRD) exclusive of influenza, pneumonia, and tuberculosis accounted for 3 deaths; 1.5 would have been expected. From these data, NIOSH concluded that a significant increase in mortality due to bronchogenic cancer and NMRD had occurred from occupational exposure to talc dust. NIOSH's report also included a morbidity study of 12 talc industry workers, currently employed, in which chest X-rays, lung function tests, and questionnaires were used. This study concluded that a higher prevalence of cough, phlegm, dyspnea, and irregular opacities in chest X-rays existed in these workers than in potash miners; instances of pleural thickening and calcification were greater than in coal and potash miners; and the pulmonary function of talc workers overall was reduced in comparison with that of coal and potash miners employed for the same length of time. The reductions in pulmonary function were dose- and duration-related.

The ACGIH (1986, p. 552) concludes that serious health effects have been associated in the past (i.e., prior to 1945) with exposures to amphibole-containing talc. However, the ACGIH believes that the introduction of mining improvements has all but eliminated "the excess of death rates from pneumoconiosis and lung cancer" (ACGIH 1986, p. 552).

Two recent studies of talc exposures (Rubino, Scansetti et al. 1976; Selevan, Dement et al. 1979) are available. The Rubino et al. study found that miners and millers exposed to an average of 849 to 8470 mppcf-years (miners) and 76 to 651 mppcf-years (millers) showed no increase in the number of observed (compared to expected) deaths from causes other than silicosis. These authors concluded that the disease-causing factor in these workers was silica rather than talc (Rubino, Scansetti et al. 1976).

Selevan and Dement's studies (1979) of 392 workers exposed to talc in five mines found non-malignant respiratory deaths for millers to be almost eight times the expected rate, while miners experienced more than three times the expected mortality rate for these same diseases. The ACGIH (1986, p. 552) concludes that the Selevan and Dement study is incomplete because confounders were not adequately identified and controlled for.

OSHA is proposing an 8-hour TWA limit of 2 mg/m^3 for the respirable dust of talc containing no asbestos fibers and less than 1 percent silica. The Agency preliminarily concludes that this limit will protect workers from the risk of non-malignant respiratory effects associated with exposure to the dust of non-fibrous talc.

With regard to the finding by NIOSH (Dement and Zumwald 1978) of excess cancer deaths among talc workers, OSHA is currently reviewing data describing the effects of exposure to non-asbestiform varieties of mineral fibers that are found in talc deposits. OSHA is considering a separate rulemaking to address this issue.

In addition, OSHA is proposing to express the limit for talc in mg/m^3 rather than mppcf, to facilitate employee exposure monitoring. The Agency is proposing this change for all of its Z table limits that are currently expressed as mppcf.

TIN OXIDE
CAS: 7440-31-5; Chemical Formula: SnO
H.S. No. 1395

OSHA currently has no exposure limit for tin oxide. The ACGIH recommends an exposure limit of 2 mg/m^3 as an 8-hour TWA. Tin oxide may be a white or yellow-brown powder.

Injection of tin dust intraperitoneally into guinea pigs resulted in a non-specific, well-vascularized chronic granulomatous reaction (Oyanguren, Haddad, and Maass 1958). Chronic exposure to tin oxide fume and dust results in stannosis, a form of pneumoconiosis. The fume is considered a more important source of stannosis than the dust (Dundon and Hughes 1950), but other authorities consider the quality of the dust and the duration of exposure equally important (Robertson and Whittaker 1954). The onset of the symptoms of stannosis may be delayed for years; the appearance of the condition is signalled by the onset of difficulty in breathing. One worker who had been exposed to unspecified tin oxide levels for 22 years was tested for stannosis and registered a vital breathing capacity 70 percent of normal and a maximal breathing capacity 61 percent of the predicted value (Spencer and Wycoff 1954).

More than 150 cases of stannosis have been reported in the world literature (Robertson and Whittaker 1954), and five cases were reported in the United States before 1954. No cases of massive fibrosis caused by exposure to tin oxide dust or fume have been reported (ACGIH 1986, p. 574).

OSHA is proposing an 8-hour TWA of 2 mg/m^3 for tin oxide dust and fume. The Agency preliminarily concludes that this limit will protect workers from the risk of reduced pulmonary capacity and stannosis associated with exposure to this substance in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for tin oxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TRIMELLITIC ANHYDRIDE (TMAN)
CAS: 552-30-7; Chemical Formula: $C_9H_4O_5$
H.S. No. 1409

OSHA has no exposure limit for trimellitic anhydride. In 1981, the ACGIH set 0.005 ppm (0.04 mg/m^3 as the 8-hour TWA limit for this substance. Trimellitic anhydride is a colorless solid.

Exposure to trimellitic anhydride (TMAN) causes irritation of the eyes, nose, skin, and pulmonary tract. NIOSH (1978) reported in a Current Intelligence Bulletin that trimellitic anhydride should be considered an extremely toxic workplace hazard, because exposure to it can cause noncardiac pulmonary edema and immunological sensitization, as well as upper respiratory tract irritation.

Pulmonary edema has occurred in workers exposed to TMAN at unreported air concentrations; the development of pulmonary edema in these workers without upper respiratory tract irritation suggests that TMAN is a sensitizer (Rice et al. 1977). Zeiss and colleagues (1977) described TMAN-related illnesses among a group of workers synthesizing TMAN. These authors believe there are three separate syndromes associated with TMAN exposure: Rhinitis/asthma; a flu-like condition; and irritation of the upper

respiratory tract. Another case of TMAN-related occupational sensitization occurred in a worker exposed during the application of an epoxy resin coating (Fawcett et al. 1977).

At levels averaging 1.5 and 2.8 mg/m³ in two processes, NIOSH reported that employees reported eye and nose irritation, shortness of breath, coughing, nausea, headache, skin irritation, and throat irritation (NIOSH 1974). Pulmonary hemorrhage and hemolytic anemia have been reported in workers exposed to TMAN at unspecified levels (Ahmed et al. 1979).

Rats have shown intralveolar hemorrhage after TMAN exposures to concentrations of 0.01 ppm.

OSHA is proposing to regulate trimellitic anhydride to an 8-hour TWA level of 0.005 ppm. The Agency preliminarily concludes that this limit will protect workers from the severe pulmonary effects, sensitization and skin and upper respiratory tract irritation observed in workers exposed to this extremely toxic substance. OSHA believes that this limit will substantially reduce this risk, which is presently not controlled due to the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for trimellitic anhydride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

WOOD DUST
CAS: None; Chemical Formula: None
H.S. No. 1430A (Hard Wood)
H.S. No. 1430B (Soft Wood)

Before 1980, OSHA regulated wood dust under its nuisance dust standard of 15 mg/m³ (29 CFR 1910.1000, Table Z–3). However, in an enforcement proceeding, wood dust was held not to be an inert mineral dust, and the Agency has subsequently not regulated this substance. Consequently, OSHA has no current PEL for hard wood or soft wood dust. The ACGIH recommends a TLV–TWA of 1 mg/m³ for hard wood dust, and a TLV–TWA of 5 mg/m³ and STEL of 10 mg/m³ for soft wood dust. Wood dust is defined as any wood particles arising from the processing or handing of woods. Hard woods derive from the deciduous broad-leaved flowering species of trees, and soft woods include the coniferous species that do not shed their leaves in the winter.

Exposure to wood dust has long been associated with a variety of adverse health effects, including dermatitis, allergic respiratory effects, mucosal and non-allergic respiratory effects, and cancer. The toxicity data in animals are limited, particularly with regard to exposure to wood dust alone.

Animal Studies

Groups of male guinea pigs were injected intratracheally with suspensions containing 75 mg of sheesham or mango wood dust or of hemp or bagasse fibers, or 20 mg of jute fiber (Bhattacharjee et al. 1979; Bhattacharjee and Zaidi 1982). Animals were sacrificed serially at intervals up to 90 days after injection. Lung examination revealed that, at 90 days, Grade I fibrosis of the lungs had occurred in the guinea pigs injected with mango or jute, while those treated with sheesham or hemp had developed Grade II pulmonary fibrosis.

In another experiment involving guinea pigs, animals were exposed by inhalation to average respirable dust concentrations of 1143 mg/m³ for 30 minutes/day, 5 days/week for 24 weeks (McMichael et al. 1983). Histopathological examination showed lung changes, described by the authors as moderate to severe, in all exposed guinea pigs. The changes seen included an increase in septal connective tissue components and aggregation of lymphocytes; however, no pulmonary fibrosis or extensive destruction of the parenchymal tissue occurred. The authors of this study concluded that exposure to fir bark dust may cause inflammatory changes in the lung.

Two studies examined the effect of exposing Syrian golden hamsters to beech wood dust by inhalation, with or without concurrent administration of the known carcinogen diethylnitrosamine (DEN) (Wilhelmsson et al. 1985a, b; Drettner et al. 1985). In each study, the animals were divided into four separate groups. In Study 1, there were 12 animals per group. Two groups were exposed to fresh beech wood dust (a hard wood dust) at a mean total dust concentration of 15 mg/m³ for 6 hours/day, 5 days/week for 36 weeks, and one of these groups was also given 1.5 mg of DEN once a week for the first 12 weeks. The third group in Study 1 was given the DEN doses only (positive control) and the fourth group was given no exposure at all (negative control).

In Study II, there were 24 animals in each of four groups. Two groups of animals were exposed to fresh beech wood dust at a mean total dust concentration of 30 mg/m³ for 6 hours/day, 5 days/week for 40 weeks. The positive and negative control groups were treated as in Study I.

In Study I, none of the hamsters had lung or nasal tumors or metaplasia. Four hamsters exposed to wood dust and DEN exhibited squamous cell papillomas of the trachea, as did three animals in the positive control group and one in the negative control group. No differences in organs other than the respiratory organs were seen between the treated and control groups in Study I.

In Study II, all DEN-exposed hamsters had nasal lesions ranging from hyperplasia and dysplasia to papillomas. In addition, half of all DEN-exposed hamsters developed nasal adenocarcinomas, whether or not they had also been exposed to wood dust. Half of the DEN-exposed animals also had papillomas of the larynx and trachea. In the wood-dust-exposure-only group, two of the animals had nasal lesions, one of which was an unclassifiable malignant nasal tumor and the other of which consisted of fo[illegible] metaplasia with mild dysplasia. The authors concluded that exposure to wood dust did not increase the tumor incidence in DEN-exposed animals but did affect the respiratory tract of all exposed animals.

Human Studies

Dermatitis. There are a large number of case reports, epidemiological studies, and other data on the health effects of wood dust exposure in humans. Dermatitis caused by exposure to wood dusts is common, and can be caused either by chemical irritation, sensitization (allergic reaction), or either of these together. As many as 300 species of trees have been implicated in wood-caused dermatitis.

The chemicals associated with allergic reactions are generally found in the inner parts of a tree, e.g., the heartwood, and the workers most prone to these reactions are those involved in secondary wood processing (carpenters, joiners, finishers).

The symptoms of sensitization are redness, scaling, and itching, which may progress to vesicular dermatitis and, after repeated exposures, to chronic dermatitis. The parts of the body most often affected are the hands, forearms, eyelids, face, neck, and genitals. This form of dermatitis generally appears after a few days or weeks of contact.

Allergic Respiratory Effects. Allergic respiratory responses are mediated by the immune system, as is also the case with allergic dermatitis. Many authors have reported cases of allergic reactions in workers exposed to wood dust. (Sosman et al. 1969; Greenberg 1972; Pickering et al. 1972; Eaton 1973; Booth et al. 1976; Chan-Yeung et al. 1978; Edwards et al. 1978; Innocenti and Angotzi 1980; Bush and Clayton 1983; Cartier et al. 1986). Asthma is the most

common response to wood dust exposure, and the allergic nature of such reactions has been demonstrated by the presence of IgE antibodies and positive skin reactions on patch testing. The best-studied of the allergic reactions to wood dust is Western red cedar (WRC) asthma; it is estimated that 5 percent of the exposed population is allergic to this wood. However, only one study is available that relates exposure level to ventilatory function. In that study, exposure to concentrations of 2 mg/m³ of WRC dust caused significant decreases in forced vital capacity and forced expiratory volume (Vedel et al. 1986). These authors also found that exposures to concentrations above 3 mg/m³ produced eye irritation.

Mucosal and Nonallergic Respiratory Effects. This section discusses changes in the structure and function of the nasal mucosa and respiratory tract that are caused by exposure to wood dust. These changes include nasal dryness, irritation, bleeding, and obstruction; coughing, wheezing, and sneezing; sinusitis; and prolonged colds. These symptoms have been observed even at wood dust concentrations below 4 mg/m³.

Bellion et al. (1964) found that 97 of 225 workers (carpenters, sawmill workers, woodworkers) exposed from 3 to 24 years to the dust of several different hard woods showed radiologic evidence of pulmonary abnormalities. Black et al. (1974) studied nine woodworkers from a woodworking factory in England. In all of these workers, mucociliary movement was markedly depressed, leading these authors to conclude that exposure to wood dust in the furniture industry for 10 years or more can impair mucociliary clearance. These findings were confirmed in a Danish study involving furniture makers (Solgaard and Andersen 1975; Andersen et al. 1976, 1977); compared with controls, the mucociliary transport rate was also significantly impaired in these woodworkers and dose-response effects were noted.

A respiratory survey conducted by Chan Yeung et al. (1980) in pulp and paper mill workers in British Columbia showed that workers exposed to wood dust at a mean total dust concentration of 0.5 mg/m³ had a slight but statistically significant decrease in pulmonary function values compared with controls. The authors concluded that the chemical preservatives used to treat the wood could also have been responsible for these adverse effects.

In a cross-sectional survey of 1,157 American woodworkers (both hard and soft wood), Whitehead et al. (1986) found that exposure to higher (10+ mg/years/m³) compared with lower (0–2 mg-years/m³) dust concentrations was associated with a statistically significant and higher incidence of decreased pulmonary function. However, dose-response effects were observed only for soft wood (i.e., pine) dusts. A later study by Beckman et al. (1981) examined subgroups of the workers studied by Whitehead and found no correlation between years of exposure to pine wood dust and pulmonary function.

In a pilot study of 55 workers in a North Carolina hardwood furniture plant, Goldsmith (1983) found that, at mean area wood dust concentrations of 2 mg/m³ or below, peak ventilatory flow correlated significantly with cumulative person-years of exposure. Goldsmith interpreted this finding to mean that inhalation of wood dust may impair large airway function.

A study of Italian woodworkers showed that the number of wood-dust-exposed workers who had developed anosmia (loss of smell) was significantly higher than in a control group of non-exposed workers (Innocenti et al. 1985). Amoore (1986) confirmed this finding in other workers exposed to hardwood dusts.

Summary of mucosal and nonallergic respiratory effects. A large number of studies have demonstrated that occupational exposure to wood dust causes both statistically significant and non-significant increases in respiratory symptoms. These symptoms range from irritation to bleeding, wheezing, sinusitis, and prolonged colds. In addition, chronic wood dust exposure reduces the rate of mucociliary transport in the nose and, in some workers, also causes changes in the nasal mucosa. Several studies have demonstrated decreased pulmonary function among wood-dust-exposed workers, although other studies have not confirmed these findings.

Carcinogenicity

The association between occupational exposure to wood dust and various forms of cancer has been explored in many studies and in many countries. In 1987, the International Agency for Research on Cancer (IARC) classified furniture manufacturing in Category I (confirmed human carcinogen) and carpentry in category 2B (suspected human carcinogen).

The discussion below focuses on selected U.S. studies.

Nasal and Sinus Cavity Cancer. The earliest U.S. study of wood dust exposure and nasal cancer was conducted by Brinton et al. in 1976. These authors analyzed cancer death rates between 1950 and 1969 in 132 U.S. counties having at least 1 percent of their population employed in furniture and wood fixture manufacturing. This study revealed that the age-adjusted mortality rate for cancer of the nasal cavity and sinuses among white males in the "furniture" counties was significantly higher than in non-furniture counties.

In a later case-control study, these authors (Brinton et al. 1984) analyzed cases of nasal and sinus cancers occurring in North Carolina and Virginia between 1970 and 1980. This study identified a significantly elevated risk of adenocarcinomas in males working in the furniture manufacturing industry, but no increased risk among lumber, carpentry, or construction workers. There was no significant increase in the risk of squamous cell carcinoma in workers from any other wood-related industry.

In a study sponsored by the Inter-Industry Wood Dust Task Force, Viren and colleagues (1982) described a death certificate case-control study of nasal cancer deaths for 1963 to 1977 in North Carolina, Mississippi, Washington, and Oregon. Findings of this study included a relative nasal cancer risk of 1.95 for industries involving lumber and wood products; however, no significant relative risk of nasal cancer was seen for workers in the furniture manufacturing industry.

Imbus and Dyson conducted a study of nasal cancer and North Carolina furniture workers (1985). This study found: (1) That there was a statistically significant increase of nasal cancer among furniture workers; (2) that the nasal cancer rates among North Carolina furniture workers were much lower than those reported for English furniture workers; (3) that the number of nasal cancer deaths among North Carolina furniture workers decreased between 1956 and 1977; and (4) that a slight excess in nasal cancer may have existed among North Carolina furniture workers but is currently either declining or non-existent.

At present, the National Cancer Institute is conducting a cohort mortality study of 36,622 workers employed in the wood, metal, and plastic furniture manufacturing industries (Miller 1987). Results are too preliminary to be described at this time.

Summary of evidence for nasal and sinus cavity cancers. NIOSH (1987) concluded that the literature clearly demonstrates an association between occupational wood dust exposure and nasal cancer. English studies first

identified this link by showing a 10- to 20-times greater incidence of nasal adenocarcinoma among woodworkers in the furniture industry than among other woodworkers and 100 times greater than in the general population. In the United States, three studies have reported a fourfold risk of nasal cancer or adenocarcinoma in furniture workers, and another study noted a similar relationship between nasal cancer and wood dust exposure. One other study failed to find such an association for furniture workers, but did find an increase among logging and timber industry workers. Although hard wood dust has most often been implicated, soft-wood-dust exposure has also been a risk factor in some studies. In addition, there is some evidence that the development of adenocarcinomas is associated with quantitatively higher levels of wood dust exposure and that the risk of this form of cancer increases with latency from first exposure.

Pulmonary Cancer. A number of studies investigating the association between wood dust exposure and the development of lung cancer have been conducted. Milham (1974) found a significant excess of malignant tumors of the bronchus and lung in workers who had belonged to the AFL–CIO United Brotherhood of Carpenters and Joiners of America. Only construction workers showed a statistically significant increase in lung cancer rate.

In a study of lung cancer in Florida residents, Blot et al. (1982) found that an elevated risk of lung cancer that was statistically significant existed among workers in the lumber and wood industry and in construction; however, smoking may have been a confounding factor in these results.

Summary of evidence for pulmonary cancer. The association between lung cancer and occupational wood dust exposure is inconclusive, although several epidemiological studies have reported increases in lung cancer among wood-dust-exposed workers.

Hodgkin's Disease. The data on the relationship between exposure to wood dust and the development of Hodgkin's disease are conflicting. Milham (1967) and Milham and Hesser (1967) concluded, on the basis of a case-cohort study of 1,549 white males dying of this disease between 1940–1953 and 1957–1964, that there was an association between Hodgkin's disease and exposure to wood dust.

Another study (Spiers 1969) concluded that men working in the wood industries in the eastern United States were at special risk for Hodgkin's disease, and suggested that pine pollen exposure might be responsible for the increase.

A Washington State epidemiological study (Petersen and Milham 1974) also found that woodworkers had an increase risk of Hodgkin's disease, and the work of these authors was supported by the results of another study (Gufferman et al. 1976), which showed a non-significant increase in the relative risk for Hodgkin's disease among woodworkers.

Summary of evidence for Hodgkin's disease. Although the data are conflicting, several epidemiological studies of U.S. workers do report increases in the incidence of Hodgkin's disease among woodworkers. This excess is particularly apparent among carpenters.

Other Cancers. NIOSH (1987) concluded that the data on the relationship between occupational exposure to wood dust and the development of cancers other than nasal, Hodgkin's disease, or lung cancers are insufficient and inconclusive.

Basis for the Proposed Limits

OSHA is proposing an 8-hour TwA limit of 1 mg/m^3 for hard wood dust and a 5 mg/m^3 8-hour TWA and 10 mg/m^3 15-minute STEL for soft wood dust. These limits reflect evidence in the literature that exposures to these substances cause allergic respiratory effects and eye irritation (Vedal et al. 1986), mucosal and nonallergic respiratory effects (Bellin et al. 1964; Black et al. 1974; Goldsmith 1983), nasal and sinus cavity cancers (Brinton et al. 1976, 1984; Viren et al. 1982; Imbus and Dyson 1985), and, perhaps, Hodgkin's disease (Milham 1967; Milham and Hesser 1967; Spiers 1969; Petersen and Milham 1974; Gufferman et al. 1976). OSHA preliminarily concludes that these limits will protect exposed workers from the risks of the many conditions and diseases associated with wood dust exposure. However, the Agency notes that many of the studies described above implicate both hard wood and soft wood dusts or do not distinguish between these two substances for cancer, asthma, and dermatitis. OSHA requests information on the health effects, the exposure levels, and the protectiveness of the proposed limits. The health evidence forms a reasonable basis for proposing a new limit for wood dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions for All Respiratory Toxicants

As Table C6–2 and the discussions above show, limits for substances in this group have been established to control employee exposures to or below concentrations of substances that have been associated with acute or chronic respiratory effects. For most of these substances, the evidence is sufficient to identify the NOE or low-effect levels that are related to these effects in humans or animals. Accordingly, OSHA preliminarily concludes that maintaining employee exposures at or below these limits will greatly decrease the likelihood that employees will be at significant risk of respiratory effects when they are exposed to these substances in the workplace. Because chronic pulmonary disease caused by exposure to toxic dusts can be incapacitating, such exposures can effectively end the working life of severely affected individuals. Less serious pulmonary disease can result in lost work days, both as a result of the associated symptoms themselves and as a consequence of increased susceptibility to respiratory infections. The effects of exposure to acute pulmonary toxins, such as ozone or trimellitic anhydride, range from reduced lung function to life-threatening pulmonary edema. Lowering the Agency's current limits or establishing limits where none previously existed will substantially reduce these risks. The health evidence for the substances in this group provides a reasonable basis for revising or adding limits for these substances. At the time of the final rule, OSHA will establish new or revised limits for these respiratory toxins if the Agency determines that these limits will substantially reduce significant risks.

7. Substances for Which Proposed Limits Are Based on Avoidance of Cardiovascular Effects

Introduction

For seven chemicals, OSHA is proposing limits based on their adverse effects on the cardiovascular system. Table C7–1 lists the current Z table limits for these substances, along with the ACGIH TLVs, NIOSH RELs, CAS numbers and HS numbers for these substances. For two of these substances, chloropentafluoroethane and sodium azide, neither OSHA nor NIOSH has current limits. OSHA is proposing to replace its current ceiling limits for two substances (ethylene glycol dinitrate and nitroglycerin) with lower short-term limits. OSHA is proposing to reduce its

current TWA-PEL for carbon disulfide to 1 ppm. For one other substance (fluorotrichloromethane), OSHA is proposing to replace its current TWA-PEL with a ceiling value. For the remaining substance (1,1,2-trichloro-1,2,2-trifluoroethane), OSHA proposes to add a STEL to its existing 8-hour TWA. For three substances in this group, NIOSH recommends limits substantially lower than those established by the ACGIH.

Description of the Health Effects

Although the cardiovascular system can be adversely affected in many different ways by exposure to toxic substances, the adverse effects caused by exposure to the seven chemicals in Table C7-1 are limited to three categories: (1) Cardiac sensitization, (2) vasodilation, and (3) atherosclerosis.

Cardiac sensitization is not related to the type of sensitization that is mediated by the immune system and that causes an allergic reaction. Instead, it results when a chemical "sensitizes" the heart to the effects of a class of biological compounds called sympathomimetic amines. The physiological action of sympathomimetic amines is to stimulate the heart to beat faster. The hormone adrenaline, also called epinephrine, is an example of a sympathomimetic amine. It is normally secreted into the bloodstream when the body anticipates an increase in physical exertion, such as occurs when someone is frightened. A concentration of epinephrine equal to or higher than the noe-ffect level for this substance is necessary to increase the heartbeat rate in exposed individuals. The effect of a cardiac sensitizer is to lower the no-effect level so that the heartbeat rate is stimulated by a lower concentration of adrenaline.

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TABLE C7-1. List of Substances for Which Limits Are Based on Avoidance of Cardiovascular Effects

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1070 Carbon disulfide+	75-15-0	20 ppm TWA 30 ppm STEL 100 ppm Ceiling	10 ppm TWA, Skin	1 ppm TWA 10 ppm Ceiling (15 min)
1087 Chloropenta-fluoroethane	76-15-3	--	1000 ppm TWA	--
1170 Ethylene glycol+ dinitrate	628-96-6	0.2 ppm Ceiling, Skin	0.3 mg/m^3 TWA, Skin	0.1 mg/m^3 Ceiling (20 min)
1180 Fluorotrichloro-methane	75-69-4	1000 ppm TWA	1000 ppm Ceiling	--
1290 Nitroglycerin+	55-63-0	0.2 ppm Ceiling, Skin	0.5 mg/m^3 TWA, Skin	0.1 mg/m^3 Ceiling (20 min)
1364 Sodium azide	26628-22-8	--	0.1 ppm Ceiling	--

TABLE C7-1. List of Substances for Which Limits Are Based on Avoidance of Cardiovascular Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1403 1,1,2-Trichloro-1,2,2-trifluoro-ethane	76-13-1	1000 ppm TWA	1000 ppm TWA 1250 ppm STEL	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed limit is the NIOSH REL.

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The region of the heart that becomes sensitized is the pacemaking and conduction system, which determines the rhythm and rate of the heartbeat. Unregulated or unnecessary interference with this region of the heart can result in arrhythmia, an abnormality in the rhythm or rate of the heartbeat (Wyngaarden and Smith 1985). The clinical consequences of an arrhythmia vary among individuals. A young person with a healthy heart may not be adversely or seriously affected. However, fatal arrhythmias have occurred in healthy young people, and in older people or individuals whose cardiovascular systems have already been compromised, arrhythmias can cause symptoms of cerebral or myocardial ischemia, shock, or congestive heart failure.

Vasodilators are compounds that cause blood vessels to expand, resulting in a decrease in blood pressure (hypotension) and a decrease in the amount of blood reaching the organs. Acute hypotension is a common cause of shock (Petersdorf et al. 1983). Chronic hypotension may result in a number of symptoms, including lethargy, weakness, easy fatigability, and dizziness or faintness.

Atherosclerosis is a serious disease produced by a degenerative process in the arteries. Plaques containing lipids, complex carbohydrates, blood products, and calcium form on the inside walls of arteries, usually on major blood vessels. These plaques are also called atheromas; their presence makes arteries narrower. Depending on which arteries in the body contain atheromas, different clinical consequences may result, including renal hypertension, stroke, and myocardial ischemia (inadequate circulation of blood to the myocardium) (Balazs et al. 1986). Some chemicals can enhance or accelerate the formation of atheromas and thereby encourage the development of atherosclerosis, a major cause of coronary heart disease.

Dose-Response Relationships and Cardiac Effects

For four of the chemicals in Table C7–1 (carbon disulfide, ethylene glycol dinitrate, nitroglycerin, and sodium azide), the ACGIH-recommended limits are based primarily on health surveys and case reports indicating that occupationally exposed workers subjected to concentrations above a no-effect level experience these cardiovascular effects. Human data for the other three chemicals (chloropentafluoroethane, fluorotrichloromethane, and 1,1,2-trichloro-1,1,2-trifluoroethane), however, are scarce. For these chemicals, limits are based on the results of studies in laboratory animals.

Chemically induced cardiovascular disease occurs in a pattern that appears to correspond to a typical effect level dose-response relationship. That is, an exposure level and exposure duration exist below which the substance appears unlikely to exert an adverse effect. Thus, the limits for substances in this group are designed to maintain exposures below this apparent no-effect level.

The following discussions describe OSHA's preliminary findings for some substances in this group and point to the seriousness of the cardiovascular effects potentially associated with exposure to these substances.

CARBON DISULFIDE
CAS: 75–15–0: Chemical Formula: CS_2
H.S. No. 1070

The current OSHA PELs for carbon disulfide include a TWA of 20 ppm, a STEL of 30 ppm, and a ceiling of 100 ppm. The ACGIH has recommended a TLV–TWA for this substance of 10 ppm without a ceiling or STEL, but with a skin notation, and NIOSH recommends a 1-ppm TWA and a 10-ppm 15-minute ceiling.

The serious adverse effects of exposure to carbon disulfide on the cardiovascular and neurological systems have been documented for decades (ACGIH 1986). Evidence has accumulated indicating that even exposure to low levels of carbon disulfide exerts harmful effects on the cardiovascular and neurological systems of occupationally exposed populations. The current PEL of 20 ppm (i.e., the 1968 ACGIH TLV) was established primarily to prevent neurological disturbances. Since that time, carbon disulfide has been implicated as a risk factor in the development of coronary heart disease at the 20-ppm PEL.

The cardiovascular effects of exposure to carbon disulfide have been well documented in three studies. Tiller et al. (1968), Tolonen et al. (1975), and Tolonen et al. (1979) all identified exposure to carbon disulfide as a contributing factor in coronary heart disease. The latter two studies were epidemiological investigations in Finland in which viscose rayon workers were exposed to low levels of carbon disulfide for at least 5 years; at times, they were exposed to high carbon disulfide concentrations.

Mihail et al. (1968) observed "significant vascular, nervous and biochemical changes" in workers exposed to an average carbon disulfide concentration of 9 ppm for 2 years. According to the ACGIH (1986) and NIOSH (1977b), other studies have reported cardiovascular disorders among the effects of carbon disulfide exposure at levels between 10 and 40 ppm.

Several other studies demonstrate that exposure to carbon disulfide is associated with the development of neurological symptoms, including nervousness, irritability, indigestion, bizarre dreams, insomnia, excessive fatigue, loss of appetite, and headache. More severe symptoms such as psychosis, polyneuritis, and tremors have also been reported (Vigliani 1954; Gordi and Trumper 1938).

Seppalainen and Tolonen (1974) conducted a neurological study on a subgroup of the same workers whose exposure to carbon disulfide at levels between 10 and 30 ppm was considered a contributing factor to coronary heart disease (Tolonen et al. 1975; 1979). They reported an increased incidence of pathologically reduced nerve conduction velocities and abnormal electroencephalograms in exposed workers relative to unexposed workers. The observed decreases in nerve conduction velocity were believed by these researchers to be irreversible.

Several scientists have urged that the exposure limits for carbon disulfide be reduced; Gordi and Trumper (1938) and Kleinfeld and Tabershaw (1955) all advocated a TWA of 10 ppm for carbon disulfide on the basis of its adverse neurological effects. In light of these recommendations and the reports of adverse cardiovascular effects in workers exposed to "relatively low concentrations," the ACGIH (1986) recommended a TLV of 10 ppm TWA. However, NIOSH (1977) considered 10 ppm to be the "lowest concentration causing demonstrated adverse health effects" (p. 137), and believed it necessary to apply a safety factor because "coronary heart disease frequently results in sudden death" (p. 137). Therefore, NIOSH recommended a 10-hour TWA of 1 ppm with a 15-minute short-term limit of 10 ppm with a 15-minute short-term limit of 10 ppm to protect against acute neurological effects associated with exposure to high concentrations of carbon disulfide.

OSHA preliminarily concludes that the epidemiological studies showing neurological and cardiovascular disease among workers exposed to 9 ppm and to between 10 and 40 ppm demonstrate that a risk exists at the current OSHA TWA PEL of 20 ppm for carbon disulfide. OSHA believes that the reduction of the current PEL from 20 ppm to a 1-ppm TWA and a 10-ppm 15-

minute STEL is essential to reduce the risk of adverse effects on the cardiovascular and neurological systems caused by exposure to carbon disulfide at the existing PEL. Because there are reports of cardiovascular and biochemical changes at levels below the ACGIH's limit, the 10-ppm TLV does not provide adequate protection. OSHA is proposing the NIOSH recommendations of a 1-ppm TWA and a 10-ppm STEL as the permissible exposure limits. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for carbon disulfide if the Agency determines that this limit will substantially reduce significant risk.

CHLOROPENTAFLUOROETHANE
CAS: 76–15–3; Chemical Formula: $ClCF_2CF_3$
H.S. NO. 1087

OSHA has no current limit for chloropentafluoroethane (FC–115); the ACGIH recommends a TLV–TWA of 1000 ppm for this colorless, odorless gas.

Chloropentafluoroethane vapors have rather low acute toxicity. In dogs and rats, gastrointestinal absorption following intragastric intubation has been shown to be minimal (Terrill 1974; Clayton, Hood, Nick, and Waritz 1966). The inhalation toxicity for this compound is very low; rats exposed to 800,000 ppm for 4 hours showed no clinical or histopathologic effects (Clayton, Hood, Nick, and Waritz 1966). Rats and guinea pigs showed no adverse clinical effects at inhalation levels of 600,000 ppm for 2 hours (Weigand 1971), and guinea pigs exposed to 200,000 ppm for varying intervals also exhibited no adverse signs (Breen and Wallis 1963). Rats, mice, rabbits and dogs have also demonstrated that FC–115 has a very low subchronic inhalation toxicity. These species have tolerated 6-hour daily exposures of 100,000 ppm for 90 days without adverse effects (Clayton, Hood, Nick, and Waritz 1971), and laboratory animals have tolerated doses of 200,000 ppm for 3.5 hours daily, 5 days per week, for 4 weeks (Weigand 1971). The potential for cardiac sensitization appears to be very low for FC–115; only one of 13 unanesthetized dogs showed cardiac sensitization after exposure to 150,000 ppm intravenously (Trochimoicz, Azar, Terrill, and Mullin 1974). However, several other studies indicate that unanesthetized dogs, rats, and monkeys receiving dosages between 100,000 ppm and 200,000 ppm may show increased blood pressure, accelerated heart rate, myocardial depression, or altered pulmonary effects under certain conditions (Belej and Aviado 1975; Friedman, Cammarato, and Aviado 1973; Aviado and Belej 1975). There are no reports of mutagenic, teratogenic, or carcinogenic toxicities in these studies.

OSHA is proposing an 8-hour TWA permissible exposure limit of 1000 ppm for chloropentafluoroethane. The Agency preliminarily concludes that this limit will protect workers from the risk of cardiac effects at the extremely high levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for chloropentafluoroethane. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ETHYLENE GLYCOL DINITRATE
CAS: 628–96–6; Chemical Formula: $CH_2H_4(NO_3)_2$
H.S. No. 1170

NITROGLYCERIN
CAS: 55–63–0; Chemical Formula: $CH_2NO_3CHNO_3NO_3$
H.S. No. 1290

The current OSHA PELs for ethylene glycol dinitrate (EGDN) and nitroglycerin (NG) are ceilings of 0.2 ppm (1 mg/m³ and 2 mg/m³, respectively, with skin notations). The ACGIH (1986) has established a TWA of 0.05 ppm (0.3 mg/m³) for EGDN and a TWA of 0.05 ppm (0.05 mg/m³) for NG, both with skin notations, to protect against the hypotension and headaches caused in occupationally exposed populations by the vasodilatory effects of these substances. NIOSH recommends a 20-minute ceiling of 0.1 mg/m³ for both of these substances.

Most occupational exposures to EGDN actually involve mixtures of EGDN and nitroglycerin (NG). Because EGDN is 160 times more volatile than nitroglycerin, and most of the mixtures of these two substances used in industry consist of 60 to 80 percent EGDN, the adverse effects associated with inhalation of such mixtures can be attributed primarily to EGDN.

Trainor and Jones (1966) reported that exposure to EGDN:NG at a level of 0.7 mg/m³ for 25 minutes was sufficient to produce decreased blood pressure and a slight headache in humans. The authors also reported that workers at a munitions plant developed headaches when exposed to EGDN:NG concentrations between 0.1 and 0.53 mg/m³ (0.36 mg/m³ average). Morikawa et al. (1967) found that workers in an explosives plant exposed to low concentrations of EGDN:NG (0.066 ppm was the highest average level) had a much higher incidence of abnormal pulse waves than controls (143 out of 1,271 versus 0 out of 175). (Abnormal pulse waves often indicate a clinically significant defect in the functioning of the heart and/or circulatory system (Braunwald 1978).)

In its Criteria Document for NG and EGDN, NIOSH (1978b) refers to a report of a dynamite worker who died when exposed to EGDN:NG concentrations between 0.3 and 1.4 mg/m³, and to another report of two workers who died suddenly following exposure to EGDN:NG at concentrations ranging from 1.7 to 2.7 mg/m³. NIOSH (1978) observed that skin absorption may have contributed significantly to these deaths.

Based on the evidence described above, the ACGIH recommended a 0.05-ppm TLV–TWA and a 0.1-ppm TLV–STEL in 1981. Because the studies relied on were primarily reports of adverse effects resulting from chronic exposure, ACGIH adopted the TLV–TWA without the STEL in 1983. After reviewing the same evidence, NIOSH (1978) concluded that exposure to EGDN:NG should be controlled to a level below that associated with vasodilation, which is the most sensitive indicator of toxicity. Relying primarily on the Trainor and Jones (1966) study, NIOSH concluded that workers exposed to or below 0.1 mg/m³ will not develop vasodilation, as indicated by the development of headache. Because vasodilation and associated headache were found to occur even on short-term exposure to EGDN:NG, NIOSH recommended a 20-minute short-term limit of 0.1 mg/m³ approximately 0.01 ppm).

Hypotension and headache have been observed in populations exposed below 0.5 mg/m³, and fatalities have occurred at EGDN:NG exposures of between 0.3 and 1.4 mg/m³ in one instance, and between 1.7 and 2.7 mg/m³ in another. OSHA's existing standard is 0.3 mg/m³, as is the ACGIH TLV. Since worker deaths have occurred at or near the current PEL, OSHA proposes adoption of the more stringent 0.1-mg/m³ (0.01-ppm) NIOSH short-term limit as the PEL to prevent fatalities and protect against adverse health effects. It should be noted that toxicity can be produced readily through the skin, and therefore the recommended environmental limit is protective only if skin contact is prevented. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethylene glycol dinitrate and nitroglycerin if the Agency determines that this limit will substantially reduce significant risk.

FLUOROTRICHLOROMETHANE
CAS: 75–69–4; Chemical Formula: CCl_3F
H.S. No. 1180

Fluorotrichloromethane, also known as FC–11, is a member of a large family of chemicals, the chlorofluorocarbons. The current OSHA PEL is an 8-hour TWA of 1000 ppm. NIOSH has no REL for fluorotrichloromethane. OSHA proposes that the standard be revised to a ceiling limit of 1000 ppm, which corresponds to the current ACGIH TLV for this substance.

Inhalation of large doses of FC–11 has caused cardiac sensitization and death in humans. Experimental mice that inhaled aerosol containing 10 percent FC–11 exhibited cardiac arrhythmias. In the same study, dogs that inhaled aerosol containing 2.5 percent FC–11 had decreased myocardial function; monkeys that inhaled an aerosol containing 5 percent FC–11 developed tachycardia and hypotension (NRC 1977).

Exposure to 5000 ppm FC–11 has induced cardiac sensitization and arrhythmia in dogs that were intravenously injected with epinephrine (Reinhardt, Azar, Maxfield et al. 1971). Jenkins, Jones, Coon, and Siegel (1970) found that four species of animals (monkeys, dogs, rats, and guinea pigs) suffered no ill effects after 90 days of continuous exposure to 1000 ppm FC–11.

Because 1000 ppm appears to represent a no-effect level for FC–11, OSHA recommends a ceiling of 1000 ppm, which will provide workers with a greater margin of safety against cardiac sensitization than the Agency's current 1000-ppm 8-hour TWA. The cardiac sensitization exhibited by FC–11-exposed animals is an acute effect. OSHA's current 1000-ppm TWA PEL would permit workers to be exposed to short-term concentrations of FC–11 that are sufficiently high to sensitize the heart to sympathomimetic amines. Accordingly, OSHA finds that, at the current limit, workers are at risk of experiencing arrhythmia. Reducing this to a 1000-ppm ceiling limit (the observed no-effect level in animals) should ensure that no worker is placed at risk of cardiac sensitization as a result of exposure to FC–11. Therefore OSHA is proposing to revise its 1000-ppm TWA–PEL for this substance to a 1000-ppm ceiling value. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for fluorotrichloromethane if the Agency determines that this limit will substantially reduce significant risk.

SODIUM AZIDE
CAS: 26628–22–8; Chemical Formula: NaN_3
H.S. No. 1364

There is no current OSHA PEL for sodium azide and NIOSH also has no REL for this substance. The ACGIH (1986) recommends ceiling limits of 0.1 ppm for sodium azide (as hydrazoic acid vapor), or 0.3 mg/m³ as NaN_3).

Sodium azide is known to produce hypotension in laboratory animals and humans. An intravenous dose of 1 mg/kg has been reported to lower blood pressure in cats (Graham 1949). In the 1950s, the medicinal usefulness of sodium azide as a hypotensive agent was tested in 30 hypertensive patients. Their hypertension was reduced, but observed side effects included headaches; in addition, 20 of 30 patients developed increased sensitivity to sodium azide, necessitating a reduction in the dose (Black et al. 1954).

Acute inhalation by humans of hydrazoic acid vapor (which forms when sodium azide contacts water) results in lowered blood pressure, eye irritation, bronchitis, headache, weakness, and collapse (Fairhall et al. 1943; Graham 1949). The exposure levels that produce these effects were not reported by these authors. Haas and Marsh (1970) report that exposure to concentrations of hydrazoic acid vapor as low as 0.5 ppm "cause some discomfort to laboratory personnel."

Because of its hypotensive effect in humans, OSHA believes that a limit should be established for sodium azide that will reduce the risk posed to workers at the previously uncontrolled levels of this substance permitted in the workplace. To reduce this risk substantially, OSHA is proposing to establish a ceiling limit of 0.1 ppm HN_3 (0.3 mg/m³ NAN_3) for sodium azide. The health evidence forms a reasonable basis for proposing a new limit for sodium azide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE
CAS: 76–13–1; Chemical Formula: CCl_2FCClF_2
H.S. No. 1403

1,1,2-Trichloro-1,2,2-trifluoroethane (FC–113) is a member of the chlorofluorocarbon family. The current OSHA PEL is an 8-hour TWA of 1000 ppm. The ACGIH has an 8-hour TLV–TWA of 1000 ppm and a 15-minute STEL of 1250 ppm. NIOSH has no REL for 1,1,2-trichloro-1,2,2-trifluoroethane.

Cardiac sensitization following the administration of epinephrine is the most significant effect observed after exposure to FC–113. Reinhardt, Mullin, and Maxfield (1973) observed that 10 out of 29 dogs exposed to 5000 ppm FC–113 for 5 minutes and simultaneously injected with epinephrine developed serious arrhythmias. Similar experiments in which the dogs were exposed to 2000 to 2500 ppm of this substance for longer periods of time (from one-half to 6 hours) and administered epinephrine resulted occasionally in arrhythmia (Aviado 1975). However, when the experiment was repeated using four 6-hour exposures to 1000 ppm in conjunction with an injection of epinephrine, no arrhythmias were observed.

A study by Stopps and McLaughlin (1967) of human volunteers revealed that exposure to 2500 ppm FC–113 resulted in impairment of psychomotor performance (described as loss of ability to concentrate and lethargy). This effect was not observed at concentrations below 2500 ppm.

The evidence described above demonstrates that FC–113 can exert toxic effects at levels of exposure comparable to the levels that are permitted by excursions above the current OSHA TWA of 1000 ppm; thus, current levels pose a risk of cardiac sensitization to exposed workers. OSHA finds that a STEL of 1250 ppm will provide a wider margin of safety against cardiac sensitization and impaired psychomotor performance by limiting the potentially high, short-term exposures currently permitted by the 8-hour TWA. OSHA believes that establishing a STEL of 1250 ppm will reduce this risk of FC–113-induced cardiovascular toxicity. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 1,1,2-trichloro-1,2,2-trifluoroethane if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

Of all the physiological systems, the cardiovascular system is especially vulnerable to occupational hazards because cardiovascular diseases are already so prevalent in our society. According to Levy (1985), "an estimated 40 million Americans have some form of cardiovascular disease." The major risk factors, as revealed by epidemiology, are age, male sex, hypertension, cigarette smoking, the existence of low-density and high-density plasma lipoproteins, cholesterol, and diabetes (Levy 1985). Many American workers exposed to the chemicals grouped here on the basis of their cardiovascular

effects have one or more of these risk factors and are therefore particularly susceptible to exposure to cardiovascular toxicants. Although the precise interactions among these risk factors and exposures to cardiovascular toxins are difficult to demonstrate with accuracy, few would argue that they do not occur.

OSHA preliminarily concludes that the potential for cardiovascular system damage associated with exposure to these cardiac sensitizers, vasodilators, and atherosclerosis-causing substances poses a risk to employees in a broad range of workplaces. The effects experienced by exposed workers range from arrhythmia, low blood pressure, stroke, and blockage of the flow of blood to the myocardium. Reducing the exposure limits for these cardiovascular toxins from levels where such effects could occur to concentrations where their occurrence is unlikely will substantially reduce these risks. OSHA believes that the health evidence for these cardiovascular toxins forms a reasonable basis for proposing new or revised limits. At the time of the final rule, OSHA will establish new or revised limits for these substances if the Agency determines that such limits will substantially reduce significant risk.

8. Substances for Which Proposed Limits Are Based on Avoidance of Systemic Toxicity

Introduction

For a number of substances, OSHA's proposed limits are based primarily on evidence that exposure to these substances is associated with general systemic toxicity. This group of substances is unique among the groupings discussed so far in that no single low-dose target organ system can be identified for these chemicals. Instead, these substances have been shown either to affect several organ systems simultaneously or to cause a variety of nonspecific adverse signs and symptoms that are indicative of general toxicity.

The 33 substances belonging to this group and their CAS numbers, HS numbers, current PELs, ACGIH TLVs, and RELs are shown in Table C8–1. OSHA is proposing to establish exposure limits for 17 substances in this group for which there are currently no Z table limits. OSHA is also proposing to retain the Agency's PELs for eight substances and to add STELs to them. For five substances, OSHA is proposing to lower its existing TWA PELs. For two additional substances that have existing TWA PELs, OSHA is proposing to delete the TWA PELs and to adopt ceiling values instead. For one remaining substance, OSHA is proposing to delete its existing ceiling limit and to adopt a new TWA PEL. NIOSH recommends limits for 11 of the substances that differ in some respects from the ACGIH TLVs.

Description of the Health Effects

For each substance included in this grouping, limits have been established to protect against a variety of adverse exposure-related effects that are manifested at multiple target organ sites. In some instances, the nature of the toxic effects associated with exposure is well-defined and clearly understood (for example, CNS depression, histological organ changes, embryotoxicity, methemoglobinemia, conjunctivitis). The effects of exposure to other substances in this group, however, have been demonstrated only by such nonspecific indicators as weight loss or decreased weight gain, lethargy, loss of appetite, nervousness, or gastrointestinal disturbances. Although the specificity of the systemic effect caused by exposure to the substances in this group may vary, all of these substances have been shown to be biologically active in mammalian species, to interfere significantly with biological processes, and to impair normal organ function.

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TABLE C8-1. Substances for Which Limits Are Based on Avoidance of Systemic Toxicity

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1005 Acetonitrile[+]	75-05-8	40 ppm TWA	40 ppm TWA 60 ppm STEL, Skin	20 ppm TWA
1006 Acetylsalicylic acid (Aspirin)	50-78-2	--	5 mg/m^3 TWA	--
1019 Aluminum (Welding fumes)	7429-90-5	--	5 mg/m^3 TWA	--
1046 2-Butoxy ethanol	111-76-2	50 ppm TWA, Skin	25 ppm TWA, Skin	--
1052 n-Butyl glycidyl ether	2426-08-6	50 ppm TWA	25 ppm TWA	5.6 ppm Ceiling (15 min)
1067 Captan	133-06-2	--	5 mg/m^3 TWA	--
1088 Chloroprene	126-99-8	25 ppm TWA, Skin	10 ppm TWA, Skin	1 ppm Ceiling (15 min)
1109 Cyclohexylamine	108-91-8	-	10 ppm TWA	-
1112 Cyhexatin	13121-70-5	-	5 mg/m^3 TWA	-
1120 2-N-Dibutylamino-ethanol	102-81-8	-	2 ppm TWA, Skin	-

TABLE C8-1. Substances for Which Limits Are Based on Avoidance of Systemic Toxicity (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1139 Diglycidyl ether	2238-07-5	0.5 ppm Ceiling	0.1 ppm TWA	0.2 ppm Ceiling (15 min)
1159 Ethanolamine	141-43-5	3 ppm TWA	3 ppm TWA 6 ppm STEL	--
1167 Ethylene chlorohydrin	107-07-3	5 ppm TWA, Skin	1 ppm Ceiling, Skin	--
1189 Glycidol	556-52-5	50 ppm TWA	25 ppm TWA	--
1198 Hexafluoroacetone	684-16-2	--	0.1 ppm TWA, Skin	--
1207 Hydrogen cyanide+	74-90-8	10 ppm TWA, Skin	10 ppm Ceiling, Skin	4.7 ppm Ceiling (10 min)
1210 Hydrogenated terphenyls	61788-32-7	--	0.5 ppm TWA	--
1223 2-Isopropoxyethanol	109-59-1	--	25 ppm TWA	--
1227 Isopropyl glycidyl ether	4016-14-2	50 ppm TWA	50 ppm TWA 75 ppm STEL	50 ppm Ceiling (15 min)
1273 4,4'-Methylene bis (2-chloroaniline)	101-14-4	--	0.02 ppm TWA ($0.22\ mg/m^3$), Skin	3 ug/m^3 TWA (Lowest detectable limit)

TABLE C8-1. Substances for Which Limits Are Based on Avoidance of Systemic Toxicity (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1317 Phenylhydrazine	100-63-0	5 ppm TWA, Skin	5 ppm TWA 10 ppm STEL, Skin	0.14 ppm Ceiling (120 min)
1318 Phenylphosphine	638-21-1	-	0.05 ppm Ceiling	-
1321 Phosphine	7803-51-2	0.3 ppm TWA	0.3 ppm TWA 1 ppm STEL	--
1330 Piperazine dihydrochloride	142-64-3	--	5 mg/m^3 TWA	--
1340 n-Propyl nitrate	627-13-4	25 ppm TWA	25 ppm TWA 40 ppm STEL	--
1366 Sodium fluoroacetate	62-74-8	0.05 mg/m^3 TWA, Skin	0.05 mg/m^3 TWA 0.15 mg/m^3 STEL, Skin	--
1412 Trimethylbenzene	25551-13-7	-	25 ppm TWA	--
1416 Tungsten Compounds (insoluble)	7440-33-7	--	5 mg/m^3 TWA 10 mg/m^3 STEL	5 mg/m^3 TWA
1417 Tungsten Compounds (soluble)	7440-33-7	--	1 mg/m^3 TWA 3 mg/m^3 STEL	1 mg/m^3 TWA

TABLE C8-1. Substances for Which Limits Are Based on Avoidance of Systemic Toxicity (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1428 Vinylidene chloride	75-35-4	--	5 ppm TWA 20 ppm STEL	Lowest feasible level
1430 Welding fumes (Total particulate)	--	-	5 mg/m^3 TWA	--
1437 Zinc oxide (Fume)	1314-13-2	5 mg/m^3 TWA	5 mg/m^3 TWA 10 mg/m^3 STEL	5 mg/m^3 TWA 15 mg/m^3 Ceiling (15 min)
1439 Zirconium compounds	7440-67-7	5 mg/m^3 TWA	5 mg/m^3 TWA 10 mg/m^3 STEL	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceiling are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed limit is the NIOSH REL.

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Table C8–2 summarizes the toxic effects reported in humans and experimental animals to support the establishment of limits for these substances. This table shows the variety of adverse health effects that adoption of the proposed limits will minimize or prevent. The table also shows that, for the vast majority of substances in this group, the risks of exposure have been defined in studies of humans or animals and are known to include respiratory effects, neurological effects, adverse effects on the reproductive system, organ damage, hematopoietic effects, sensitization, and mucosal irritation. All of these effects are indicative of generalized systemic effects rather than localized effects occurring at the site of chemical contact.

Dose-Response Relationships and Systemic Effects

As Table C8–2 shows, adverse toxic reactions have been reported to occur in humans for 18 of the 33 substances in this group; thus, for more than half of these substances, it has been established conclusively that exposure is associated with adverse health effects in humans. Experimental animal data comprise the principal evidence for the toxicologic action of the remaining substances. As is the case for many substances for which limits are being proposed, apparent no-observed effect levels, supplemented by the use of an additional safety factor to take more sensitive individuals into account, provide the basis for setting limits. The systemic toxic effects caused by exposure to substances in this group appear to follow an NOE dose-response pattern. That is, as intensity and/or duration of exposure decreases, the severity of the effect on organ systems also decreases until a point is reached where there is no detectable effect, at least at observable levels, on organ systems at or below the NOE level. No-effect exposure levels have been identified in humans and animals for several of the substances in this group; where no-effect levels have been identified (i.e., for diglycidyl ether and phenylphosphine), they have provided the primary basis for the proposed limits.

TABLE C8–2.—SUMMARY OF ADVERSE HEALTH EFFECTS REPORTED FOR SUBSTANCES PRODUCING GENERAL SYSTEMIC TOXICITY

H.S. No./Chemical name	Effects reported in humans	Effects reported in animals
1005 Acetonitrile	Tightness in chest	Embryotoxicity.
	Flushing of face	Teratogenicity at maternally toxic doses.
		Liver, blood count changes.
1006 Acetylsalicylic acid	Mucosal irritation	Teratogenicity at "very large" doses.
	Respiratory allergic response	
	Internal bleeding	
1019 Aluminum welding fumes	No data	Respiratory effects.
1046 2-Butoxy ethanol	Mild sensory irritation	Severe hemoglobinuria; lung, kidney, liver changes.
		Hemolytic anemia, increased osmotic fragility in erythrocytes
1052 n-Butyl glycidyl ether	Dermatitis, skin sensitization	Delirium, depression.
1067 Captan	Recurrent urticaria	Decreased fertility index in males.
		Polyploid carcinoma of duodenum.
1088 Chloroprene	CNS depression	"Mineral systemic effect."
	Lung, liver, kidney injury	
	Conjunctivitis, necrosis of cornea	
	Lowering of blood pressure	
1109 Cyclohexylamine	Acute toxicity	Mutagenic and reproductive effects.
	Sensitization	
1112 Cyhexatin	No data	Microscopic changes in liver, kidney, adrenal glands.
1120 2-N-Dibutylaminoethanol	No data	Weight loss.
		Elevated liver- and kidney-to-body-weight ratios.
1139 Diglycidyl ether	Mucosal irritation	CNS depression.
		Clouding of cornea.
		Respiratory irritation.
		Hematopoietic effects.
1159 Ethanolamine	No data	Pulmonary, hepatic, and renal lesions.
		Decreased alertness.
		Temporary weight loss.
1167 Ethylene chlorohydrin	Damage to liver and brain at lethal concentrations.	Respiratory depression.
		Liver and kidney damage.
	Mucosal irritation	
	Gastrointestinal disturbances	
1189 Glycidol	No data	Pneumonitis, emphysema.
1198 Hexafluoroacetone	No data	Renal dysfunction.
		Increased lung weight.
		Testicular damage. Hematopoietic effects.
		Fetotoxicity.
1210 Hydrogenated terphenyls	No data	Decreased weight gain.
		Liver, kidney damage.
		Lung changes, bronchopneumonia.
1207 Hydrogen cyanide	Cyanide poisoning	None reported.
	Weakness	
	Mucosal irritation	
	Colic	
	Nervousness	
	Enlargement of thyroid	
1223 2-Isopropoxyethanol	No data	Anemia.
		Hemoglobinuria.
		Lung congestion.
1227 Isopropyl glycidyl ether	Mucosal irritation	Reduced weight gain.
		Hemoglobin increase.
		Emphysematous changes in lungs.
		CNS depression.

TABLE C8-2.—SUMMARY OF ADVERSE HEALTH EFFECTS REPORTED FOR SUBSTANCES PRODUCING GENERAL SYSTEMIC TOXICITY—Continued

H.S. No./Chemical name	Effects reported in humans	Effects reported in animals
1273 4,4'-methylene-bis (2-chloroaniline)	Hematuria	Cyanosis. Methemoglobinemia. Liver, lung tumors.
1317 Phenylhydrazine	Skin sensitization	Anemia. Irregular growth. General weakness. Blood vessel tumors.
1318 Phenylphosphine	No data	Mild hemolytic anemia. Testicular degeneration. Hind leg tremor. Nausea, loss of appetite. Hypersensitivity to sound and touch.
1321 Phosphine	Pulmonary edema Gastrointestinal disturbances Dizziness	Respiratory irritation.
1330 Piperazine dihydrochloride	Skin burns, sensitization, asthma	No data.
1340 n-Propyl nitrate	No data	Cyanosis. Methemoglobinemia. Hypotension. Respiratory depression.
1366 Sodium fluoroacetate	No data	Fluctuation in growth rate. Tissue changes.
1412 Trimethylbenzene	Nervousness, tension, anxiety Asthmatic bronchitis Hypochromic anemia	Lymphopenia, neutrophilia.
1416 Tungsten compounds (insoluble)	No data	Gross changes in liver and spleen. Lung tissue changes.
1417 Tungsten compounds (soluble)	No data	Generalized cellular asphyxiation. Colic. Incoordination. Dyspnea.
1428 Vinylidene chloride	No data	Nasal irritation. Liver cell degeneration. Retarded weight gain. Embryotoxicity Kidney adenocarcinoma.
1430 Welding fumes (total particulate)	Pulmonary irritation	Pulmonary irritation.
1437 Zinc oxide (fume)	Metal fume fever, gastritis	No data.
1439 Zirconium compounds	No data	Toxic effects from zirconium tetrachloride due to liberation of hydrochloric acid.

In instances where no-effect levels have not been reported (e.g., for n-butyl glycidyl ether, trimethylbenzene, and acetylsalicylic acid), OSHA has used safety factors and expert judgment to derive an NOE value.

The following discussions describe OSHA preliminary findings for these systemic toxicants.

ACETONITRILE
CAS: 75-05-8; Chemical Formula: CH_3CN
H.S. No. 1005

Acetonitrile is most widely used in industry as a specialty solvent and chemical intermediate. The current occupational exposure limit for acetonitrile is a 40-ppm TWA. The ACGIH has recommended a 40-ppm TLV-TWA with a 60-ppm TLV-STEL, in addition to a skin notation. NIOSH (1978) has also evaluated the toxicity of acetonitrile and has recommended a TWA limit of 20 ppm.

The only human evidence describing the toxic effects associated with exposure to acetonitrile is a report by Pozzani et al. (1959), who exposed human subjects to acetonitrile vapor. None of three subjects exposed to 40 ppm for 4 hours reported any adverse responses during the exposure period, but one subject experienced slight tightness of the chest a few hours after termination of exposure as well as a cooling sensation in the lungs the following day. None of the subjects had elevated blood cyanide levels; one subject showed a slightly elevated urinary thiocyanate level. Pozzani et al. (1959) also exposed two subjects to 80 ppm and 160 ppm of acetonitrile for 4 hours. Subjects exposed to 80 ppm reported no adverse response. One subject exposed to 160 ppm experienced slight flushing of the face and chest tightness a few hours after exposure (Pozzani et al. 1959).

In animal studies, acetonitrile has been found to be embryotoxic and teratogenic in rodents only at exposure levels sufficiently high to cause maternal toxicity (Berteau et al. 1982; Willhite 1983). A 13-week inhalation study conducted by the National Toxicology Program (Hazelton Laboratories 1983) found pathological changes in the liver and some blood changes in mice and rats exposed to concentrations of 400 ppm acetonitrile.

The human study by Pozzani et al. (1959) provides the primary basis for both the ACGIH's 40-ppm TWA and 60-ppm STEL and NIOSH's REL of 20 ppm (TWA). In addition to this study, NIOSH (1978) cites a report by Amdur (1959), who investigated an incident in which 16 painters became ill (with one death) after using an acetonitrile-containing material in a confined space. Amdur (1959) reported no further incidents after adequate ventilation was installed and acetonitrile levels were maintained at about 17 ppm. NIOSH concluded that exposure to 40 ppm "produced minimal effects, whereas no observable effects were produced in humans at 17 ppm" (NIOSH 1978, p. 97). Therefore, NIOSH recommended that exposure not exceed 20 ppm as a 10-hour TWA.

OSHA proposes a 20-ppm PEL for acetonitrile. Minor health effects have been reported at the 40-ppm TLV-TWA (with a 60-ppm STEL) level; the identification of 17 ppm as a no-effect

level is a major consideration in selection of the 20-ppm REL value that the Agency proposes to adopt. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for acetonitrile if the Agency determines that this limit will substantially reduce significant risk. OSHA's preliminary feasibility analysis is based on limited data at this level, and additional feasibility information is requested from the public.

ACETYLSALICYLIC ACID (ASPIRIN)
CAS: 50-78-2; Chemical Formula: $CH_3COOC_6H_4COOH$
H.S. No. 1006

There is no current OSHA limit or NIOSH REL for acetylsalicylic acid. The ACGIH has established a TLV of 5 mg/m³ as an 8-hour TWA.

The work of O'Brien (1968) reports that a normal therapeutic dose of 600 mg aspirin will interfere with platelet aggregation in exposed subjects for a period of five days or more. Hart (1947) also reported that 150 mg is the smallest oral dose of acetylsalicylic acid that will produce this effect. Unpublished data from the Dow Chemical Company (cited in ACGHIH 1986, p. 10) indicate that aspirin concentrations exceeding 100 mg/m³ are tolerated except for occasional skin irritation. However, no data are available on the long-term effects on organ systems of inhalation exposure to aspirin. Secondary sources report that aspirin is an acute irritant to the gastric mucosa and respiratory tract.

OSHA is proposing an 8-hour TWA of 5 mg/m³ for acetylsalicylic acid. The Agency preliminarily concludes that this limit will prevent blood effects and gastric and respiratory irritation, and proposes to protect workers from these adverse effects by reducing this uncontrolled risk. This health evidence forms a reasonable basis for proposing a new limit for acetylsalicylic acid. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ALUMINUM (WELDING FUMES)
CAS: 7429-90-5; Chemical Formula: Al
H.S. No. 1019

OSHA currently has no permissible exposure limits for aluminum welding fume. The ACGIH recommends an 8-hour TLV-TWA of 5 mg/m³.

Aluminum welding fumes are produced by arc-welding in a protective, inert atmosphere such as argon. Some aluminum fume is created by these arcs, as is an intense radiation that can produce ozone. Because workers exposed to arc welding fumes have previously not been protected by a permissible exposure limit, OSHA proposes a PEL of 5 mg/m³ TWA for these welding fumes. The Agency preliminarily concludes that this limit will protect welders and other workers in the vicinity of the welding from exposure to the significant irritation potentially associated with inhalation of these fumes. This health evidence forms a reasonable basis for proposing a new limit for aluminum (welding fumes). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2-BUTOXYETHANOL
CAS: 111-76-2; Chemical Formula: $C_4H_9OCH_2CH_2OH$
H.S. No. 1046

OSHA's current permissible exposure limit for 2-butoxyethanol, one of the family of substances known as the glycol ethers, is 50 ppm as an 8-hour TWA, with a skin notation. The ACGIH recommends a limit of 25 ppm TWA, also with a skin notation, for this colorless liquid with a mild ether odor.

2-Butoxyethanol has long been known to be toxic, with early studies indicating that a single 7-hour exposure to 700 ppm was lethal to laboratory animals (Werner, Mitchel, Miller et al. 1943). Exposures near the lethal level caused systemic toxicity in the form of hemoglobinuria and lung, kidney, and liver changes. Carpenter and associates (1956) reported hemolytic anemia and increased fragility of the red blood cells in rats repeatedly exposed to 2-butoxyethanol at 320 ppm for 5 weeks. However, repeated exposure for 12 weeks at 400 ppm was only slightly injurious to dogs (Werner, Mitchell, Miller et al. 1943).

Humans appear to be less susceptible to butoxyethanol poisoning than experimental animals. In humans, several single 8-hour exposures at levels of 200 ppm and 100 ppm caused urinary excretion of butoxyacetic acid. However, these subjects experienced irritation and discomfort after these exposures (Carpenter, Pozzani, Weil et al. 1956). However, a recent study has confirmed that the increased erythrocyte osmotic fragility observed in rats exposed to many of the glycol ethers is a very sensitive indicator of toxicity and correlates with the development of hemoglobinuria at higher exposure levels (Moffett, Linnett, and Blair 1976). These findings indicate that the no-effect level in animals is approximately 25 ppm. The ACGIH suggests that 2-butoxyethanol's toxicity may be more likely to occur as a result of skin absorption than as a consequence of inhalations (ACGIH 1986, p. 71).

OSHA preliminarily concludes that the current PEL of 50 ppm is insufficiently protective against the risk of 2-butoxyethanol's hematological effects. The proposed limit of 25 ppm will reduce this risk to a level below that at which these toxic effects have been observed. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 2-butoxyethanol if the Agency determines that this limit will substantially reduce significant risk.

n-BUTYL GLYCIDYL ETHER
CAS: 2426-08-6; Chemical Formula: $C_4H_9OH_2CHOCH_2$
H.S. No. 1052

The current OSHA limit for n-butyl glycidyl ether is 50 ppm TWA. The ACGIH-recommended TLV is 25 ppm; NIOSH has recommended that occupational exposure to n-butyl glycidyl ether not exceed 5.6 ppm as a 15-minute short-term level.

OSHA's current PEL of 50 ppm, which was adopted from the ACGIH's 1968 TLV list, was based on a Dow Chemical Company report (cited in ACGIH 1986, p. 81) that showed that repeated applications of n-butyl glycidyl ether to the skin of humans caused irritation and sensitization; at the time, the ACGIH concluded that a limit of 50 ppm would prevent these irritation responses. The ACGIH proposed to reduce the TLV to 25 ppm in 1978, noting that the 50-ppm limit was only 13 times lower than the 8-hour LC_{50} (670 ppm) reported for this chemical in rats and that a wider margin of safety was desirable.

The NIOSH limit of 5.6 ppm was recommended in the Institute's June 1978 Criteria Document on Glycidyl Ethers. This limit was based, in large part, on mutagenic studies conducted in microbial and mammalian test systems, as well as some evidence for other glycidyl ethers that exposure is associated with testicular atrophy and hematopoietic abnormalities in laboratory animals. After publication of its Criteria Document, NIOSH received a confidential report prepared for the Shell Development Company by Anderson et al. (1957), who had conducted a rat inhalation study. In the research, rats were exposed to 38 ppm, 75 ppm, 150 ppm, or 300 ppm for seven hours daily, 5 days per week for 10 weeks. Atrophic testes were found in 5 of 10 rats exposed to 300 ppm, very small testes were found in 1 of 10 rats exposed to 150 ppm, and patchy atrophy was found in 1 of 10 rats exposed to 75 ppm. No effects were observed in rats exposed at 38 ppm. Based on this

additional evidence, NIOSH reaffirmed its REL for n-butyl glycidyl ether in a Current Intelligence Bulletin published in October, 1978.

The NIOSH REL of 5.6 ppm (15-minute STEL) is based on in-vitro testing of microbial and mammalian systems, and extensive extrapolation of these data is required to predict effects in humans. The 25-ppm TLV is based on an increased factor of safety applied to the LC_{50} rate determined in animal studies and is below the observed no-effect level of 38 ppm. OSHA therefore proposes that a PEL of 25 ppm TWA be adopted to protect exposed workers from the serious adverse effects of butyl glycidyl ether exposure. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-butyl glycidiy ether if the Agency determines that this limit will substantially reduce significant risk.

CAPTAN
CAS: 133-06-2; Chemical Formula: $C_9H_8Cl_3NO_2S$
H.S. No. 1067

OSHA does not currently regulate captan. The ACGIH recommends a TLV-TWA of 5 mg/m³ for this substance, which is a white, crystalline, odorless solid.

Skin applications of 900 mg/kg captan produce skin irritation in experimental animals. Long-term feeding studies did not reveal adverse effects in dogs fed captan in the diet at levels of 100 mg/kg/day for 66 weeks or in rats fed 1000 mg/kg/day for 2 years (Martin 1971; Spencer 1968). Male mice showed decreased fertility at levels of 50 or 100 mg/kg/day for 5 days (Collins 1972).

Studies on the mutagenicity of captan indicate that the substance acts as an alkylating agent and induces chromosome rearrangements in rats and point mutations in *Neurospora crassa* (Epstein and Legator, as cited in ACGIH 1986, p. 98). Legator and colleagues (1969) reported that concentrations of 10 ug/ml inhibited DNA in human embryo cells, and concentrations of 1.5 ug/ml produced chromosomal aberrations in somatic and germ cells of kangaroo rats. Animal evidence concerning carcinogenicity is contradictory, although high doses caused significant incidences of polypoid carcinoma of the duodenum in mice, as well as adenomatous polyps (NCI 1977).

Some exposed individuals experience skin irritation (Spencer 1968). A case of recurrent urticaria caused by captan exposure has been reported and confirmed (Croy 1973), and captan exhibited high reactivity when administered in a battery of patch tests (Rudner 1977).

OSHA is proposing a PEL of 5 mg/m³ TWA to protect workers exposed to captan from the risk of skin irritation and reproductive effects associated with exposure to this previously unregulated substance. This health evidence forms a reasonable basis for proposing a new limit for captan. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CHLOROPRENE
CAS: 126-99-8; Chemical Formula: $CH_2{:}CClCH{:}CH_2$
H.S. No. 1088

The current OSHA limit for chloroprene is 25 ppm TWA with a skin notation. The ACGIH has recommended a 10-ppm TLV-TWA, with a skin notation, and NIOSH (1977c) recommended a limit of 1 ppm, measured over a 15-minute period.

The ACGIH recommended a reduction in the TLV from 25 ppm to 10 ppm in 1981 based on a review of the world literature by Trochimowicz, who prepared the 1980 ACGIH proposed documentation, and by Reinhardt (personal communication 1980, as cited in ACGIH 1986, p. 135). Reinhardt concluded that there was no evidence indicating a lack of safety associated with the 25-ppm TLV, but "minimal systemic effects" (i.e., growth retardation) seen in rats and hamsters exposed to 39 ppm for 4 weeks or 50 ppm for a lifetime suggest that an additional margin of safety was in order. Therefore, the ACGIH reduced the TLV-TWA to 10 ppm.

In recommending a 1-ppm 15-minute exposure limit, NIOSH (1977c) cited three reports on plants in the Soviet Union. Katosova (1973) reported finding a significant excess of chromosomal abnormalities in the blood of workers exposed to approximately 5 ppm chloroprene. Volkova et al. (1976) reported similar findings in a plant where chloroprene levels ranged from 0.8 to 1.95 ppm. In the third study, Sanotskii (1976) reported abnormal sperm morphology among workers exposed from 0.28 to 1.94 ppm; a threefold increase in the rate of spontaneous abortion among wives of the workers was also found. In addition, NIOSH (1977c) cited a study by Davtian et al. (1973), who reported a significant excess of embryonic mortality in female rats that were mated to male rats exposed to 1 ppm chloroprene. The investigators also found chromosomal aberrations in bone marrow cells of exposed male rats. NIOSH (1977c) also cited a number of reports showing chloroprene to be mutagenic in a variety of test systems. NIOSH concluded that it was prudent to limit exposure to 1 ppm over a 15-minute period, to limit the risk of genetic abnormalities being transmitted to subsequent generations. This limit represents the lowest concentration that can be measured reliably over a 15-minute period.

The 1-ppm (15-minute STEL) value recommended by NIOSH is based on studies reported in the USSR literature, and it represents an analytical and sampling limit of detection. The 10-ppm TLV-TWA is based on a 1981 critical review of the world literature and the observation that minimal systemic effects are observed at 38 ppm. OSHA proposes to adopt the 10-ppm TWA as a PEL to substantially reduce the systemic effects associated with chloroprene exposure. However, the Agency solicits comments on the significance of the Russian studies as their findings relate to risks to employees. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for chloroprene if the Agency determines that this limit will substantially reduce significant risk

CYCLOHEXYLAMINE
CAS: 108-91-8; Chemical Formula: $C_6H_{13}N$
H.S. No. 1109

OSHA has no current limit for cyclohexylamine. The ACGIH recommends a TLV-TWA of 10 ppm. Cyclohexylamine is a liquid with a strong, fishy, amine odor.

Data concerning the acute toxicity of cyclohexylamine were reported by Eastman Kodak in 1958. In rats, the oral LD_{50} of a 5-percent solution in water was between 400 and 800 mg/kg; mice fed a diet of the 1-percent aqueous solution or the undiluted amine had LD_{50}s of between 200 and 400 mg/kg. Injection of the 5-percent aqueous solution in rats produced LD_{50}s of between 5 and 25 mg/kg, while mice injected intraperitoneally with the 1-percent solution had LD_{50}s of between 5 and 10 mg/kg. In guinea pigs, the dermal LD_{50} of undiluted cyclohexylamine is reported to be between 1 and 5 mL/kg. Edema, necrosis, and eschars were reported as a consequence of these dermal exposures. In rabbits, one drop of a 50-percent solution caused complete destruction of the eye. Six-hour inhalation exposures at a vapor concentration of 12,000 ppm caused deaths in rats, but exposure to 1000 ppm caused neither toxic effects nor deaths.

Legator, Palmer, Green, and Petersen (1969) considered cyclohexylamine to be a potential carcinogen, mutagen, or

teratogen on the basis of dose-dependent chromosomal abnormalities observed in rats injected intraperitoneally with cyclohexylamine. Khera and Stolz (1971) noted adverse effects on rat fertility, and Becker and Gibson (1970) reported embryotoxic effects in mice intraperitoneally injected with cyclohexylamine. In contrast, Kennedy, Sanders, Weinberg, et al. (1969) reported no effects of exposure to cyclohexylamine on rabbit and rat fertility, reproduction, embryogenesis, or perinatal and postnatal development.

In general, there is agreement concerning the moderate-to-severe toxicity of cyclohexylamine and its potential for intense skin irritation and moderate skin sensitization (Sax 1969). The chemical is well known to be pharmacologically active, having sympathomimetic activity (Barger and Dale 1910). However, Lichfield and Swan (1971) report that human dietary levels of 5 g/day for 7 to 8 days produced no pharmacologically active levels in the tissues; furthermore, no changes were detected in blood pressure or heart rate, or in the electrocardiograms of exposed subjects. Chronic experimental toxicity data are lacking, but Watrous and Shulz (1950) have reported that exposure to 4 to 10 ppm of cyclohexylamine caused no symptoms of any kind in acutely exposed workmen.

OSHA is proposing an 8-hour TWA PEL of 10 ppm for cyclohexylamine. The Agency preliminarily concludes that limiting workplace exposures to this previously unregulated substance to the 10-ppm level will protect workers against the risk of severe skin and eye irritation, and sensitization that are potentially associated with exposure to cyclohexylamine. This health evidence forms a reasonable basis for proposing a new limit for cyclohexylamine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CYHEXATIN
CAS: 13121-70-5; Chemical Formula: $(C_6H_{11})_3SnOH$
H.S. No. 1112

OSHA currently has no limit for cyhexatin. The ACGIH recommends a TLV-TWA of 5 mg/m³. At room temperature, cyhexatin exists in the form of white crystals.

Cyhexatin has oral LD_{50}s of 500, 700, and 654 mg/kg for rabbits, guinea pigs, and chickens, respectively. The intraperitoneal LD_{50} for the rat is 13 mg/kg (NIOSH 1977). and the oral LD_{50} for the rat has been reported to be 190 mg/kg (ACGIH 1974). Skin exposure to a 1- to 2-percent solution in goats and cattle caused mild effects; sheep showed mild effects after application of a 0.5-percent solution. One of 5 sheep died from multiple skin applications of a 1-percent suspension (Johnson et al. 1975).

The toxicity of cyhexatin is considered to be moderate, although it is greater than the toxicity of most other organic tin compounds. Long-term feeding studies in the rat produced no behavioral changes, mortality, tissue changes, or hematologic or biochemical changes in response to a 2-year oral dosage at 12 mg/kg per day for 2 years; however, dosed animals were smaller than controls. After daily doses by gavage of 24 mg/kg per day for 2 weeks, rats showed microscopic changes in the liver, kidneys, and adrenal glands at autopsy. Six mg/kg is considered to be the no-effect level in rats, and in dogs, the no-effect feeding level is reported to be 3 mg/kg. Rats fed 4 to 6 mg/kg, and rabbits fed 3 mg/kg, showed no ill effects on indices for fertility, gestation, viability, or lactation (Dow Chemical Company 1973). No inhalation data on animals are available and there are no human data.

OSHA proposes an 8-hour TWA limit of 5 mg/m³ for cyhexatin. OSHA preliminarily concludes that a PEL of 5 mg/m³ will protect workers against the risk of skin and other irritation associated with exposure to this tin compound in the absence of a current limit. This health evidence forms a reasonable basis for proposing a new limit for cyhexatin. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2-N-DIBUTYLAMINOETHANOL
CAS: 102-81-8; Chemical Formula: $(C_4H_9)_2NCH_2CH_2OH$
H.S. No. 1120

OSHA currently has no limit for 2-N-dibutylaminoethanol (DBAE). The ACGIH recommends a TLV-TWA of 2 ppm, with a skin notation, for this colorless, combustible liquid, which has a faint, amine-like odor.

In rats, 2-N-dibutylaminoethanol has a single-dose oral LD_{50} of 1.7 g/kg and a corresponding intraperitoneal LD_{50} of 0.14 g/kg; these values are approximately analogous to the oral and intraperitoneal LD_{50}s for diethanolamine (Hartung and Cornish 1968). The LD_{50} for skin absorption in rabbits is 1.68 g/kg (Smyth et al. 1954). In male rats, the lowest 5-week drinking water dose tolerated without weight loss was 0.13 g/kg/day. Rats that ingested a dose of 0.43 g/kg/day showed elevated kidney-to-body-weight ratios but no histologic changes at autopsy (Cornish, Dambrauskas, and Beatty 1969). In inhalation studies of rats, 6-hour exposures at 70 ppm for 5 days killed one rat, and the surviving rats showed a 57 percent average body weight loss, as well as a doubling of kidney-to-body-weight ratio, a 10-fold increase in serumbilirubin, a slight increase in clotting time, and an elevated hematocrit. Inhalation of 33 ppm for one week caused a 3-percent body weight loss and a slight increase in clotting time, but no significant changes in the other variables observed. Twenty-seven weeks of exposure to 22 ppm caused no differences in the variables measured between exposed rats and controls (Cornish, Dambrauskas, and Beatty 1969). 2-N-dibutylaminoethanol is a more potent inhibitor of acetylcholinesterase in vitro than is diethylamine (DEA) (Hartung and Cornish 1968).

OSHA is proposing an 8-hour TWA PEL of 2 ppm, with a skin notation, for 2-N-dibutylaminoethanol. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of metabolic effects associated with inhalation exposure at the levels permitted in the absence of any OSHA limit. In addition, OSHA concludes that this substance presents a risk of systemic toxicity via percutaneous absorption and that a skin notation is required to substantially reduce this risk. This health evidence forms a reasonable basis for proposing a new limit for 2-n-dibutylaminoethanol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIGLYCIDYL ETHER
CAS: 2238-07-5; Chemical Formula: $C_6H_{10}O_3$
H.S. No. 1139

The current OSHA limit for diglycidyl ether (DGE) is 0.5 ppm as a ceiling concentration, and the ACGIH recommended TLV is 0.1 ppm as an 8-hour TWA. NIOSH recommends a limit of 0.2 ppm as a 15-minute ceiling.

Both the previous ACGIH 0.5 ppm TLV and that organization's current TLV are based on the results of an animal study reported by Hine and Rowe (1963) in which rats were administered repeated 4-hour exposures of 20 ppm, 3 ppm, or 0.3 ppm DGE. Rats exposed to 20 ppm of DGE showed respiratory irritation, loss of body weight, decreased leukocyte count, involution of the spleen and thymus, and hemorrhagic bone marrow. Residual hematopoietic effects were observed among rats exposed to 3 ppm, and no observed effects were

noted among rats exposed to 0.3 ppm after as many as 60 exposures. The previous TLV of 0.5 ppm as a ceiling value was based on the no-observed effect level of 0.3 ppm reported in this study and on industrial experience. In 1979, the ACGIH reconsidered its limit for DGE, noting that "in view of the seriousness of some of the effects produced [in the rat study], a TLV below the no-ill-effect level [of 0.3 ppm] would normally be adopted" (ACGIH 1986). The ACGIH consequently revised the TLV to 0.1 ppm as a TWA.

OSHA preliminarily finds that the revised TWA limit of 0.1 ppm will protect exposed workers against the hematopoietic and irritant effects to which they are potentially exposed at OSHA's current PEL. The risks of DGE exposure range from respiratory irritation to bone marrow effects. The proposed limit for DGE is intended to reduce this risk substantially. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, DSHA will establish a new limit for diglycidyl ether if the Agency determines that this limit will substantially reduce significant risk.

ETHANOLAMINE
CAS: 141–43–5; Chemical Formula:
$NH_2CH_2CH_2OH$
H.S. No. 1159

OSHA currently has an 8-hour TWA limit of 3 ppm for ethanolamine. The ACGIH recommends the same TWA limit and a 15-minute STEL of 6 ppm. Ethanolamine is a colorless liquid with a mild smell like that of ammonia.

The health hazards associated with exposures to ethanolamine include skin irritation and necrosis and central nervous system depression. The oral LD_{50} in rats is reported as 3.32 g/kg and the intraperitoneal LD_{50} in rats as 981 mg/kg (Hartung and Cornish 1968). The dermal toxicity is considerably higher, with the LD_{50} being reported as 1 mg/kg in the rabbit. Dermal application of the undiluted liquid also caused redness, swelling, and burns comparable to mild first-degree burns (Union Carbide Corporation, as cited in ACGIH 1986, p. 235). The eye injury potential of ethanolamine is just slightly less than that of undiluted ammonia (Carpenter and Smyth 1946). Rats fed 0.5 percent in their food for 90 days (Smyth, Carpenter, and Weil 1951) showed no adverse effects, but at 1.28 g/kg/day, fatalities occurred. Treon and associates (1975) reported lung, liver, and kidney damage in various species exposed to high concentrations of the vapor and mist. In tests of various species, Weeks and coworkers (1960) reported marked dermal effects from continuous exposures (24 hours/day, 7 days/week for from 24 to 90 days) at various concentrations of the vapor; at 12 to 26 ppm, dermal effects were less severe, but at 5 ppm, skin irritation was still evident. Dogs also experienced a slight and temporary weight loss after 90-day exposure to 5 ppm, as well as decreased activity and alertness (Weeks, Dowing, Musselman et al. 1960). Luck and Wilcox (1953) demonstrated that a portion of low-dose ethanolamine is not excreted and is presumably retained in the body of cats, rats, and rabbits.

In studies of anesthetized dogs, Priddle (1954) reported that low doses cause central nervous system stimulation, while lethal doses cause CNS depression. Ethanolamine's irritant and necrotic effect on the skin is not related to its alkalinity (Hinglais 1948).

OSHA is proposing a PEL of 3 ppm TWA and a 15-minute STEL of 6 ppm for ethanolamine. The Agency preliminarily concludes that both of these limits are required to protect workers against the risk of irritation and neuropathic effects potentially associated with exposure to the levels permitted in the absence of a short-term limit. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethanolamine if the Agency determines that this limit will substantially reduce significant risk.

ETHYLENE CHLOROHYDRIN
CAS: 107–07–3; Chemical Formula:
$ClCH_2CH_2OH$
H.S. No. 1167

OSHA currently has an 8-hour TWA limit of 5 ppm, with a skin notation, for ethylene chlorohydrin. The ACGIH recommends a ceiling limit of 1 ppm, with a skin notation. Ethylene chlorohydrin is a colorless liquid with a faint ethereal odor.

The primary health hazards associated with exposure to this substance are central nervous system effects, cardiovascular effects, liver damage, kidney damage, gastrointestinal effects, skin irritation, eye irritation, and mutagenic effects. The oral LD_{50} for rats is 72 mg/kg, and the intra peritoneal LD_{50} is 56 mg/kg (Goldblatt and Chiesman 1944). In guinea pigs, the intraperitoneal LD_{50} is 98 mg/kg, and the percutaneous LD_{50} is 205 mg/kg (Wahlberg and Bowman 1978).

The skin absorption rate for ethylene chlorohydrin is high; Semenova and associates (1978) determined that the LD_{50} must be reduced to one-fifth if ethylene chlorohydrin is administered daily for 20 days (Semenova, Kazanina, Fedyanina et al. 1978).

Inhalation toxicity is also high. Ambrose (1950) has reported that a single 1-hour exposure at 7.5 ppm and repeated 1-hour exposures at 2 ppm can be fatal to rats. Exposures of 15 minutes daily at concentrations of from 900 to 1000 ppm were fatal to rats within a few days (Goldblatt and Chiesman 1944).

In subacute and chronic studies, rats have shown fatalities from a daily dietary dose of 67.5 mg/kg (Oser, Morgareidge, Cox, and Carson 1975). Semenova and associates (1978) reported a 4-month no-effect inhalation level of 0.0033 ppm; at 0.017 ppm, slight CNS inhibition changes in the cavity of acid phosphatases and urinary secretion of nitrogen were observed after 4 months. These investigators also observed increased chromosomal aberrations in rat bone marrow at the 0.22-ppm level for 4 months (Semenova, Kazanina, Fedyanina et al. 1978).

Voost and Vet (1969) tested ethylene chlorohydrin in Klebsiella pneumoniae and found it strongly mutagenic. This finding was confirmed by the Ames test in Salmonella typhimurium; ethylene chlorohydrin reacts with DNA, since it inhibits the growth of DNA-deficient bacteria (Rosenkranz and Whodkowski 1974). A dose related increase of liver protein and glutathion depletion was observed in rats after a single dose of ethylene chlorohydrin of from 10 to 50 mg/kg (Friedman, Scalera, Balazs et al. 1977).

One fatal and several non-fatal cases of poisoning in industrial workers have been reported from exposure (for unspecified periods) to levels between 300 and 500 ppm. Autopsy of the worker who died revealed severe damage to the liver and brain, as well as effects in other organs. The survivors experienced nausea, vomiting, and irritation of the eyes, nose, and lungs (Bush, Abrams, and Brown 1949). Dierker and Brown (1944) reported that a 2-hour inhalation exposure to 300 ppm was fatal in one accidental exposure.

OSHA is proposing a ceiling limit of 1 ppm for ethylene chlorohydrin, with a skin notation. The Agency preliminarily concludes that this limit will protect workers against the risk of central nervous system and other systemic effects associated with workplace exposures at the levels permitted with a TWA limit alone. The skin notation is retained because ethylene chlorohydrin is readily absorbed through the skin. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ethylene

chlorohydrin if the Agency determines that this limit will substantially reduce significant risk.

GLYCIDOL (2,3-EPOXY-1-PROPANOL)
CAS: 556–52–5; Chemical Formula: $C_3H_6O_2$
H.S. No. 1189

OSHA currently has an 8-hour TWA limit of 50 ppm TWA for glycidol. The ACGIH recommends a limit of 25 ppm TWA for this colorless liquid.

Glycidol causes eye, respiratory, and pulmonary irritation. Hine and associates (1956) conducted a study of animal toxicity caused by glycidol exposure and reported that glycidol is irritating to the lungs, with mice and rats exhibiting pneumonitis and emphysema resulting from vapor inhalation. The LC_{50} reported for mice is 450 ppm for a 4-hour exposure; the 8-hour LC_{50} for rats is 580 ppm (Hine, Kodama, Wellington et al. 1956). A single dermal application was only mildly irritating (Draize score, 4.5); repeated daily skin applications were severely irritating after 4 days. One drop of pure glycidol in the rabbit eye caused severe but reversible corneal injury (Hine, Kodama, Wellington et al. 1956). In rats, chronic exposures to 400 ppm (7 hours/day for 50 days) did not cause systemic toxicity, but eye irritation and respiratory distress were observed after the first few exposures (Hine, Kodama, Wellington et al: 1956). A study to determine glycidol's tumorigenic potential on the skin of mice showed negative results (Van Duuren et al. 1967).

OSHA proposes an 8-hour TWA limit of 25 ppm TWA for glycidol. The Agency preliminarily concludes that this limit will protect workers against the risk of eye, respiratory, and pulmonary irritation potentially associated with exposures to this substance. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for glycidol (2,3-epoxy-1-propanol) if the Agency determines that this limit will substantially reduce significant risk.

HEXAFLUOROACETONE
CAS: 684–16–2; Chemical Formula: C_3F_6O
H.S. No. 1198

OSHA currently has no limit for hexafluoroacetone. The ACGIH recommends a TLV–TWA of 0.1 ppm, with a skin notation, for this colorless, non-flammable, and highly reactive gas.

Inhalation studies of hexafluoroacetone in animals have shown varied systemic toxicities, including injury to the liver, kidney, testes, thymus, and bone marrow. In rats and dogs exposed 6 hours/day, 5 days/week for 13 weeks at concentrations of about 0.1, 1.0, or 12 ppm, no effects (other than increased lung weights in dogs) were observed in either species at 0.1 ppm. However, the 12-ppm exposures produced severe effects in both species, including marked but reversible testicular damage and slight hypoplasia of the spleen, thymus, and lymph nodes (E.I. du Pont de Nemours & Company, Inc. 1971 as cited in ACGIH 1986, p. 303). Reversible kidney damage in rats and increased lung weights in dogs occurred during the 1.0-ppm exposures. An earlier 4-hour acute exposure of rats demonstrated that 300 ppm was a lethal concentration (E.I. du Pont de Nemours and Company, Inc., as cited in ACGIH 1986, p. 303).

In rats, 2-week dermal exposures of 65, 130, or 250 mg/kg resulted in numerous adverse effects, including testicular damage and corresponding changes in lipid metabolism (Kennedy et al. 1982). A dermal dose of 13 mg/kg produced no adverse effects (Lee and Gillies 1984). An injected dose of radiolabeled hexafluoroacetone was, for the most part, rapidly excreted in unmetabolized form in the urine; this material also did not accumulate in rat testes (Gillies and Rickard 1984). Britelli and co-workers reported that hexafluoroacetone was fetotoxic in rats (1979). Dermal application of 90 mg/kg/day to pregnant rats resulted in maternal toxicity. Fetal toxicity occurred at maternal doses of 25 mg/kg, and fetal size was reduced at maternal doses of 5 and 25 mg/kg; however, 1 mg/kg produced no fetal effect. Although soft-tissue damage and external abnormalities were observed, teratogenicity could not be demonstrated definitively (Britelli et al. 1979).

OSHA proposes an 8-hour TWA PEL of 0.1 ppm TWA and a skin notation for hexafluoroacetone. The Agency preliminarily concludes that these limits, taken together, will protect hexafluoroacetone-exposed workers from the systemic injuries that can be manifested at multiple organ sites, reproductive effects, kidney damage, and fetotoxic effects associated with exposure to this substance at previously uncontrolled levels. This health evidence forms a reasonable basis for proposing a new limit for hexafluoroacetone. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

HYDROGEN CYANIDE
CAS: 74–90–8; Chemical Formula: HCN
H.S. No. 1207

The current OSHA limit for hydrogen cyanide is a 10-ppm TWA, with a skin notation. The ACGIH recommends a 10-ppm ceiling limit, also with a skin notation. NIOSH (1976) has recommended that workplace exposures not exceed 4.7 ppm as a 10-minute ceiling.

The ACGIH summarized the extensive body of human evidence on the adverse effects resulting from exposure to hydrogen cyanide. They note that exposure to levels of 45 to 54 ppm can be tolerated for 1 hour with no immediate or delayed effects, and that 18 to 36 ppm produces "slight" symptoms after several hours of exposure. They also cite Grabois (1954), who reported that workers in apricot kernel processing plants experienced no ill effects when exposed to hydrogen cyanide on the order of 10 ppm.

The NIOSH recommendation of 4.7 ppm as a 10-minute ceiling limit is based largely on an epidemiologic study by El Ghawabi (1976), showing an increase in symptoms of headache, weakness, throat irritation, vomiting, dyspnea, lacrimation, colic, and nervousness among workers exposed for an average of 7.5 years to cyanide concentrations ranging from 4.2 to 12.4 ppm. NIOSH also cited other papers reporting similar symptoms among cyanide-exposed workers. NIOSH acknowledged that such symptoms can be caused by a wide variety of other chemical or physical factors, but believed that these symptoms were sufficiently well characterized as being associated with cyanide exposure to warrant their consideration as indicators of health impairment. Therefore, NIOSH recommended a 4.7 ppm limit, determined from a 10-minute sample. Because of this recommendation, ACGIH considered recommending a 3-ppm TLV-ceiling for hydrogen cyanide; however, a majority of committee members favored retention of the 10-ppm ceiling limit at ACGIH's 1979 meeting.

The 10-ppm (ceiling) TLV is based on the observation of some health effects at 18 to 36 ppm and no observed effects at 10 ppm. More recent epidemiological data indicate that a variety of symptoms may be associated with exposure to hydrogen cyanide at levels less than 10 ppm. This indicates that neither the existing PEL nor the ACGIH TLV may be sufficiently protective. OSHA therefore proposes a 4.7 ppm (ceiling) as the PEL. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for hydrogen cynanide if the Agency determines that this limit will substantially reduce significant risk.

OSHA's preliminary feasibility analysis is based on limited data at this exposure level, and the Agency therefore requests additional feasibility information from the public.

HYDROGENATED TERPHENYLS
CAS No.: 61788-32-7; Chemical Formula: None
H.S. No. 1210

OSHA does not currently regulate the hydrogenated terphenyls. The ACGIH recommends a TLV-TWA of 0.5 ppm (approximately 5 mg/m³) TWA for these complex mixtures of ortho-, meta-, and para-terphenyls in various stages of hydrogenation.

Acute exposure to the hydrogenated terphenyls poses a risk of potential lung, eye, and skin damage. Chronic exposure presents a risk of systemic toxicity involving injury to the liver, kidneys, and blood-forming organs, as well as possible metabolic disturbances and cancer (ACGIH 1986, p. 311).

Early studies of unhydrogenated terphenyl isomers determined that the LD_{50} in rats is low, i.e., 1900 mg/kg for the ortho isomer, 2400 mg/kg for the meta isomer, and 10,000 mg/kg for the para isomer (Cornish 1962). Thirty-day oral administration of 500 mg/kg/day in the diet of rats indicated possible liver and kidney damage, which was suggested by increases in the liver and kidney to body-weight ratios and decreases in the rate of weight gain (Cornish 1962). Other studies have demonstrated nephrotoxicity and liver damage in rats fed 33 mg/kg or more of unirradiated terphenyl isomers (Petkau and Hoogstraater 1965; Young et al. 1969). Inhalation studies showed that bronchopneumonia is associated with exposure to the ortho and meta isomers, but not to the para isomer (Haley et al. 1959). Cornish's work (1962) showed that none of the isomers caused skin irritation in rabbits following a 24-hour dermal application. For terphenyls that are approximately 40 percent hydrogenated, the acute oral LD_{50} in rats is reported as 17,500 mg/kg; in mice, it is 12,500 mg/kg (Adamson and Weeks 1973). This study also demonstrated that an irradiated hydrogenated terphenyl mixture is three times more acutely toxic by ingestion than is a non-irradiated mixture. This finding was confirmed in 16-week chronic ingestion studies (Adamson and Weeks 1969); these authors found that 1200 mg/kg of an irradiated mixture was lethal to mice, while the same dose in non-irradiated form produced only an irreversible interstitial nephritis. In the same study, no effects were observed for either mixture at a dose level of 250 mg/kg.

Eight-day inhalation studies in mice showed some pathologic changes in lung tissue after 500 mg/m³ exposures to non-irradiated hydrogenated terphenyls; 8-week exposures at 2000 mg/m³ resulted in the same lung damage, as well as some proliferation of the smooth endoplastic reticulum in the liver (Adamson and Weeks 1969, 1973). Carcinogenesis in mice has been reported from 8-week skin exposures to the irradiated mixture (Henderson and Weeks 1973). The significance of the changes observed by Adamson and Furlong (1974) in the mouse lung after 8 weeks of inhalation exposure to the irradiated mixture is difficult to interpret in terms of the potential of the hydrogenated terphenyls to cause pulmonary cancer; particles were found to clear the lungs rapidly but to accumulate and clear more slowly in the intestine, kidney, and liver.

OSHA is proposing a 0.5-ppm 8-hour TWA for the complex mixtures of ortho-, meta-, and para-terphenyls (either irradiated or non-irradiated) in various stages of hydrogenation. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of eye, skin, and lung damage, and of systemic toxicity to the liver, kidney, and blood-forming organs, potentially associated with exposure at the levels possible in the absence of any OSHA limit for this substance. This health evidence forms a reasonable basis for proposing a new limit for hydrogenated terphenyls. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2-ISOPROPOXYETHANOL
CAS: 109-59-1; Chemical Formula: $(CH_3)_2CHOCH_2CH_2OH_2$
H.S. No. 1223

OSHA has no current limit for 2-isopropoxyethanol. The ACGIH recommends a TLV-TWA of 25 ppm for this mobile liquid.

2-Isopropoxyethanol has been demonstrated to produce systemic toxicity in laboratory animals. In studies of rats, fifteen 6-hour exposures at 1000 ppm caused hemoglobinuria, anemia, and lung congestion, but no fatalities (Gage 1970). At 300 ppm, Gage reported transient hemoglobin and MCHC decreases and lung congestion after 15 exposures. Exposure at the 100-ppm level produced no effect (Gage 1970). Another study reported a significant increase in the osmotic fragility of erythrocytes in female rats after a 4-hour inhalation exposure to 62 ppm, but no effect was observed at 32 ppm (Carpenter et al. 1956). Studies of four species exposed at concentrations of 200, 50, or 25 ppm 6 hours/day for 26 weeks resulted in hematologic changes only in rats; increased osmotic fragility of erythrocytes was marked at 200 ppm, slight at 50 ppm, and minimal at 25 ppm (Moffet, Linnett, and Blair 1976).

OSHA is proposing an 8-hour TWA PEL of 25 ppm for 2-isopropoxyethanol. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of hemolytic effects associated with exposure to this substance, which is not presently regulated. This health evidence forms a reasonable basis for proposing a new limit for 2-isopropoxyethanol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ISOPROPYL GLYCIDYL ETHER
CAS: 4016-14-2; Chemical Formula: $C_6H_{12}O_2$
H.S. No. 1227

OSHA's current limit for isopropyl glycidyl ether (IGE) is 50 ppm as an 8-hour TWA. The ACGIH has established an 8-hour TWA of 50 ppm and a 15-minute STEL of 75 ppm for IGE. NIOSH recommends a limit of 50 ppm for IGE as a 15-minute ceiling. IGE is a colorless and volatile liquid.

The 4-hour LC_{50} for mice was 1500 ppm and the 8-hour LC_{50} in rats was 1100 ppm (Hine, Kodama, Wellington et al. 1956). The intragastric LD_{50}s in mice and rats were 1.30 and 4.2 g/kg, respectively; in rabbits, the dermal LD_{50} was 9.65 g/kg (Hine, Kodama, Wellington et al. 1956). Fifty daily 7-hour exposures of rats to 400 ppm caused a reduced rate of weight gain, an increase in hemoglobin, a decrease in peritoneal fat, and, in some animals, emphysematous lungs and mottling of the liver (Hine, Kodama, Wellington et al. 1956). Animals in this study also exhibited signs of ocular irritation and respiratory distress.

In humans, eye, nose, and upper respiratory irritation occurred in the technicians handling the animals in the Hine and co-workers' study; exposure levels were not specified. Dermatitis has also been reported in workers exposed to other glycidyl ethers during manufacture, and one such case involved IGE exposure (ACGIH 1986, p. 340).

OSHA is proposing an 8-hour TWA of 50 ppm and a 15-minute STEL of 75 ppm for IGE. The Agency preliminarily concludes that these limits will work together to protect workers from the risk of eye, skin, and upper respiratory tract irritation associated with exposures at the levels permitted in the absence of a short-term limit. This health evidence

forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for isopropyl glycidyl ether if the Agency determines that this limit will substantially reduce significant risk.

4,4'-METHYLENE BIS(2-CHLOROANILINE)
CAS: 101-14-4; Chemical Formula: $CH_2(C_6H_4ClNH_2)_2$
H.S. No. 1273

OSHA currently has no limit for 4,4-methylene bis (2-chloroaniline), or MBOCA, a tan-colored solid. The ACGIH recommends a limit of 0.02 ppm TWA, with a skin notation; MBOCA is classified as a suspected human carcinogen (A2) by the ACGIH. NIOSH recommends a TWA limit of 3 mg/m^3, which is the lowest detectable limit.

MBOCA is highly toxic, causing cyanosis, kidney irritation, and methemoglobinemia. It is similar in effect to the other aromatic amines (Hosein and van Roosmalen 1978; Mastromatteo 1965.)

Steinhoff and Grundman (1969) demonstrated that feeding MBOCA at unspecified levels to rats on a protein-deficient diet caused a high incidence of liver cancer. Russfield and associates (1975) reported liver and lung tumors in rats fed MBOCA while on a standard diet. Dogs fed MBOCA at a dose of 100 mg/day, 5 days/week showed no hepatic cancer, but malignant nodules in the bladder occurred in a dog fed MBOCA for 9 years (Stula et al. 1977).

In industry, reversible hematuria has been reported among MBOCA-exposed workers, but precise concentration data are lacking (Mastrometteo 1965). However, a study of workers exposed for as long as 18 years to MBOCA showed no adverse effects, although the substance and its metabolites were detected in the urine of these subjects (Linch et al. 1971). Hosein and van Roosmalen (1978) reported an industrial incident where molten MBOCA was splashed in a worker's face; urinary levels of 3.6 mg/L MBOCA, as well as protein, were detected in the urine, and the subject experienced nausea. However, this worker recovered quickly.

A recent NIOSH retrospective study involving 370 workers employed in a MBOCA-manufacturing plant evaluated the carcinogenicity of this substance, which is structurally similar to benzidene. The study has found 2 bladder cancers in very young workers (less than 30 years of age), both of whom are non-smokers.

OSHA is proposing an 8-hour TWA limit of 0.02 ppm for MBOCA, with a skin notation. The Agency preliminarily concludes that this limit will protect workers against the risk of cyanosis, methemoglobinemia, kidney irritation, and cancer potentially associated with exposures to this substance at the levels permitted in the absence of any OSHA limit. A skin notation is proposed to protect against the percutaneous absorption and systemic toxicity demonstrated for this substance in industrial accidents. This health evidence forms a reasonable basis for proposing a new limit for 4,4'-methylene bis (2-chloroaniline). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PHENYLHYDRAZINE
CAS: 100-63-0; Chemical Formula: $C_6H_5NHNH_2$
H.S. No. 1317

OSHA's current limit for phenylhydrazine is 5 ppm TWA, with a skin notation. The ACGIH recommends a TLV-TWA of 5 ppm with a STEL of 10 ppm, and a skin notation. NIOSH (1978a) recommends that workplace exposures not exceed 0.14 ppm as measured over a 2-hour period.

No data are available on the effects of phenylhydrazine resulting from inhalation. The ACGIH limits are based on the high acute toxicity of the compound when administered orally or subcutaneously to animals; single doses on the order of 20 mg/kg have resulted in the death of dogs within 22 days (Hease et al. 1935) and produced a marked decrease in erythrocyte count in rodents (von Oettingen and Deichmann 1936). Anemia and hemolysis are the characteristic responses seen in animals fed or injected with phenylhydrazine.

In its criteria document on hydrazines, NIOSH (1978a) reviewed four studies on the carcinogenicity of phenylhydrazine in mice. One study (Toth and Shimizu 1976) found significant increases in blood vessel tumors. Another study (Clayson et al. 1966) reported increased incidences of lung adenomas and adenocarcinomas. Two other studies (Roe et al. 1967; Kelly et al. 1969) were negative. NIOSH concluded that phenylhdyrazine should be considered a potential human carcinogen and recommended that exposures not exceed 0.14 ppm over a 2-hour sampling period, which represents the lowest level that can be detected reliably. The ACGIH (1986) has placed phenylhydrazine on its A2 list.

As discussed previously, the NIOSH REL is based on the limitations of the available sampling and analytical methods for this substance; this approach does not necessarily satisfy OSHA's requirements regarding significant risk and feasibility. In addition, OSHA is not able to conduct the risk assessment necessary to consider the potential carcinogenic risks associated with occupational exposure to phenylhydrazine in time for this rulemaking. The Agency therefore proposes that a 5-ppm (8-hour) TWA and 10-ppm STEL be adopted as an interim PEL to reduce the risk of acute blood-related toxicity that has been associated with phenylhydrazine. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phenylhydrazine if the Agency determines that this limit will substantially reduce significant risk. As future priorities dictate, OSHA may consider the need for a lower limit for this substance.

PHENYLPHOSPHINE
CAS: 638-21-1; Chemical Formula: $C_6H_5PH_2$
H.S. No. 1318

OSHA has no current requirement for limiting worker exposure to phenylphosphine: NIOSH also has no REL for this substance. The ACGIH has recommended a ceiling limit of 0.05 ppm.

A 90-day inhalation study conducted by the duPont Company in which rats and beagle dogs were exposed to average concentrations of 0.6 ppm or 2.2 ppm for 6 hours per day, 5 days per week, showed that rats exposed to 2.2 ppm had significant hematologic changes and testicular degeneration (as cited in ACGIH 1986, p. 479). These effects were not noted among rats exposed to 0.6 ppm, but rats exposed at the lower level did show hypersensitivity to sound and touch and mild hyperemia. The dogs tolerated the higher exposure level better than the rats in that some regeneration of testicular damage occurred during a 1-month recovery period. Dogs exposed to 0.6 ppm exhibited intermittent nausea, diarrhea, lacrimation, and hind leg tremor (ACGIH 1986). The ACGIH considered 0.6 ppm to be an NOE level for severe effects in animals and recommended a 0.05-ppm ceiling TLV to provide a 10-fold safety margin to protect workers against the changes exhibited by the test animals at the 0.6 ppm level.

OSHA preliminarily concludes that workers currently exposed to uncontrolled levels of phenylphosphine are at risk of experiencing the nausea, irritation, and CNS effects found to be associated with such exposures in animals. The Agency believes the proposed ceiling of 0.05 ppm will reduce this risk substantially. This health evidence forms a reasonable basis for

proposing a new limit for phenylphosphine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PHOSPHINE
CAS: 7803-51-2; Chemical Formula: PH_3
H.S. No. 1321

OSHA currently has a PEL of 0.3 ppm TWA for phosphine. The ACGIH recommends a TLV-TWA of 0.3 ppm and a TLV-STEL of 1.0 ppm. Phosphine is a colorless gas with a disagreeable, garlic-like odor.

Early studies reported that laboratory animals could tolerate phosphine in 4-hour daily exposures of 5 ppm for 2 months, but fatalities were observed from seven similar exposures at 10 ppm (Muller 1940). In 1975, Waritz and Brown reported a 4-hour LC_{50} of 11 ppm in rats; these lethal exposures caused effects typical of respiratory irritation.

Prior to 1958, numerous cases of phosphine-related occupational poisonings and deaths were reported including a fatality caused by pulmonary edema that was attributed to an exposure to 8 ppm for 2 hours daily (Harger and Spolyar 1958). Sublethal symptoms (without chronic effects) occurred at phosphine exposures averaging 10 ppm or less, with excursions of up to 35 ppm: recorded symptoms included diarrhea, nausea, vomiting, respiratory distress, and dizziness (Jones, Jones, and Longely 1964). The literature contains no documented reports of chronic poisoning caused by prolonged exposure to phosphine, although several authorities have asserted that this is a possibility (Henderson and Haggard, 1963; Fairhall 1957; Johnstone and Miller, 1940; Patty 1963; American Industrial Hygiene Association, 1964).

OSHA proposes an 8-hour TWA PEL for phosphine of 0.3 ppm and a 15-minute STEL of 1 ppm. The Agency preliminarily concludes that both of these limits are required to protect exposed workers from the risk of lung damage, diarrhea, nausea, and other effects potentially associated with elevated short-term and long-term exposure to this gas. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phosphine if the Agency determines that this limit will substantially reduce significant risk.

PIPERAZINE DIHYDROCHLORIDE
CAS: 142-64-3; Chemical Formula: $C_4H_{10}N_2 \cdot 2HCl$
H.S. No. 1330

OSHA currently has no limit for piperazine dihydrochloride. The ACGIH recommends a TLV-TWA limit of 5 mgm^3. Piperazine dihydrochloride is a solid. Piperazine dihydrochloride is a water-soluble solid with low systemic toxicity and mild irritant properties; the compound is biologically active. The oral LD_{50} for rats has been reported as 4.9 g/kg (NIOSH 1984).

Eye and skin irritation have been reported as a result of human exposures to high (not further specified) levels of piperazine dihydrochloride; subjects experienced mild to moderate skin burns and sensitization. Inhalation of the dust has been associated with asthmatic reactions (Dow Chemical Company, as cited in ACGIH 1986, p. 491).

OSHA proposes a limit of 5 mg/m^3 as an 8-hour TWA for piperazine dihydrochloride. The Agency preliminarily concludes that this limit will reduce the risk of sensitization and eye and skin irritation potentially associated with exposures to this substance at the previously uncontrolled level. This health evidence forms a reasonable basis for proposing a new limit for piperazine dihydrochloride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

n-PROPYL NITRATE
CAS: 627-13-4: Chemical Formula: $CH_3CH_2CH_2ONO_2$
H.S. No. 1340

OSHA currently has an 8-hour TWA limit of 25 ppm for n-propyl nitrate. The ACGIH recommends a 25-ppm TWA and adds a 15-minute STEL of 40 ppm. n-Propyl nitrate is a pale yellow liquid with a sickly sweet odor.

Rats inhaling propyl nitrate vapor for 4 hours at a concentration of 10,000 ppm demonstrated cyanosis and methemoglobinemia before they died (Hood 1953, as cited in ACGIH 1986, p. 505). Subsequent cardiac muscle effects and respiratory depression. The intravenous LD_{50} in unanesthetized rabbits has been reported to be between 200 and 250 mg/kg; in anesthetized dogs and cats, intravenous doses of between 100 and 200 mg/kg were usually fatal (Murtha, Stabile, and Wills 1956). Murtha and associates, who conducted these studies, concluded that n-propyl nitrate exerts a direct action on the vascular smooth muscle and that the ensuing cardiac effects and respiratory depression contribute to the compound's hypotensive action (Murtha, Stabile, and Wills 1956). Inhalation trials in mice, rats, hamsters, guinea pigs, and dogs have established 4-hour LC_{50} values ranging from 9000 to 10,000 ppm for rats, 6000 to 7000 for mice, and 2000 to 2500 for dogs. Dogs survived repeated exposures (6 hours/day, 5 days/week) at 260 ppm for 6 months, although slight clinical signs were observed during the first 2 weeks of exposure (Rinehart, Garbers, Greene, and Stoufer 1958). The percutaneous toxicity of n-propyl nitrate is low but may cause inflammation and thickening of the skin after repeated exposures; these effects are sometimes transient, however (ACGIH 1986, p. 505). The odor of n-propyl nitrate is detectable at 50 ppm. To protect against cardiovascular and respiratory depressant effects requires both TWA and STEL limits.

OSHA proposes a limit of 25 ppm TWA with a STEL of 40 ppm for n-propyl nitrate. The Agency preliminarily concludes that this combined PEL-STEL limit will protect workers against the risk of cyanosis, methemoglobinemia, and hypotension that have been observed in laboratory animals. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-propyl nitrate if the Agency determines that this limit will substantially reduce significant risk.

SODIUM FLUOROACETATE
CAS: 62-74-8; Chemical Formula: $CH_2FCOONa$
H.S. No. 1366

The current OSHA standard for sodium fluoroacetate is 0.05 mg/m^3 as an 8-hour TWA with a skin notation. The ACGIH has established exposure limits of 0.05 mg/m^3 TLV-TWA and 0.15-mg/m^3 TLV-STEL, with a skin notation. Sodium fluoroacetate is a fine white powder, which is sometimes dyed black for commercial use.

Sodium fluoroacetate causes vomiting, convulsions, and ventricular fibrillation. It is highly toxic by inhalation, ingestion, or via absorption through the skin (NIOSH/OSHA, 1981). The ACGIH calculated and set the threshold limit of 0.05 mg/m^3 based on studies of rats indicating an oral LD_{50} of 1.7 mg/kg (Lehman 1951). Tissue changes in rats were noted in a later study by the same author in which the animals were fed 0.25 mg sodium fluoroacetate/kg/day (Lehman 1952); the equivalent level in humans would be 17 mg/person/day. A further study by Miller and Phillips (1955) examined growth rates in rats fed various dosages of sodium fluoroacetate. Rats who received 10 ppm in their diet experienced a transient fluctuation in growth rate. At 20 ppm (approximately 2 mg/kg in young rats),

the growth rate declined markedly the first week; the rats survived and resumed growth at the normal rate in 3 to 4 weeks. Tolerance for the chemical lasted less than 2 weeks, and those rats who had adjusted to sodium fluoroacetate showed a second retardation of growth when returned to a dietary level of 20 ppm, after a 2-week interval of eating a normal diet. Miller and Phillips (1955) noted that rats conditioned to a dietary level of 20 ppm were then able to adjust to a level of 40 ppm (a dose that is greater than the single LD_{50} dose per day).

OSHA is proposing an 8-hour TWA of 0.05 mg/m³ a STEL of 0.15 mg/m³, and a skin notation. The Agency preliminarily concludes that the 8-hour and short-term exposure limits will reduce the risk of systemic effects possible as a result of exposures above the 8-hour TWA of 0.05 mg/m³. A skin notation is proposed because this substance causes systemic toxicity when absorbed dermally. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sodium fluoroacetate if the Agency determines that this limit will substantially reduce significant risk.

TRIMETHYLBENZENE
CAS: 25551–13–7; Chemical Formula: $(CH_3)_3C_6H_3$
H.S. No. 1412

There is no current OSHA exposure limit for trimethylbenzene. The current ACGIH TLV for all isomers of trimethylbenzene is 25 ppm as an 8-hour TWA. NIOSH has no REL for this substance or its isomers.

A study by Battig et al. (1957) provides the basis for the proposed limit; this work reports symptoms among 27 workers exposed to a solvent containing 30 percent 1,3,5-trimethylbenzene and 50 percent 1,2,3-trimethylbenzene. A "significant number" of these workers were reported to have experienced symptoms of nervousness, tension and anxiety, and asthmatic bronchitis. The peripheral blood of these workers "showed a tendency to hypochronic anemia" and somewhat abnormal clotting ability. This group of workers had been occupationally exposed to total hydrocarbon concentrations ranging from 10 to 60 ppm for several years. The authors of the study recommended maintaining employee exposures below 35 ppm (Battig et al. 1957).

OSHA agrees that workers exposed to trimethylbenzene should be protected by an OSHA limit. OSHA believes that a 25-ppm 8-hour PEL will provide protection for trimethylbenzene-exposed workers, and a PEL set at this level is therefore proposed. This level will reduce the risk of bronchitis and anxiety previously reported in exposed workers. This health evidence forms a reasonable basis for proposing a new limit for trimethylbenzene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TUNGSTEN AND COMPOUNDS (insoluble)
CAS: 7440–33–7; Chemical Formula: W
H.S. No. 1416

OSHA presently has no exposure limits for insoluble tungsten and its compounds. The ACGIH has established 5 mg/m³ as an 8-hour TWA and 10 mg/m³ as a short-term exposure limit for these substances. NIOSH recommends a limit of 5 mg/m³ as a 10-hour TWA. Tungsten is a gray, hard metal.

Rats fed a diet containing 0.5 percent insoluble tungsten compounds died, and another group of rats fed 0.1 percent of these compounds suffered noticeable weight loss (Kinard and van de Erve 1941). Studies in rats fed tungsten at 2, 5, or 10 percent of their diet showed that females in all dose groups has a 15-percent reduction in weight gain (Kinard and van der Erve 1943). The intraperitoneal LD_{50} tungsten metal powder of 5 g/kg body weight; survivors showed minor liver and spleen changes at necropsy (Frederick and Bradley 1946). Studies of the tissues of guinea pigs intratracheally injected with tungsten metal and tungsten carbide revealed moderate interstitial cellular proliferation and no changes, respectively. However, Soviet studies involving similar intratracheal injections showed proliferation of the intra-alveolar septa (Kaplun and Mezentseva 1960). The NIOSH criteria document for tungsten (1977) reports that Russian investigators found a 9- to 11-percent incidence of pulmonary fibrosis in workers exposed to tungsten (Kaplun and Mezentseva 1959; Mezentseva 1967). NIOSH recommended that the standard for the tungsten and its insoluble compounds be set at 5 mg/m³ to protect against pulmonary effects. To date, studies of industrial conditions have yielded evidence that pneumoconiosis does not develop from exposure to tungsten metal or its insoluble compounds (Dernehl 1966, as cited in ACGIH 1986, p. 614).

OSHA is proposing an 8-hour TWA of 5 mg/m³ and a STEL of 10 mg/m³ for tungsten and its insoluble compounds. The Agency preliminarily concludes that these limits will protect exposed workers against the risk of pulmonary fibrosis and other lung effects associated with exposure to this metal and its compounds at the levels permitted by the absence of any OSHA limit. This health evidence forms a reasonable basis for proposing a new limit for tungsten and compounds (insoluble). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TUNGSTEN AND COMPOUNDS (soluble)
CAS: 7440–33–7; Chemical Formula: W
H.S. No. 1417

OSHA has no current limit for exposure to tungsten and its soluble compounds. The ACGIH limit is 1 mg/m³ TWA with a 3 mg/m³ STEL. NIOSH recommends a 1-mg/m³ 10-hour TWA for tungsten and its soluble compounds. Tungsten is a grey, hard metal.

Animal studies have shown that the LD_{50} for soluble sodium tungstate when injected subcutaneously in rats ranges from 140 to 160 mg/kg (Kinard and van de Erve 1940). Soluble tungsten's lethal effects are the result of systemic poisoning that occurs as the compound is absorbed by multiple organs; this is followed by cellular asphyxiation (International Labour Office [ILO] 1934). Karantassis (1924) also observed a systemic response in guinea pigs given soluble sodium tungstate or pure soluble tungsten either orally or intravenously, developed anorexia, colic, trembling, and difficulty in breathing prior to death. Rats fed a diet containing 0.5 percent tungsten as soluble sodium tungstate or tungsten oxide died from this dose. Dietary doses of 0.1 percent tungsten oxide and the sodium salt caused weight loss in rats, but no deaths (Kinard and van der Erve 1941). Tungsten is believed to act by antagonizing the action of molybdenum (Higgins, Richert, and Westerfield 1956). NIOSH states in its criteria document for tungsten (1977) that information on the effects of exposure to soluble tungsten compounds in the working population is unknown. The ACGIH (1986, p. 614) recommends a lower TLV for the soluble compared with the insoluble compounds of tungsten because of the former's greater systemic toxicity.

OSHA proposes an 8-hour TWA of 1 mg/m³ and a STEL of 3 mg/m³ for tungsten and its soluble compounds. The Agency preliminarily concludes that these limits will protect exposed workers against the risk of systemic toxicity, anorexia, colic, incoordination, trembling, and dyspnea associated with exposure to these compounds, which are presently not regulated by OSHA. This health evidence forms a reasonable

basis for proposing a new limit for tungsten and compounds (soluble). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

VINYLIDENE CHLORIDE (1,1-DICHLOROETHYLENE)
CAS: 75-35-4; Chemical Formula: $CH_2=CCl_2$
H.S. No. 1428

Currently, OSHA's Z tables do not have a limit for vinylidene chloride (VCD). The ACGIH has established 5 ppm as an 8-hour TWA and 20 ppm as a 15-minute STEL. NIOSH recommends that employee exposure to VCD be reduced to the lowest feasible level, and considers VCD a carcinogen. Vinylidene chloride is a colorless liquid that polymerizes readily.

The acute oral LD_{50} for male rats is 2500 mg/kg (Jenkins, Trabulus, and Murphy 1972). The LC_{50} for rats exposed to a single 4-hour exposure of VCD vapor was reported as 6350 ppm in one study (Siegel, Jones, Coon, and Lyon 1971) and 32,000 ppm in an earlier study (Carpenter, Smyth, and Pozzani 1949). Liquid VCD causes transient irritation to the eyes of rats but has little effect on exposed skin if the VCD is allowed to evaporate (Torkelson and Rowe 1981).

Prendergast and co-workers exposed rats, rabbits, guinea pigs, and monkeys 8 hours/day, 5 days/week for 6 weeks to 395 mg/m³ (100 ppm); these authors saw no visible signs of toxicity while the exposure was in process, but rabbits and monkeys lost weight. These same species were exposed continuously to VCD concentrations of 5, 15, 25, or 47 ppm for 90 days; only the animals exposed to 5 ppm showed no increases in mortality (Prendergast, Jones, Jenkins, and Siegel 1967).

Nasal irritation, liver cell degeneration, and retarded weight gain were reported in rats following twenty 6-hour exposures to 500 ppm VCD (Gage 1970); at 200 ppm, only nasal irritation occurred. Studies by Torkelson and Rowe (1981) in which rats, rabbits, guinea pigs, and dogs were exposed to 25, 50, or 100 ppm VCD for 8 hours per day, 5 days per week for 6 months revealed injury of the kidneys and liver in all animals at all levels of exposure. Maltoni (1977) and Maltoni, Cotti, Morisi, and Chieco (1977) conducted an evaluation of VCD's carcinogenicity in which mice, rats and hamsters were exposed to levels from 10 ppm to 150 ppm for 4 hours per day, 5 days per week for 52 weeks, with results reported through week 98 of the study. In those mice exposed to 25 ppm VCD, 21 percent of the males and 1.5 percent of the females developed kidney adenocarcinomas; these tumors were not seen in rats exposed to amounts of VCD up to 150 ppm. Exposures of 100 or 150 ppm in rats did produce a significant increase in mammary adenocarcinomas, and this response was dose-related (Maltoni 1977; Maltoni, Cotti, Morisi, and Chieco 1977). Overt toxicity and mortality occurred early in the studies after 4-hour exposures at levels of 50 ppm in mice and 200 ppm in rats; hamsters exposed to 20 ppm VCD showed no increase in tumor incidence (Maltoni 1977; Maltoni, Cotti, Morisi, and Chieco 1977).

A study by Murray, Nitschke, Rampy, and Schwetz (1979) investigated the embryotoxic, fetotoxic, and teratogenic effects of inhaled and ingested VCD (in rats) and inhaled VCD (in rabbits). In the inhalation studies, rats were exposed to 20, 80, or 160 ppm VCD for 7 hours per day. VCD was toxic to both the adults and their embryos at levels of 80 and 160 ppm among the rats, and 160 ppm in rabbits. At exposure levels of 20 ppm in rats and 80 ppm in rabbits, neither maternal toxicity nor effects on embryonic or fetal development were noted. In the ingestion study with rats, drinking water containing 200 ppm VCD caused no toxic effects in either the rats or their offspring.

Two strains of rats exposed to 75 or 100 ppm VCD for 5 days/week, 6 hours/day for 12 months did not show a significant increase in tumors (Viola and Caputo 1977). Other investigators exposed rats to 25 or 75 ppm by inhalation for 6 hours/day, 5 days/week for 18 months or to 60, 100, or 200 ppm VCD in their drinking water for 2 years and found no increase in tumor incidence in these animals (Rampy, Quast, Humiston et al. 1977). In mice, VCD was not active either as a whole mouse skin carcinogen or by subcutaneous injection.

In other studies, VCD proved mutagenic in both E. coli and S. typhimurium strains (Greim, Bonse, Radwan et al. 1975; Bartsch, Malaveille, Montesano, and Tomatis 1975). VCD has been implicated as a tumor initiator in a carcinogenesis bioassay by Van Duuren (1979). Studies by Reitz, Watanabe, McKenna et al. (1980) suggest that VCD's tumorigenicity is a result of its ability to initiate cell injury and not of its ability to alter the genetic material of an injured cell. The actual cell injury is caused by VCD metabolites which are highly reactive and cytotoxic (Maltoni 1977; Hathaway 1977; Henschler and Bonse 1977).

A cohort study of 138 VCD-exposed workers did not identify any VDC-related health effects in these workers (Ott, Fishbeck, Townsend, and Schneider 1976).

OSHA is proposing an 8-hour TWA of 5 ppm and a 15-minute STEL of 20 ppm for vinylidene chloride. The Agency preliminarily concludes that these limits will protect workers from the risk of kidney and liver damage and carcinogenicity potentially associated with exposure to VCD at the levels permitted by the absence of any OSHA limit. This limit may be an interim limit; as future priorities permit, the Agency may perform a quantitative risk assessment for VCD and consider further rulemaking. This health evidence forms a reasonable basis for proposing a new limit for vinylidene chloride (1,1-dichloroethylene). At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

WELDING FUMES
CAS: None; Chemical Formula: Not available
H.S. No. 1430

OSHA currently has no limits for exposure to welding fumes, which it defines as fumes that are generated by the manual metal arc or oxy-acetylene welding of iron, mild steel, or aluminum. The ACGIH has set an 8-hour TWA of 5 mg/m³ for welding fumes, measured as total particulate inside the welding helmet.

Although welding of these types generally produces fumes made up of aluminum, iron, or zinc oxides, other toxic gases may be produced in large amounts (Ferry and Ginther 1952; Ferry 1954; Silverman 1956; Homer et al. 1957). Iron metals may give off fumes of manganese, silicate, and various organic binders. Aluminum welding may result in fumes consisting of fluorine, arsenic, copper, silicon, and beryllium (NIOSH n.d.; American Welding Society 1973). Eighteen different substances, including fluoride, manganese, silicon, titanium, and sodium and potassium silicates, have been measured in the fumes resulting from the welding of mild steel (ACGIH 1986, p. 634). The process of shielded arc welding is known to produce ozone, and when carbon dioxide is used as a shield gas, carbon monoxide is given off (NIOSH n.d.; American Welding Society 1973).

The adverse health effects associated with over exposure to welding fumes are those of metal fume fever—chills and fever, profuse sweating, and weakness—and respiratory irritation.

OSHA preliminarily concludes that a PEL for welding fumes is needed to protect workers involved in the welding of aluminum, iron, or mild steel from the

risk of metal fume fever and respiratory irritation associated with welding fumes, and is proposing to adopt a TWA of 5 mg/m³ for welding fumes as total particulate. This health evidence forms a reasonable basis for proposing a new limit for welding fumes. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ZINC OXIDE (FUME)
CAS: 1314–13–2; Chemical Formula: ZnO
H.S. No. 1437

OSHA's existing exposure limit for zinc oxide fume is 5 mg/m³ as an 8-hour TWA. The ACGIH also recommends a 5-mg/m³ TWA and also has a STEL of 10 mg/m³. NIOSH recommends a 5-mg/m3 10-hour TWA limit with a 15-minute ceiling of 15 mg/m³. When heated. zinc oxide produces a white fume.

The most prevalent toxic effect of zinc oxide fume is a condition known as "metal fume fever," whose symptoms include chills, fever, muscular pain, nausea, and vomiting (Turner and Thompson 1926). Studies in the workplace have shown that welders exposed to zinc oxide fumes at concentrations of 320 to 580 mg/m³ reported nausea, with the development of chills, shortness of breath, and severe chest pains 2 to 12 hours later. Most workers took approximately 4 days to recover, and some eventually developed pneumonia (Hammond 1984). Other studies have reported the frequent occurrence of chills in workers exposed to zinc oxide at levels as low as 5 mg/m³ (Hickish 1963; Wall 1970). Hammond (1984) reported that workers exposed to 8 to 12 mg/m³ of zinc oxide fume did not suffer from metal fume fever.

Exposure of guinea pigs lasting only an hour caused a drop in body temperature, followed 6 to 18 hours later by an increase above normal levels (Turner and Thompson 1926). The animals in the high exposure group (2500 mg/m³ for 3 to 4 hours) died after exposure.

Early studies (Drinker and Fairhall 1957) suggested that metal fume fever was unlikely to occur at concentrations below 15 mg/m³, but subsequent experience shows that exposures even at 5 mg/m³ can cause this syndrome (Hickish, private communication, 1963; Wall, private communication, 1970, as cited in ACGIH 1986, p. 646).

NIOSH's Criteria Document (1975) reported that the development of metal fume fever was unlikely at levels as low as 5 mg/m³, but the institute stated that exposures to the fume could cause chronic respiratory effects.

OSHA is proposing a 5-mg/m³ TWA and a STEL of 10 mg/m³. The Agency preliminarily concludes that both of those limits will protect exposed workers from the risk of metal fume fever associated with exposure to zinc oxide fumes at the elevated short term levels permitted in the absence of a STEL. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for zinc oxide (fume) if the Agency determines that this limit will substantially reduce significant risk.

ZIRCONIUM COMPOUNDS
CAS: 7440–67–7; Chemical Formula: Zr
H.S. No. 1439

The current OSHA limit for zirconium compounds is an 8-hour TWA of 5 mg/m³. The ACGIH has established a TLV–TWA of 5 mg/m³, supplemented by a 10 mg/m³ STEL. Zirconium compounds may be either bluish-black powders or grayish-white lustrous metals.

The toxic effects of inhalation exposures to zirconium compounds include the formation of granulomas, both in the lungs and on the skin. Sax (1984) reports cases of pulmonary granulomas in workers exposed to zirconium aerosols. In laboratory animals, oral toxicity is low (NIOSH 1972), and inhalation studies conducted for one year at levels of 3.5 mg zirconium/m³ dust and mist resulted in limited toxicity (Stokinger 1981).

OSHA preliminarily concludes that the 5-mg/m³ TWA and 10-mg/m³ STEL limits for zirconium compounds will protect exposed workers from the risk of pulmonary effects potentially associated with the short-term exposures permitted by the 8-hour TWA alone. This health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for zirconium compounds if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

For the group of systemic toxicants shown on Table C8–1, OSHA preliminarily concludes that the risks associated with occupational exposures to these substances are substantial. As Table C8–2 shows, the systemic effects caused by such exposures include liver and kidney damage, testicular damage, fetal poisoning, central nervous system depression, and asthma. Affected employees may experience dizziness, nausea, generalized weakness, respiratory irritation, blood in the urine, chest tightness, hives, and necrosis of the cornea. These effects represent risks to health and functional capacity, and reducing the limits for these systemic toxins will substantially reduce these risks. The health evidence for these substances is a reasonable basis for proposing revised or new limits for substances in this group. At the time of the final rule, OSHA will establish revised or new limits for these systemic toxins if the Agency determines that these limits will substantially reduce significant risks.

9. Substances for Which Proposed Limits Are Based on Observed No-Effects Levels

Introduction

For a group of 23 toxic substances, OSHA is proposing limits based on evidence that the levels chosen have been shown not to produce adverse effects in exposed populations. These substances are shown in Table C9–1, along with their CAS numbers and H.S. numbers and current OSHA, ACGIH, and NIOSH limits. OSHA is proposing limits for 17 chemicals in this group that have not formerly been regulated by the Agency. The Agency is proposing to retain or decrease the 8-hour limit and to add a STEL in a total of five cases and to reduce the TWA in one instance. NIOSH has RELs only for one substance in this class.

Description of the Health Effects

The substances included in this group cause a wide range of adverse health effects in both animals and humans. Unlike most of the other groupings described in this preamble, these toxicants do not affect the same target organ or system: Some are central nervous system depressants, several are upper respiratory tract irritants, and still others have their primary effect on the liver and/or kidney.

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Table C9-1. Substances for Which Limits Are Based On A No-Effect Level

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1029 Atrazine	1912-24-9	--	5 mg/m^3 TWA	--
1041 Bromacil	314-40-9	--	1 ppm TWA	--
1056 p-tert-Butyltoluene	98-51-1	10 ppm TWA	10 ppm TWA 20 ppm STEL	--
1085 Chlorodifluoromethane	75-45-6	--	1000 ppm TWA 1250 ppm STEL	--
1090 o-Chlorotoluene	95-49-8	--	50 ppm TWA 75 ppm STEL	--
1110 Cyclonite	121-82-4	--	1.5 mg/m^3 TWA, 3 mg/m^3 STEL, Skin	--
1117 2,6-di-tert-Butyl-p-cresol	128-37-0	--	10 mg/m^3 TWA	--
1134 Diethanolamine	111-42-2	--	3 ppm TWA	--
1136 Diethyl phthalate	84-66-2	--	5 mg/m^3 TWA	--

Table C9-1. Substances for Which Limits Are Based On A No-Effect Level (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL**
1144 Dinitolmide	148-01-6	--	5 mg/m^3 TWA	--
1147 Diphenylamine	122-39-4	--	10 mg/m^3 TWA	--
1153 Diuron	330-54-1	--	10 mg/m^3 TWA	--
1249 Methyl acetate	79-20-9	200 ppm TWA	200 ppm TWA 250 ppm STEL	--
1275 Metribuzin	21087-64-9	--	5 mg/m^3 TWA	--
1297 Oil mist (mineral)	8012-95-1	5 mg/m^3 TWA	5 mg/m^3 TWA 10 mg/m^3 STEL	--
1312 Petroleum distillates (naphtha)	8002-05-9	500 ppm TWA	400 ppm TWA	87 ppm TWA 450 ppm Ceiling (15 min)
1327 m-Phthalodinitrile	626-17-5	--	5 mg/m^3 TWA	--
1332 Platinum, metal	7440-06-4	--	1 mg/m^3 TWA	--
1346 Resorcinol	108-43-3	--	10 ppm TWA 20 ppm STEL	--

Table C9-1. Substances for Which Limits Are Based On A No-Effect Level (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL**
1382 Tantalum	7440-25-7	5 mg/m^3	5 mg/m^3 TWA 10 mg/m^3 STEL	—
1410 Trimethyl phosphite	121-45-9	—	2 ppm TWA	—
1415 Triphenyl amine	603-34-9	—	5 mg/m^3 TWA	—
1418 Uranium (insoluble compounds)	7440-61-1	0.25 mg/m^3 TWA	0.2 mg/m^3 TWA 0.6 mg/m^3 STEL	—

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

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For some compounds in this category, no adverse health effects have been observed in animals or humans. This is the case because the research conducted did not reveal effects at the doses and durations tested. Compounds falling into this latter sub-group include 2,6-di-tert-butyl-p-cresol, diethanolamine, dinitolmide, diuron, oil mist, m-phthalodinitrile, resorcinol, triphenyl amine, and the insoluble uranium compounds.

The commonality among these otherwise diverse substances is that apparent no-effect levels have been defined for all of them. Permissible exposure limits have been developed for these chemicals by applying safety factors to these no-effect levels. Table C9–2 shows the health effects observed in humans and animals after exposure to these substances.

Dose-Response Relationships and No-Effect Levels

The concept of setting limits based on a NOE level assumes that there is a concentration at which repeated and prolonged exposure to a toxic substance causes no adverse effect in the majority of workers. A similar concept is widely used by a variety of federal agencies, for example the Food and Drug Administration, to set contaminant tolerances, acceptable daily intake values, and other limits.

All of the limits for these substances have been set, with varying degrees of confidence, at a no-effect or minimal effect level, regardless of the specific effect being protected against. At least in part, the limits proposed for the 23 items listed in Table C9–1 are based on published or unpublished data or information indicating that these limits are already being maintained in work environments and that industrial experience shows these levels to be both feasible and free of associated health effects or employee complaints. OSHA believes that these limits will also protect against any effects these substances have been shown to cause at higher concentrations (e.g., minimal effects are noted in animals at 50 times the TLV–TWAs for trimethylphosphite and chlorodifluoromethane). The substances in this group have effects that range in toxicity from low to high at relatively low exposure concentrations.

TABLE C9–2.—HEALTH EFFECTS ASSOCIATED WITH SUBSTANCES FOR WHICH LIMITS ARE BASED ON NO-EFFECT LEVELS

H.S. number chemical name	CAS No.	Health effects observed in animals	Health effects observed in humans
1029 Atrazine	1912-24-9	Ataxia, dyspnea, convulsions.	
1041 Bromacil	314-40-9	Mild irritation.	
1056 p-tert-Butyl-toluene	98-51-1	CNS depression, respiratory tract irritation, liver and kidney changes	Nasal irritation, nausea, headache, weakness.
1085 Chlorodifluoromethane	75-45-6	Cardiac sensitization.	
1090 o-Chlorotoluene	95-49-8	Weakness, vasodilation, incoordination, convulsions.	
1110 Cyclonite	121-82-4		Nausea, vomiting, convulsions.
1117 2,6-di-tert-Butyl-p-cresol	128-37-0		
1134 Diethanolamine	111-42-2	Impaired vision skin irritation.	
1136 Diethyl phthalate	84-66-2		Pain, numbness, transient irritation, polyneuritis.
1144 Dinitolmide	148-01-6	Liver changes.	
1147 Diphenylamine	122-39-4	Liver, kidney, spleen changes	Tachycardia, bladder symptoms, hypertension, eczema.
1153 Diuron	330-54-1		
1249 Methyl acetate	79-20-9		Eye, mucous membrane irritation, chest tightness.
1275 Metribuzin	21087-64-9	CNS depression, thyroid and liver changes.	
1297 Oil mist (mineral)	8012-95-1	Lung irritation.	
1312 Petroleum distillates (naphtha).	8002-05-9	Motor incoordination, convulsions	Eye,throat irritation.
1327 m-Phthalodinitrile	626-17-5	Skin irritation.	
1332 Platinum, metal	7440-06-4		
1346 Resorcinol	108-43-3		
1382 Tantalum	7440-25-7	Bronchitis, pneumonitis, hyperamia.	
1410 Trimethyl phosphite	121-45-9	Teratogenicity, ocular irritation.	
1415 Triphenyl amine	603-34-9	Skin irritation.	
1418 Uranium (insoluble compounds).	7440-61-6	Kidney damage, blood disorders.	

The following discussions describe OSHA's preliminary findings for some of the substances in this group and illustrate the nature of the risk faced by workers exposed to these toxicants.

ATRAZINE

CAS: 1912-24-9; Chemical Formula: $C_8H_{14}ClN_5$

H.S. No. 1029

OSHA has no current limit for atrazine. The ACGIH recommends a TLV–TWA of 5 mg/m.[3] Atrazine is a stable, white, crystalline compound.

Animal studies indicate that the toxicity of the s-triazine herbicides, of which atrazine is the best known, is low. No observable effects have been shown in rats, dogs, horses, and cattle fed dietary levels of over 25 ppm for extended periods. In addition, the s-triazine herbicides are excreted in urine and feces in relatively short periods of time (Bakke et al. 1972). Atrazine has not shown teratogenic effects in studies of rats, mice, and sheep (the Merck Index 1983; Peters and Cook 1973; Binns and Johnson 1970). *In vitro* studies have shown no mutagenic effects, and a 2-year feeding study in rats and mice showed no carcinogenic effects (Innes et al. 1969). The only reports of toxicity indicate that high-dose ingestion of atrazine can cause ataxia, dyspnea, and convulsions in animals (as cited in ACGIH 1986, p. 44). The s-triazines appear to interfere with carbohydrate metabolism by blocking the production of sugars (Gysin 1962; Gast 1958).

In humans there are no reports of atrazine poisoning (ACGIH 1986, p. 44). Because there are no reports of human reactions to atrazine that can be related to air concentrations, the ACGIH's limit was set on the basis of animal studies. Long-term feeding studies in dogs have established 3.75 mg/kg as the highest no-observed-effect level (U.S. EPA 1979). Applying appropriate safety factors to this value, and assuming that lung absorption is less than 50 percent, yields an 8-hour TWA limit of 5 mg/m^3 (Zielhuis and Van der Kreek 1979).

OSHA proposes a PEL of 5 mg/m³ TWA for atrazine and preliminarily concludes that this limit will protect employees from the risk of metabolic effects to which they could potentially be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for atrazine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BROMACIL
CAS: 314-40-9; Chemical Formula: $C_9H_{13}BrN_2O_2$
H.S. No. 1041

OSHA has no current limit for bromacil. The ACGIH recommends a TLV–TWA of 1 ppm. Bromacil is a white, crystalline solid.

Bromacil has a low order of acute and chronic toxicity (Sherman 1975). In 2-year feeding studies of rats, no-effect dietary concentrations were determined to be greater than 250 ppm but less than 1250 ppm for rats and 1250 ppm for dogs. Rats and rabbits exhibited no teratogenic or carcinogenic effects as a result of dietary intake (Sherman 1975). Inhalation studies in rats have shown that all rats tolerate a 4-hour exposure equivalent to 4800 mg/m³. Studies of guinea pigs showed no skin sensitization and only mild irritation after exposures at unspecified levels. Rabbits have shown no clinical signs of toxicity as a result of the skin application of 5000 mg/kg (ACGIH 1986, p. 64).

OSHA proposes a permissible exposure limit of 1 ppm for bromacil, and preliminarily concludes that this limit will protect exposed employees against the risk of irritation potentially associated with exposure to bromacil at uncontrolled levels. The health evidence forms a reasonable basis for proposing a new limit for bromacil. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

p-tert-BUTYLTOLUENE
CAS: 98-51-1; Chemical Formula: $(CH_3)_3C—C_6H_4CH_3$
H.S. No. 1056

OSHA currently has a limit of 10 ppm TWA for p-tert-Butyltoluene. The ACGIH recommends a TLV–TWA of 10 ppm and a TLV–STEL of 20 ppm. p-tert-Butyltoluene is a colorless liquid with an aromatic, gasoline-like odor.

p-tert Butyltoluene has been shown to be slightly toxic on ingestion, moderately toxic when inhaled, and negligibly toxic through skin exposure (Hine, Unger, Anderson et al. 1954). Repeated exposures in animals have shown liver and kidney changes and microscopic degenerative hemorrhages in the spinal cord and brain, even at relatively low concentrations. The chief acute effects in animals are central nervous system depression and respiratory irritation; in rats exposed for 1 to 7 hours daily over a 26-week period, 25 ppm daily appeared to be the no-effect level (Gerarde 1960).

In humans, Hine, Unger, Anderson, et al. (1954) observed nasal irritation, nausea, malaise, headache, and weakness associated with exposure to p-tert-butyltoluene at unspecified levels. These authors also observed cardiovascular effects, as well as effects on the central nervous system, the skin, and the respiratory tract. Half of the subjects exposed to p-tert-butyltoluene developed tremor and anxiety, and 25 percent of exposed individuals showed evidence of chemical contact irritation of the respiratory tract.

OSHA is proposing a TWA of 10 ppm and a STEL of 20 ppm for p-tert-butyltoluene. The Agency preliminarily concludes that a STEL as well as a TWA will protect exposed workers against the risk of central nervous and cardiovascular system effects and of irritation and nausea potentially associated with short-term exposures to p-tert-butyltoluene. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for p-tert-butyltoluene if the Agency determines that this limit will substantially reduce significant risk.

CHLORODIFLUOROMETHANE
CAS: 75-45-6; Chemical Formula: $CHClF_2$
H.S. No. 1085

OSHA has no current limit for chlorodifluoromethane (Freon 22). The ACGIH recommends a TLV–TWA of 1000 ppm, with a short-term limit of 1250 ppm for 15 minutes. Chlorodifluoromethane is a colorless, nearly odorless, non-flammable gas.

Exposure to very high atmospheric levels of Freon 22 cause stimulation and then depression of the central nervous system, followed by asphyxiation. Rats and guinea pigs exposed to concentrations of 75,000 to 100,000 ppm over a 2-hour period exhibited excitation and disequilibrium; narcosis was observed at 200,000 ppm and mortality at 300,000 and 400,000 ppm (Weigand 1971). In mice, similar exposures at 320,000 ppm were the maximum tolerated, and the minimum lethal dose was 370,000 ppm (Karpov 1965). In rabbits, the minimum concentration altering reflex responses was 11,000 to 20,000 ppm (Karpov 1965). Studies of guinea pigs reported no fatalities as a result of exposure for 2 hours at 200,000 ppm, but mild clinical changes were observed at 50,000 ppm and minimal effects at 25,000 ppm (Underwriters' Laboratories, Inc. 1940). Thirty-minute exposures at 500,000 ppm were lethal to guinea pigs (Booth and Bixby 1932). Karpov has also reported the results of a 10-month study of inhalation effects in rats, guinea pigs, dogs, and cats. Six-hour inhalation exposures to 14,000 ppm and 2000 ppm for 5 days/week were studied, and alterations in weight, endurance, blood chemistry, and pathology of the lungs, central nervous system, heart, liver, kidney, and spleen were seen at the 14,000-ppm level in rats, mice, and rabbits. At the 2000-ppm daily inhalation level, rats and mice showed no effects. In dogs, cardiac sensitization was not observed at the 25,000-ppm level, but it did occur at the 50,000-ppm level (Reinhardt, Azar, and Maxfield 1971). No data have been published concerning the carcinogenicity, mutagenicity, or teratogenicity of this substance.

The Agency is proposing an 8-hour TWA limit of 1000 ppm for chlorodifluoromethane and a 1250-ppm 15-minute STEL. OSHA preliminarily concludes that these limits will provide protection against the life-threatening asphyxiant effects that could occur in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for chlorodifluoromethane. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

o-CHLOROTOLUENE
CAS: 95-49-8; Chemical Formula: C_7H_7Cl
H.S. No. 1090

OSHA has no current limit for o-chlorotoluene. The ACGIH recommends a TLV–TWA of 50 ppm and a 15-minute STEL of 75 ppm for this colorless liquid.

The oral LD_{50} in rats for o-chlorotoluene is greater than 1600 mg/kg. When the undiluted material was administered orally in doses ranging from 50 to 100 mg/kg, the animals experienced weakness and vasodilation at the higher dose levels, but all survived and were gaining weight 2 weeks later (ACGIH 1986 p. 137). When the undiluted liquid was applied to the skin of guinea pigs in doses of 1 cc or 10 cc/kg for 24 hours, moderately severe skin irritation occurred at both dose levels. The guinea pigs lost weight over the 2-week period following application, indicating percutaneous absorption of this substance. One drop of undiluted material in the eyes of rabbits produced

a delayed erythema of the conjunctiva, although this effect cleared after 14 days (Ely, as cited in ACGIH 1986, p. 137). Rats exposed to an atmosphere of 21 mg/L, or about 4000 ppm, for 6 hours exhibited loss of coordination within 1.5 hours, prostration at 1.75 hours, and tremors at 2 hours. At 14,000 ppm, rats showed loss of coordination, vasodilation, labored respiration, narcosis, and tearing. Rats exposed at 4000 and 14,000 ppm survived. At 175,000 ppm, one of three rats died (Ely, as cited in ACGIH 1986 p. 137). In another study, mice, rats, and guinea pigs were exposed to o-chlorotoluene at a concentration of about 4400 ppm. Mice showed gasping and convulsions within 30 minutes, and guinea pigs and rats exhibited gasping, hyperpnea, ataxia, and convulsions in 45 minutes. All animals were comatose within 60 minutes, and, except for two guinea pigs that still survived at 14 days, all of the animals died (Hazleton Laboratories, Inc. 1966).

In rabbits, the 24-hour patch test resulted in moderate skin irritation; albino rabbits displayed conjunctival irritation from a single instillation of 0.1 ml of undiluted o-chlorotoluene, but no corneal damage was observed 7 days later (Hazleton Laboratories, Inc. 1966).

Data concerning human exposures are lacking, but no cases of dermatitis or poisoning have been reported as a result of occupational exposure. Personal communications from several occupational health experts recommend limits ranging from 25 ppm to 200 ppm TWA for human exposures (Hopton; Mastromatteo; Elkins; Torkelson, as cited in ACGIH 1986, p. 137). These limits were recommended on the basis of analogy with similar compounds, such as the chlorinated benzenes.

OSHA is proposing 50 ppm as an 8-hour TWA PEL. The Agency preliminarily concludes that this limit will protect against the risk of eye and skin irritation and systemic poisoning possible in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for o-chlorotoluene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CYCLONITE
CAS: 121-82-4; Chemical Formula: $C_3H_6N_6O_6$
H.S. No. 1110

OSHA currently has no permissible exposure limit for cyclonite. The ACGIH recommends a TLV-TWA of 1.5 mg/m³ and a STEL of 3 mg/m³, with a skin notation. Cyclonite exists in the form of orthorhombic crystals.

Cyclonite, a high explosive and a rat poison, has not been shown in animal studies to be acutely toxic. In industry, reports of poisonings as a result of occupational exposures to cyclonite were widespread as late as 1962 (Kaplan, Berghout, and Peczenik 1962). Exposure causes central nervous system effects, including nausea, vomiting, convulsions, and unconsciousness. These clinical signs result from repeated gastrointestinal and respiratory exposures and from skin absorption (Sunderman et al. 1944; von Oettingen, Donahue, Yagoda et al. 1949). In an epidemiological study, Hathaway (1977) reported that 8-hour TWA exposures ranging up to 1.57 and averaging 0.28 mg/m³ caused no identifiable abnormalities attributable to cyclonite exposure.

OSHA is proposing a limit of 1.5 mg/m³ TWA, a 3-mg/m³ 15-minute STEL, and a skin notation for cyclonite. The Agency preliminarily concludes that establishing these limits for this previously unregulated chemical will protect workers from the risk of neuropathic effects associated with cyclonite exposure, either as a result of inhalation or percutaneous exposures, in the absence of an OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for cyclonite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2,6-DI-tert-BUTYL-p-CRESOL
CAS: 128-37-0; Chemical Formula: $C_{15}H_{24}O$
H.S. No. 1117

OSHA currently has no limit for 2,6-di-tert-butyl-p-cresol (DBPD). The ACGIH recommends a TLV-TWA of 10 mg/m³ for this white crystalline compound, which is prepared from p-cresol and isobutylene. DBPD is widely used as a food preservative.

DBPD is considered to have a low order of toxicity; in extensive animal studies, ingestion has not been associated with toxic effects (ACGIH 1986, p. 227). Deichmann and associates (1955) reported oral LD_{50} values of 10.7 g/kg for guinea pigs, 1.7 and 1.97 g/kg for male and female rats, respectively, and ranges of between 0.94 and 2.1 g/kg for cats and between 2.1 and 3.2 g/kg for rabbits. One year of daily oral administration of 0.17 to 0.9 g/kg in dogs produced no effects, nor did a 24-month oral administration of 0.2, 0.5, or 0.8 percent DBPD in rats (Deichmann et al. 1955). Other studies have confirmed these overall results, although some growth rate decreases and liver weight increases were demonstrated in rats fed 0.01 to 0.5 percent DBPD, total daily diet (Brown, Johnson, and O'Halloran 1959; Creaven, Davies, and Williams 1966).

The estimated human intake of DBPD in the United States does not exceed a few milligrams daily (Gilbert and Goldberg 1965), perhaps 0.2 mg/kg body weight. These authors further observe that the no-effect dietary level in rats is 25 mg/kg.

OSHA proposes a TWA limit of 10 mg/m³ for 2,6-di-tert-butyl-p-cresol. The Agency preliminarily concludes that this limit will protect workers against the risk of any acute or chronic effects potentially associated with occupational exposure to this substance in the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for 2,6-di-tert-butyl-p-cresol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIETHANOLAMINE
CAS: 111-42-2; Chemical Formula: $HO(CH_2)_2NH(CH_2)_2OH$
H.S. No. 1134

OSHA currently has no limit for diethanolamine. The ACGIH has established an 8-hour TWA limit of 3 ppm. Diethanolamine exists as either a solid or a liquid at room temperature.

Diethanolamine has a low order of toxicity. The oral LD_{50} for both rats and guinea pigs has been reported to be about 2 g/kg (Dow Chemical Company, as cited in ACGIH 1986, p. 197). Acute toxicity studies have shown that direct contact may impair vision and denature the skin if exposure is repeated. Dietary studies in rats showed no ill effects after 90 days of feeding at 20 mg/kg/day (Smyth et al. 1951).

OSHA is proposing a PEL of 3 ppm TWA for diethanolamine. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of eye damage and skin irritation potentially associated with exposure to diethanolamine at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for diethanolamine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIETHYL PHTHALATE
CAS: 84-66-2; Chemical Formula: $C_6H_4-(COOC_2H_5)_2$
H.S. No. 1136

OSHA currently has no limit for diethyl phthalate. The ACGIH recommends a TLV-TWA of 5 mg/m³ for this stable, colorless, odorless, and oily liquid with a bitter taste.

Diethyl phthalate exposure may cause polyneuritis and disturbance of the vestibular function. By most routes of administration, this substance has low acute toxicity in laboratory animals and borders on the "relatively harmless" classification according to the systematic grouping developed by Hine and Jacobson (1954). Oral LD_{50} values in the rat range between 9.5 and 31 g/kg (Shibko and Blumenthal 1973); the intraperitoneal LD_{50} for the rat is 5.08 ml/kg (Singh, Lawrence, and Autrian 1972) and, for the mouse, 2.8 g/kg (Calley, Autrian, and Guess 1966). Chronic feeding studies lasting 6 or more weeks resulted in no-effect levels of 2.5 g/kg/day for the rat and 1.25 g/kg/day for the dog, with no specific lesion attributable to diethyl phthalate and no unusual incidence of tumors (Shibko and Blumenthal 1973).

A study of workers exposed to a mixture of diethyl phthalate, dibutyl phthalate, and di-2-ethyl hexyl phthalate vapors in air at concentrations of 8 to 53 mg/m³ resulted in findings of no phthalates in the blood (before or after the exposure) and no peripheral polyneuritis (Raleigh, as cited in ACGIH 1986, p. 200). Fassett (1963) reported transient nasal and throat irritation produced by exposure to the heated vapors of diethyl phthalate, but no cumulative effects have been noted. A Russian study of workers (employed for between 0.5 and 19 years) who were exposed to several phthalate plasticizers (e.g., butyl phthalate, the higher aryl phthalates, dioctyl phthalate, and benzyl butyl phthalate), as well as to sebacates, adipates, and tri-o-cresyl phosphate, at concentrations ranging from 1.7 to 66 mg/m³ resulted in subjective complaints of pain, numbness, and spasms in the upper and lower extremities. These complaints were related to the duration of exposure and usually began after the 6th or 7th year of employment (Milkov et al. 1969). These investigators reported polyneuritis in 32 percent of the 47 persons examined for this health effect; of 81 persons evaluated for disturbance of the vestibular function, 78 percent showed depression of vestibular receptors (Milkov et al. 1969).

OSHA proposes a PEL of 5 mg/m³ for diethyl phthalate. The Agency preliminarily concludes that this limit will protect workers against the risk of polyneuritis and vestibular function disturbance potentially associated with occupational exposure to this substance in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for diethyl phthalate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DINITOLMIDE (3,5-DINITRO-O-TOLUAMIDE)
CAS: 148-01-6; Chemical Formula: $C_8H_7N_3O_5$
H.S. No. 1144

OSHA currently has no limit for dinitolmide. The ACGIH recommends a limit of 5 mg/m³ TWA for this yellowish solid.

In rats, the oral LD_{50} for males is 560 mg/kg, and for females, 650 mg/kg; the ACGIH concludes that it has a moderate oral toxicity in rats (1986, p. 213). Two-year dietary studies of rats fed 62.5 ppm (or 3 mg/kg/day) dinitolmide showed no ill effects. Rats of both sexes fed 6 mg/kg/day showed slight fatty changes in the liver; female rats also exhibited slight liver weight increases. Dogs fed 10 mg/kg/day showed no effects after 1 year. A 3-generational study of rats fed 6 or 3 mg/kg/day revealed no effects on fertility, gestation, viability, or lactation (Dow Chemical Company, as cited in ACGIH 1986, p. 213). There are no inhalation data.

OSHA is proposing an 8-hour TWA PEL for dinitolmide of 5 mg/m³. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of hepatic changes possible as a result of exposure at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for dinitolmide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIPHENYLAMINE
CAS: 122-39-4; Chemical Formula: $(C_6H_5)_2NH$
H.S. No. 1147

OSHA currently has no limit for diphenylamine. The ACGIH recommends a TLV of 10 mg/m³ TWA. Diphenylamine exists as monoclinic crystalline leaflets that discolor when exposed to light.

Acute oral toxicity data for diphenylamine are limited. A single report describes a study in which a dietary dose of 1,500 mg/kg killed two of twenty rats within 30 days of ingestion (Griswold et al. 1966). This suggests that diphenylamine is significantly less toxic than aniline (Hamblin 1963). Dietary studies of rats fed 0.025, 0.1, 0.5, 1.0, or 1.5 percent diphenylamine for 226 days demonstrated non-malignant renal cysts at the three highest doses (Thomas et al. 1957). However, rats given diphenylamine crystals encapsulated in collodion developed bladder papillomas within 125 days (Yoshida et al. 1941). Exposure to diphenylamine dust has been linked to liver, spleen, and kidney changes in experimental animals (Robert et al. 1937).

A report of industrial diphenylamine poisoning in France described bladder symptoms, tachycardia, hypertension, and eczema (Fairhall 1957).

OSHA is proposing a PEL of 10 mg/m³ TWA for diphenylamine. The Agency preliminarily concludes that this limit will protect workers against the risk of liver, kidney, cardiovascular, and other systemic effects potentially associated with exposures to this substance in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for diphenylamine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIURON
CAS: 330-54-1; Chemical Formula: $C_9H_{10}Cl_2N_2O$
H.S. No. 1153

OSHA currently has no limit for diuron. The ACGIH recommends a TLV of 10 mg/m³ TWA for this white crystalline solid.

Hodge and associates (1967, 1968) have reported a low order of acute and chronic toxicity for diuron. For male rats, the oral LD_{50} is 3,400 mg/kg. In 2-year feeding studies of rats and dogs, the no-effect levels were reported to be 250 and 125 ppm, respectively. A concentration of 125 ppm in the diet did not cause reproductive or carcinogenic effects in a 3-generational study of rats (Hodge, Downs, and Panner 1967; Hodge, Downs, Smith et al. 1968); 1,400 ppm did not have carcinogenic effects in mice (Innes et al. 1969). Skin irritation and sensitization test findings in guinea pigs have been negative (ACGIH 1986, p. 228).

OSHA is proposing an 8-hour limit of 10 mg/m³ TWA for diuron. This is the limit being proposed by the Agency for all inert dust and particulates; OSHA preliminarily concludes that this limit will protect exposed workers from the risks potentially associated with workplace exposure in the absence of any OSHA PEL. These risks include accidents, skin and upper respiratory tract irritation, and interference with vision. The health evidence forms a reasonable basis for proposing a new limit for diuron. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL ACETATE
CAS: 79-20-9; Chemical Formula: CH_3COOCH_3
H.S. No. 1249

OSHA currently has a limit of 200 ppm TWA for methyl acetate. The ACGIH also recommends an 8-hour TWA limit of 200 ppm, with the addition of a TLV–STEL of 250 ppm. Methyl acetate is a highly volatile, colorless liquid with a pleasant odor.

Methyl acetate is mildly narcotic and is a known irritant to the mucous membranes of the eyes and respiratory passages. Occupational exposure to this substance by vapor inhalation at unreported levels resulted in inflammation of the eyes, nervous irritation, and tightness in the chest (Duquenois and Revel 1934; Fairhall 1957). Duquenois and Revel (1934) suggested that, like methyl alcohol, methyl acetate may produce atrophy of the optic nerve.

Other researchers have suggested that the methanol formed by hydrolysis in the body may be responsible for the toxicity of methyl acetate and, on this basis, have recommended a limit of 250 ppm in the occupational setting (Henderson and Haggard 1943). However, Lehmann and Flury (1943) have attributed toxic effects (e.g., blood changes, weight loss, lung irritation), as well as some deaths, to chronic exposures at 6600 ppm. These health effects require a PEL which will protect workers against both chronic and acute exposures.

No cases of irritation or systemic injury have been reported from industrial exposures to methyl acetate below 200 ppm.

OSHA is proposing an 8-hour PEL of 200 ppm TWA and a 15-minute STEL of 250 ppm for methyl acetate. The Agency preliminarily concludes that both of these limits will protect exposed workers from the risk of narcosis, eye and skin irritation, and pulmonary irritation possible at elevated exposure levels. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl acetate if the Agency determines that this limit will substantially reduce significant risk.

METRIBUZIN
CAS: 21087–64–9; Chemical Formula: $C_8H_{14}N_4OS$
H.S. No. 1275

OSHA currently has no limit for metribuzin. The ACGIH recommends a TLV–TWA of 5 mg/m.³ Metribuzin is a crystalline solid.

The herbicide metribuzin has a low order of acute toxicity; single exposures to high concentrations produce central nervous system depression, and repeated high doses affect the thyroid and liver function (Deutsche Forschungsgemeinshaft 1981, as cited in ACGIH 1986, p. 411). The oral LD_{50} in rats has been reported to be 2000 mg/kg; in cats and rabbits, the LD_{50} is up to 500 mg/kg. A 4-hour aerosol exposure at concentrations of between 860 and 892 mg/m³ was tolerated by rats and mice; no skin or eye irritation was observed in rabbits. No sensitizing effects were seen in guinea pigs, and a skin application of the 70-percent wettable powder of 1000 mg/kg per day for 3 weeks produced no effects in rats (Deutsche Forschungsgemeinschaft 1981 as cited in ACGIH 1986, p. 411).

Inhalation studies have shown no adverse effects in rats exposed to 31 mg/m³ of the aerosol for 6 hours/day, 5 days/week during a 3-week period (Bayer 1981, as cited in ACGIH 1986, p. 411). No carcinogenic effects were observed in rats and mice fed 20, 800, or 3200 ppm for 2 years (Kimmerle 1982, as cited in ACGIH 1986, p. 411). A no-effect level of 100 ppm was observed in a 2-year dietary study of rats and dogs (Deutsche Forschungsgemeinschaft 1981, as cited in ACGIH 1986, p. 411); these same investigators observed no teratogenic, embryotoxic, or reproductive effects in rats or rabbits. In Chinese hamsters and mice, no mutagenic activity was observed (Siebert and Lemperle 1974).

No human poisonings with metribuzin have been reported. In oral long-term studies, the highest no-observed effect levels (NOELs) were 2.5 to 5 mg/kg per day (ACGIH 1986, p. 411). Single and repeated patch tests in humans resulted in neither irritation nor sensitization (Deutsche Forschungsgemeinschaft 1981, as cited in ACGIH 1986, p. 411).

OSHA is proposing a PEL of 5 mg/m³ TWA for metribuzin. The Agency preliminarily concludes that this limit will protect workers against the risks of metabolic and CNS effects that potentially exist from workplace exposure to metribuzin at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for metribuzin. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

OIL MIST (MINERAL)
CAS: 8012–95–1; Chemical Formula: None
H.S. No. 1297

OSHA currently has a limit of 5 mg/m³ TWA for oil mist. The ACGIH has the same limit and recommends the addition of a 10 mg/m³ TLV–STEL. Oil mist (mineral) refers to the airborne mist of petroleum-based cutting oils or of white petroleum oil; its odor is described as that of burned lubrication oil.

Studies in animals have shown no ill effects as a result of repeated 6-hour daily exposures to 5 mg/m³ level (Wagner, Wright, and Stokinger 1964). At 100 mg/m³, slight changes (not further specified) were observed in exposed animals (Lushbauch, Green, and Redemann 1950). Oil fumes and the role of additives have not yet been evaluated, but it has been suggested that heat-decomposed oil fumes are irritating to the lungs (Wagner, Dobrogorski, and Stokinger 1961). Some lung effects have been reported as a result of exposures in animals at 100 mg/m³ Lushbauch, Green, and Redemann 1950).

OSHA proposes a PEL of 5 mg/m³ TWA and a STEL of 10 mg/m³ for mineral oil mist. The Agency preliminarily concludes that both a TWA limit and a STEL are necessary to protect against the risk of lung irritation potentially associated with elevated short-term exposures to oil mist. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for mineral oil mist if the Agency determines that this limit will substantially reduce significant risk.

PETROLEUM DISTILLATES (NAPHTHA)
CAS: None; Chemical Formula: None
H.S. No. 1312

For petroleum distillates (naphtha), also identified as rubber solvents, OSHA is proposing to reduce its current 8-hour limit of 500 ppm to 400 ppm. The ACGIH has a TLV–TWA of 400 ppm, and NIOSH recommends a TWA of 87 ppm and a ceiling (15 min) of 450 ppm for these substances.

A 1975 study performed by Carpenter et al. exposed rats to between 2800 and 24,200 ppm of naphtha. Motor incoordination occurred at 5300 ppm, and convulsions and death occurred in all animals at 24,200 ppm. Animals exposed to 480 ppm for 63 days showed no signs of toxicity (Carpenter et al. 1975).

NIOSH (1977i) noted that rubber solvent (naphtha) is composed primarily of C_5–C_8 alkanes and, as such, the limit of 350 mg/m³ (85 ppm) recommended for C_5–C_8 alkanes should apply to naphtha. This recommendation presumes that all C_5–C_8 alkanes possess neuropathic capability; as discussed above in the section on narcotic agents, OSHA has preliminarily concluded that not all C_5–C_8 alkanes are neuropathic agents.

In establishing its recommended 400-ppm TLV–TWA for petroleum distillates, the ACGIH relied on the

observations that slight irritation occurs in humans at exposure to 430 ppm and that no signs of toxicity occur in animals exposed to 480 ppm. The NIOSH-recommended 85-ppm limit is based on the assumption that all C_6–C_8 alkanes possess equivalent neuropathic properties. OSHA has tentatively rejected this hypothesis and proposes therefore to reduce the PEL to 400 ppm TWA in order to avoid the risk of extensive irritation. The Agency requests comments on the issue of equivalent toxicity for all C_6–C_8 alkanes. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for petroleum distillates if the Agency determines that this limit will substantially reduce significant risk.

m-PHTHALODINITRILE
CAS: 626–17–5; Chemical Formula: $C_8H_4N_2$
H.S. No. 1327

OSHA currently has no limit for m-phthalodinitrile. The ACGIH has recommended a TLV–TWA of 5 mg/m³. meta-Phthalodinitrile exists in the form of needles obtained from solutions containing either water or ligroin as the solvent.

In rabbits, slight skin reactions have been reported from dermal applications of m phthalodinitrile to intact or abraded skin for 6 hours/day, 5 days/week during a 3-week period. The doses applied were 0.5, 1.0, and 2.0 g/kg; at the two higher dose levels, some changes in organ size, without histopathologic changes, were observed. Female rabbits exposed at the highest dose lost body weight (Owen 1972, as cited in ACGIH 1986, p. 488).

A 15-year review of industrial experience revealed no reports of adverse effects from exposure to m-phthalodinitrile (Zeller, Hofmann, Thiess, and Hey 1963). Williams (1959) attributes this absence of exposure effects to the fact that the aromatic nitriles, of which m-pthalodinitrile is one, do not liberate cyanide in the body, as is the case with the aliphatic nitriles.

OSHA is proposing an 8-hour TWA limit for m-phthalodinitrile of 5 mg/m³. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of skin irritation that exists in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for m-phthalodinitrile. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PLATINUM (METAL)
CAS: 7440–06–4; Chemical Formula: Pt
H.S. No. 1332

OSHA currently has no limit for platinum metal. The ACGIH recommends a limit of 1.0 mg/m³ TWA for platinum metal dust. Platinum is a silver gray, lustrous, malleable, and ductile precious metal.

Extrapolating from its TLV for platinum soluble salts and recognizing no major health effects associated with exposure to the metal dust, the ACGIH recommended a TLV of 1.0 mg/m³ for platinum metal dust. This level apparently was based on good industrial hygiene practices and the expectation that a heavy metal dust will be more toxic than nuisance dusts (which are controlled to 10 mg/m³.

OSHA therefore proposes a limit of 1.0 mg/m³ TWA for platinum metal dust. The Agency preliminarily concludes that this limit will protect workers against the risk of adverse health effects potentially associated with workplace exposure in the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for platinum metal dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

RESORCINOL
CAS: 108–46–3; Chemical Formula: $C_6H_4(OH)_2$
H.S. No. 1346

OSHA currently has no limit for resorcinol. The ACGIH recommends an 8-hour TWA limit of 10 ppm with a TLV–STEL of 20 ppm. Resorcinol occurs in the form of sweet-tasting white crystals that may turn pink on exposure to air and light or on contact with iron.

Resorcinol has been reported to be less toxic than either catechol or phenol by ingestion or skin penetration (von Oettingen 1949; Koppers Company 1974, as cited in ACGIH 1986, p. 511). The oral LD_{50} in rats is 301 mg/kg (NIOSH 1977). Daily 6-hour exposures at 8 ppm for 2 weeks produced no ill effects in rats, guinea pigs, and rabbits. Acute inhalation exposures to a resorcinol-water aerosol at concentrations as high as 7800 mg/m³ for 1 hour and 2800 mg/m³ for 8 hours caused no toxic effects in laboratory animals (Koppers Company 1974, as cited in ACGIH 1986, p. 511).

In humans, regular exposure to 10 ppm also caused no irritation and no complaints of discomfort (Koppers Company 1974, as cited in ACGIH 1986, p. 511).

OSHA proposes a PEL of 10 ppm TWA and a STEL of 20 ppm for resorcinol. The Agency preliminarily concludes that this combined limit will protect workers against the risk of irritation that exists in the absence of any OSHA limit for occupational exposure to this substance. The health evidence forms a reasonable basis for proposing a new limit for resorcinol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TANTALUM (METAL DUST AND OXIDE)
CAS: 7440–25–7; Chemical Formulas: (Tantalum metal)Ta; (Tantalum oxide)Ta_2O_5
H.S. No. 1382

OSHA's existing PEL for tantalum is 5 mg/m³; the ACGIH recommends a 5-mg/m³ and TWA and a 15-minute STEL of 10 mg/m³. Tantalum dust is a black powder and tantalum oxide is a white, microcrystalline powder.

Animal studies by Miller, Davis, Goldman, and Wyatt (1953) have not implicated tantalum as a cause of pnuemoconiosis, although an exposure to 100 mg tantalum oxide produced "soft white circumscribed pigmented dust lesions" (ACGIH 1986, p. 554) in the lungs of these animals. Additionally, this particular study demonstrated transient bronchitis, interstitial pneumonitis, and hyperemia at the 100-mg exposure level. Tantalum oxide has been used as a dressing for burns (Olsen 1944), and the use of tantalum gauze in surgical repair showed no long-term adverse effects (Dales and Kyle 1958). No adverse health effects have been associated with industrial exposures to tantalum or its compounds (Cochran, Doull, Mazur, and DuBois 1950). A single oral dose of 6500 mg/kg oxide was virtually nontoxic to rats (ACGIH 1986, p. 554).

The ACGIH (1986, p. 554) believes that tantalum dust and oxide should be classified as an inert or nuisance dust and, accordingly, placed tantalum on its 1987–88 Notice of Intended Changes list with a recommendation for increasing the TLV–TWA to 10 mg/m³, the ACGIH's limit for all nuisance dusts, and deleting the current STEL of 10 mg/m³. However, OSHA notes that inhalation exposures to tantalum have produced pulmonary lesions, bronchitis, interstitial pneumonitis, and hyperemia. The Agency preliminarily concludes that the existing 5-mg/m³ TWA for these compounds should be supplemented with a short-term limit of 10 mg/m³ to protect exposed workers from these respiratory effects of exposure. OSHA therefore proposes a PEL of 5 mg/m³ TWA and a STEL of 10 mg/m³ for tantalum (metal dust and oxide). The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for tantalum dust and oxide if the Agency determines

that this limit will substantially reduce significant risk.

TRIMETHYL PHOSPHITE
CAS: 121–45–9; Chemical Formula: $(CH_3O)_3P$
H.S. No. 1410

OSHA currently has no limit for trimethyl phosphite. The ACGIH limit is a 2-ppm 8-hour TWA. Trimethyl phosphite is a colorless liquid with a pungent odor.

Trimethyl phosphite's toxic effects include lung, skin, and eye irritation. In a chronic inhalation study of rats, Levin and Gabriel (1973) found that exposure to trimethyl phosphite at concentrations of 500±75 ppm for 7.5 hours daily, 5 days/week for 8 weeks caused an adverse effect on body weight and, at necropsy, revealed evidence of severe pulmonary and cutaneous pathology. At exposures of 600 ppm 6 hours/day, 5 days/week for 4 weeks, 70 percent of the rats died, and 10 percent of those exposed even at 300 ppm on the same regimen died (Mobil Oil Corporation 1979).

Rats exposed at 100 ppm showed signs of eye irritation, and at 300 to 600 ppm, mild to severe cataracts developed. At doses of 164 mg/kg, trimethyl phosphite caused gross abnormalities in the offspring of treated rats (Mobil Oil Corporation 1979).

Skin contact with trimethyl phosphite produced severe skin irritation in rabbits, and instillation in the eyes of rabbits caused temporary swelling and irritation but no permanent effects (Fassett 1963).

In a group of 179 workers exposed to average concentrations of trimethyl phosphite of between 0.3 and 4 ppm, no ocular changes were observed (Mobil Chemical Corporation 1980, as cited in ACGIH 1986, p. 609).

OSHA is proposing an 8-hour TWA for trimethyl phosphite of 2 ppm. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of eye damage, skin irritation, and upper respiratory tract irritation potentially associated with exposures to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for trimethyl phosphite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TRIPHENYL AMINE
CAS: 603–34–9; Chemical Formula: $(C_6H_5)_3N$
H.S. No. 1415

OSHA currently has no exposure limit for triphenyl amine. The ACGIH recommends a 5-mg/m³ 8-hour TWA limit for this substance. Triphenyl amine exists as colorless monoclinic prisms.

Animal studies conducted by the Eastman Kodak Company (as cited in ACGIH 1986, p. 612) showed an oral LD_{50} in rats of 3200 to 6400 mg/kg and an oral LD_{50} in mice of 1600 to 3200 mg/kg. The LD_{50} by intraperitoneal administration for both rodent species exceeded 6400 mg/kg. Skin and eye sensitivity tests in both rabbits and guinea pigs were essentially negative except that application of 5 to 20 ml/kg occlusively for 4 hours produced slight erythema (Eastman Kodak Company, as cited in ACGIH 1986, p. 612).

OSHA is proposing a 5-mg/m³ TWA limit for triphenyl amine. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of skin irritation potentially associated with exposure to this substance in the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for triphenyl amine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

URANIUM (INSOLUBLE COMPOUNDS)
CAS: 7440–61–1; Chemical Formula: U
H.S. No. 1418

OSHA's existing PEL for insoluble uranium compounds is 0.25 mg/m3; the ACGIH has a TLV–TWA of 0.2 mg/m³ and a 0.6-mg/m³ STEL. Uranium is a silver-white radioactive metal.

OSHA's existing limit for the insoluble compounds of uranium was based on several early studies of uranium's toxic effects in animals; these effects included kidney damage and blood changes (Voegtlin and Hodge 1953). In the intervening years, a considerable body of evidence has accumulated based on the actual occupational exposures of uranium plant workers over a period as long as 25 years. This evidence shows that, before 1950, workers were often exposed to uranium levels between 0.2 and 1.5 mg/m³, but that after 1950, only about 6 percent were exposed at 0.05 mg/m³ or above; despite these relatively high early exposures, the incidence of all diseases, whether or not linked to radiation exposure, has been no higher than is the case for workers in the general population (ACGIH 1986, p. 617). However, there is also evidence that several workers were exposed to brief excursions during which exposure levels reached a concentration as much as five times the TLV (Wing, Heatherton, and Quigley 1963, as cited in ACGIH 1986, p. 617).

OSHA is proposing an 8-hour TWA of 0.2 mg/m³ and a STEL of 0.6 mg/m³ for the insoluble forms of uranium. The Agency preliminarily concludes that these limits are required to protect uranium plant workers from the risk of kidney or blood disorders potentially associated with both full-shift and excursion exposures to these compounds. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for uranium if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

For the group of substances shown in Table C9–1, OSHA preliminarily concludes that workplace exposures to these substances cause a broad range of adverse health consequences in exposed individuals; effects include CNS depression, respiratory irritation, liver and kidney damage, cardiac sensitization, and hepatocellular cancer. OSHA believes that the health evidence forms a reasonable basis for proposing new or revised limits for these substances. At the time of the final rule, the Agency will establish new or revised limits if it determines that significant risk will be substantially reduced thereby.

10. Substances for Which Proposed Limits Are Based on Avoidance of Adverse Nuisance Effects

Introduction

OSHA is proposing limits for a group of substances that cause a variety of adverse effects. These substances are recognized universally as posing a substantial threat to the health, safety, and well-being of workers exposed to them. The term "nuisance" for these particulates can be misleading because the hazards they pose in the workplace are real and often serious. The ACGIH classifies many of these substances as nuisance particulates and applies a single workplace limit to them. OSHA has no substance-specific limits for these dusts; the Agency's limit for the category of nuisance dusts as a whole is 15 mg/m³ as total dust and 5 mg/m³ as respirable dust (see Table Z–3 of 29 CFR 1910.1000). Table C10–1 shows the 47 substances included in this group. NIOSH does not recommend a limit for the category of nuisance dusts but does have a REL for malathion and fibrous glass dust, two substances included in this group by the ACGIH. For all of these substances except fibrous glass dust, OSHA is proposing to establish an

8-hour TWA limit of 10 mg/m³ as total dust. For fibrous glass dust, the Agency is proposing a limit of 5 mg/m³ as a TWA.

Description of the Health Effects

The adverse effects caused by exposure to these substances include: Interference with vision; deposition of these substances in the eyes, ears, nasal passages, and upper respiratory tract; and skin irritation. Thus, workers exposed to excessive concentrations of these substances may have difficulty seeing or be subjected to attacks of uncontrolled coughing and sneezing. Moreover, workers may injure their skin and mucous membranes when they attempt to remove these substances, which settle everywhere. These undesirable exposure effects also have serious safety implications, because they lead to workplace accidents and injuries.

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TABLE C10-1. - Substances Causing Adverse Nuisance Effects

H.S. Number/ Chemical Name	CAS No.	OSHA Nuisance Dust Limit	ACGIH TLV	NIOSH REL
1014 Alpha-alumina	1344-28-1	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1016 Aluminum metal dust	7429-90-5	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1024 Ammonium sulfamate	7773-06-0	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1031 Barium sulfate	7727-43-7	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1032 Benomyl	17804-35-2	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1035 Bismuth telluride (undoped)	1304-82-1	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1039 Boron oxide	1303-86-2	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1057 Calcium carbonate	1317-65-3	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1061 Calcium silicate, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1062 Calcium sulfate	7778-18-9	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1076 Cellulose	9004-34-6	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1082 2-Chloro-6-trichloro-methyl pyridine	1929-82-4	15 mg/m^3 TWA	10 mg/m^3 TWA	--

TABLE C10-1. - Substances Causing Adverse Nuisance Effects (continued)

H.S. Number/ Chemical Name	CAS No.	OSHA Nuisance Dust Limit	ACGIH TLV	NIOSH REL
1095 Clopidol	2971-90-6	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1102 Crag herbicide (sesone)	136-78-7	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1133 Dicyclopentadienyl iron	102-54-5	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1155 Emery	112-62-9	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1176 Ferbam	14484-64-1	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1178 Fibrous glass dust+	--	--	10 mg/m^3 TWA	5 mg/m^3 TWA*
1188 Glycerin (mist)	56-81-5	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1191A Graphite, synthetic, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	-
1192 Gypsum, total dust	-	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1230 Kaolin, total dust	-	15 mg/m^3 TWA	10 mg/m^3 TWA	--

* NIOSH has an additional limit for fibrous glass of 3 million fibers/m^3; fibers less than or equal to 3.5 microns in diameter and equal to or greater than 10 microns in length are counted.

TABLE C10 1. Substances Causing Adverse Nuisance Effects (continued)

H.S. Number/ Chemical Name	CAS No.	OSHA Nuisance Dust Limit	ACGIH TLV	NIOSH REL
1232 Limestone, total dust	1317-65-3	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1233 Magnesite, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1234 Magnesium oxide fume	1309-48-4	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1235 Malathion	121-75-5	15 mg/m^3 TWA, Skin	10 mg/m^3 TWA, Skin	15 mg/m^3 TWA
1239 Marble, total dust	1713-65-3	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1246 Methoxychlor	72-43-5	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1277 Mineral wool fiber	-	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1278 Molybdenum (insoluble compounds)	7439-98-7	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1294 Nuisance particulates, total dust	-	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1305 Pentaerythritol, total dust	115-77-5	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1310 Perlite	-	15 mg/m^3 TWA	10 mg/m^3 TWA	-

TABLE C10-1. - Substances Causing Adverse Nuisance Effects (continued)

H.S. Number/ Chemical Name	CAS No.	OSHA Nuisance Dust Limit	ACGIH TLV	NIOSH REL
1328 Picloram	1918-02-1	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1331 Plaster of Paris, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1333 Portland cement	65997-15-1	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1351 Rouge, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1359 Silicon	7440-21-3	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1360 Silicon carbide	409-21-2	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1369 Starch, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1374 Sucrose, total dust	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1383 Temephos	3383-96-8	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1391 4,4'-Thiobis (6-tert-butyl-m-cresol)	96-69-5	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1396 Titanium dioxide	13463-67-7	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1423 Vegetable oil mist	--	15 mg/m^3 TWA	10 mg/m^3 TWA	--
1434 Zinc stearate	557-05-1	15 mg/m^3 TWA	10 mg/m^3 TWA	--

TABLE C10-1. - Substances Causing Adverse Nuisance Effects (continued)

H.S. Number/ Chemical Name	CAS No.	OSHA Nuisance Dust Limit	ACGIH TLV	NIOSH REL
1438 Zinc oxide, total dust	1315-13-2	15 mg/m^3 TWA	10 mg/m^3 TWA	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed PEL is the NIOSH REL.

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When exposures to the substances shown in Table C10–1 are kept under proper control in the workplace, exposures are not likely to result in significant organic disease or irreversible toxic effects. However, it is inappropriate to consider these nuisance particulates biologically inert, because, if inhaled in sufficient amount, these dusts do cause pulmonary responses.

The lung-tissue reactions associated with exposure to these nuisance particulates leave the structure of the air spaces intact and do not cause scar tissue formation to any significant extent (ACGIH 1986). In addition, the reactions caused by inhalation are reversible if exposure is stopped. Controlling occupational exposures to these nuisance particulates and the other substances included in this category to levels below 10 mg/m³ as an 8-hour TWA will prevent these adverse effects. Workers protected by the proposed 10 mg/m³ limit will therefore not be at risk of the seriously distracting and often painful effects associated with exposures above this NOE level.

The following discussions describe OSHA's preliminary findings for the particulates included in this group. In addition, the health effects potentially associated with exposures to these substances are reviewed.

ALPHA-ALUMINA
CAS: 1344–28–1; Chemical Formula: Al_2O_3
H.S. No. 1014

OSHA presently has no specific limit for alpha-alumina, although OSHA's general nuisance dust limit of 15 mg/m³ applies. The ACGIH recommends an 8-hour TWA of 10 mg/m³, measured as total dust. Alpha-alumina, also called aluminum oxide, is a white powder that is widely used as an abrasive grinding material.

A study by Miller and Sayers (1941) determined that alumina particles with diameters less than 40 microns produced no reaction in laboratory animals. The results of a study by Stacy, King, Harrison et al. (1959) confirmed the findings of Miller and Sayers; these authors found a-alumina to be nearly inert when injected in the lungs of rats (Stacy, King, Harrison et al. 1959). Inhalation of fine aluminum powders at unspecified levels did not cause fibrosis in rats, guinea pigs, or hamsters (Gross et al. 1973).

In 1923, shortly after a-alumina replaced sandstone as the industrial abrasive of choice. Macklin and Middleton (1923) reported that workers exposed to aluminum oxide dust using the new, synthetic abrasive had much less pulmonary disease than workers using sandstone abrasives. Other studies (Sutherland, Meiklejohn, and Price 1937; Meiklejohn and Posner 1947; Meiklejohn and Posner 1948) reported that workers exposed to aluminum oxide dust in the chinaware industry and in aluminum production showed no evidence of pneumoconiosis. However, some early studies (Clark and Simmons 1925; Clark 1929) reported that workers engaged in aluminum oxide production and exposed to dust levels generally between 50 and 100 mppcf showed X-ray evidence of pulmonary fibrosis; these workers are likely also to have been exposed to silica. Workers exposed during World War II to bauxite fumes containing both alumina and silica developed pulmonary fibrosis and emphysema; the authors believe that silica fume was involved in the development of these diseases (Shaver and Riddell 1947). The ACGIH (1986, p. 21) states that alpha-alumina acts as an inert material.

OSHA is proposing an 8-hour limit of 10 mg/m³ for alpha-alumina, the limit being proposed for all inert particulates. The Agency preliminarily concludes that this limit will protect workers from the safety and health risks potentially associated with exposures to inert particulates in the workplace. These risks include safety accidents, skin and eye irritation, interference with vision, and distraction from the task at hand. This health evidence forms a reasonable basis for proposing a new limit for alpha-alumina. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ALUMINUM METAL DUST
CAS: 7429–90–5; Chemical Formula: Al
H.S. No. 1016

OSHA currently has no specific permissible exposure limit for aluminum metal dust; however, OSHA's current nuisance dust limit of 15 mg/m³ TWA applies. The ACGIH recommends an 8-hour TWA limit of 10 mg/m³ as total dust.

Aluminum metal dust has been shown to present a minimal health hazard, according to results from the McIntyre Foundation's 27-year study of aluminum oxide dust. No deleterious lung or systemic effects were observed as a result of exposure to aluminum metal dust having a particle size of 1.2 um at calculated concentrations equivalent to 2 mg/m³ over an 8-hour workshift. Even much higher concentrations (not further specified) over 10- or 20-minute periods produced no adverse effects (ACGIH 1986, p. 22).

Therefore, OSHA has preliminarily concluded that aluminum metal dusts are essentially inert and is proposing a PEL of 10 mg/m³ TWA, the standard being proposed for all nuisance dusts. This level will provide protection against the physical irritation possible at the previously uncontrolled level and prevent the safety hazards potentially associated with overexposure to dusts. This health evidence forms a reasonable basis for proposing a new limit for aluminum metal dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

AMMONIUM SULFAMATE
CAS: 7773–06–0; Chemical Formula: $NH_4SO_3NH_2$
H.S. No. 1024

OSHA currently regulates ammonium sulfamate under its general nuisance dust limit of 15 mg/m³. The ACGIH recommends a limit of 10 mg/m³ as an 8-hour TWA. Ammonium sulfamate is a colorless, non-combustible, white crystalline substance.

Ammonium sulfamate has a low order of toxicity and should be considered a nuisance dust. Lehman (1951) found oral LD_{50}s of 3900 mg/kg, 5700 mg/kg, and 3000 mg/kg in rats, mice, and quail, respectively. He also reported that no effects were noted in rats administered 10,000 ppm in the diet for 105 days. The hazards associated with exposure to ammonium sulfamate include eye and nose irritation, interference with vision, and the danger of accidents caused by the distraction and avoidance reactions typical of workers overexposed to dusts in the workplace.

OSHA proposes a PEL of 10 mg/m³ TWA for ammonium sulfamate, which is the limit being proposed for all workplace dusts with a low order of toxicity. The Agency preliminarily concludes that this revised limit will protect workers against physical and other irritation and against workplace accidents associated with exposure to this substance. The health evidence forms a reasonable basis for proposing a new limit for ammonium sulfamate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BARIUM SULFATE
CAS: 7727–43–7; Chemical Formula: $BaSO_4$
H.S. No. 1031

OSHA has no specific limit for barium sulfate, although OSHA's nuisance dust limit applies; the ACGIH recommends a TLV–TWA of 10 mg/m³, total dust, for this substance. Barium sulfate is a white or yellowish, odorless, tasteless powder.

Because barium sulfate is insoluble, it is considered an inert dust. Einbrodt et

al. (1972) exposed rats to a concentration of 40 mg/m³ for 2 months and concluded that barium sulfate is an inert dust. As an inert dust of the non-collagenous type; however, barium sulfate has the potential to cause pneumoconiosis through tissue reaction to accumulated dust in the lung (Anon., *Brit. Med. J.* 1972). Barium sulfate has been observed to cause no adverse effects in industrial workers exposed over periods of several years (Doig 1976).

OSHA proposes that a PEL for barium sulfate be established at the 10 mg/m³ TWA level; this limit is the limit proposed by OSHA for all inert dusts. The Agency preliminarily concludes that this limit will protect workers against the hazards associated with exposures to these dusts, which include safety hazards, eye irritation, and upper respiratory tract irritation. The health evidence forms a reasonable basis for proposing a new limit for barium sulfate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BENOMYL
CAS: 17804–35–2; Chemical Formula: $C_{14}H_{18}N_4O_3$
H.S. No. 1032

OSHA currently regulates benomyl under its general nuisance dust limit of 15 mg/m³. The ACGIH has established a TLV TWA of 10 mg/m³ for this substance. Benomyl is a white crystalline solid, and exposures to it occur in its particulate form.

Studies of rats and rabbits indicate that the oral and skin absorption LD_{50}s are greater than 10,000 mg/kg, and studies of guinea pigs show a very low risk of skin irritation. Application to the shaved intact skin of ten male guinea pigs (as aqueous suspensions containing 5, 12.5, and 25 percent benomyl) resulted in negligible irritation; one of ten guinea pigs had mild erythema 2 days after application at the high rate (E. I. du Pont de Nemours and Co., Inc. 1974). In another study, instillation of 10 mg of dry 50-percent powder or 0.1 ml of 10-percent suspension in mineral oil caused only temporary mild conjunctival irritation (E. I. du Pont de Nemours and Co., Inc. unpublished). No teratogenic or mutagenic effects have been observed in rats, and dogs have been shown to eliminate more than 99 percent of ingested benomyl within 72 hours (Gardiner, Kirkland, and Klopping 1974).

OSHA proposes a PEL of 10 mg/m³ for this substance as an 8-hour TWA. The Agency believes that this limit will protect workers from the risks of benomyl's effects, which include irritation and erythema. The health evidence forms a reasonable basis for proposing a new limit for benomyl. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BISMUTH TELLURIDE (UNDOPED)
CAS: 1304–82–1; Chemical Formula: Bi_2Te_3
H.S. No. 1035

OSHA has no current limit for undoped bismuth telluride; however, OSHA's general nuisance dust limit of 15 mg/m³ applies. The ACGIH recommends a TLV–TWA of 10 mg/m³ for the undoped substance. Bismuth telluride appears as gray, hexagonal platelets; it is also available as ingots or single crystals.

An 11-month inhalation study of dogs, rabbits, and rats exposed to pure bismuth telluride dust at 15 mg/m³ showed the pulmonary responses typical of exposure to inert dust (Wagner, Madden, Zimber et al. 1974).

Thus, OSHA proposes a permissible exposure limit of 10 mg/m³ TWA for pure undoped bismuth telluride. This limit is the same as the limit proposed for all nuisance dusts. The Agency believes that a 10-mg/m³ PEL will protect workers from the hazards associated with workplace dust exposures, which include skin and eye irritation and safety accidents. The health evidence forms a reasonable basis for proposing a new limit for undoped bismuth telluride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BORON OXIDE
CAS: 1303–86–2; Chemical Formula: B_2O_3
H.S. No. 1039

OSHA currently regulates boron oxide under its general nuisance dust limit of 15 mg/m³, and the ACGIH recommends a TLV–TWA of 10 mg/m³. Boron oxide occurs as a white powder or granular solid, and it has a bitter taste.

Animal studies indicate that skin and eye irritation were caused by the topical application of boron oxide to the skin of rabbits and by ocular instillation. Studies of aerosol administration at various exposure levels for varying time periods caused mild nasal irritation and an increase in urine acidity and creatinine coefficient in dogs and rats (Wilding, Smith, Yevich et al. 1959). Young rats that were force-fed a 10-percent slurry of boron oxide in water for 3 weeks showed no growth retardation or other effects (Wilding, Smith, Yevich et al. 1959).

Gabrant and co-workers (1984) determined the prevalence of eye and respiratory irritation among boron-oxide-exposed workers; those exposed to boron oxide concentrations ranging from 1.2 to 8.5 mg/m³ were then compared with controls. Workers exposed at an average concentration of 4.1 mg/m³ reported significant increases in coughing; eye, nose, and throat irritation; dryness of the mouth; and sore throats.

The ACGIH believes that a TLV–TWA of 10 mg/m³ will provide protection against boron oxide's irritant effects (ACGIH 1986). However, OSHA notes that irritation of the upper respiratory tract and eyes occurs among occupationally exposed workers at an average airborne concentration of 4.1 mg/m³. OSHA therefore proposes a PEL of 10 mg/m³ TWA and solicits additional information on the boron oxide exposure levels associated with adverse health effects in workers. The health evidence forms a reasonable basis for proposing a new limit for boron oxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CALCIUM CARBONATE
CAS: 1317–65–3; Chemical Formula: $CaCO_3$
H.S. No. 1057

OSHA currently regulates calcium carbonate under the 15-mg/m³ nuisance dust limit. The ACGIH recommends a TLV–TWA of 10 mg/m³, total dust. Calcium carbonate is an odorless, tasteless powder or crystal.

The ACGIH considers calcium carbonate a nuisance dust and has accordingly established a 10-mg/m³ TWA limit for it. Beal, Griffith, and Nagelschmidt (as cited in the ACGIH 1986, p. 90) believe that exposure to this substance in its pure form does not cause pneumoconiosis, and Hunter (1975) confirms this finding.

OSHA is proposing to reduce its current PEL of 15 mg/m³ for calcium carbonate to 10 mg/m³ to protect workers against the risks associated with dust exposures in the workplace. These risks include eye and skin irritation, as well as the danger of accidents caused by interference with vision and the distractive effects of these substances. The health evidence forms a reasonable basis for proposing a new limit for calcium carbonate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CALCIUM SILICATE
CAS: 1344–95–2; Chemical Formula: None
H.S. No. 1061

OSHA has no limit specifically for calcium silicate; the Agency classifies this substance as a nuisance dust and assigns it an 8-hour TWA limit of 15 mg/m³, as total dust. The ACGIH also classifies calcium silicate as a nuisance dust and has established an 8-hour limit of 10 mg/m³ for this white powder.

There are no reported health effects in humans or animals as a result of exposure to calcium silicate. Calcium silicate is thus a nuisance dust, without long-term adverse health effects if exposures are kept under reasonable control.

OSHA is proposing an 8-hour limit of 10 mg/m³ TWA for calcium silicate; this limit is being proposed for all nuisance dusts and inert particulates. The Agency preliminarily concludes that this limit will protect workers from the risk of reduced visibility and distraction that can cause accidents in the workplace and will also prevent them from experiencing the eye and skin irritation associated with exposures to higher levels of this or other nuisance dusts. The health evidence forms a reasonable basis for proposing a new limit for calcium silicate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CALCIUM SULFATE
CAS: 7778-18-9; Chemical Formula: $CaSO_4$
H.S. No. 1062

OSHA currently regulates calcium sulfate under its general nuisance dust limit of 15 mg/m³. The ACGIH recommends a TLV-TWA of 10 mg/m³ total dust for this crystalline or powdery substance.

Calcium sulfate dust is known to have a low order of toxicity, and it is not reported to have specific irritant properties (ACGIH 1986, p. 93). One report has indicated that no lung diseases are associated with exposure to calcium sulfate in miners (Hunter 1975). Because calcium sulfate appears to be biologically inert, it is appropriately classified as a nuisance dust.

OSHA is proposing to reduce the permissible exposure limit to an 8-hour TWA of 10 mg/m³ (total dust) for calcium sulfate, the limit being proposed for all dusts in this category. The Agency preliminarily concludes that this limit will prevent eye and skin irritation, interference with vision, and lack of concentration associated with high dust exposures in the workplace. As is the case for all of the substances classified as nuisance dusts, calcium sulfate presents a safety as well as a health hazard to exposed workers. The health evidence forms a reasonable basis for proposing a new limit for calcium sulfate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CELLULOSE
CAS: 9004-34-6; Chemical Formula: $(C_6H_{10}O_5)n$
H.S. No. 1076

OSHA currently regulates cellulose under the 8-hour TWA limit of 15 mg/m³ for nuisance dusts. The ACGIH recommends a TLV-TWA of 10 mg/m³ (total dust). Technical cellulose refers to that portion of the plant cell wall derived exclusively from glucose and resembles cotton cellulose in its physical and chemical properties (ACGIH 1986, p. 113).

Technical cellulose is inert, and inhalation of cellulose dust is not irritating or toxic in exposed humans (Schreiber 1974). In industry, cellulose dust occurs in combination with other substances, such as quartz dust, wood, cotton, flax, jute, and hemp fibers, and these substances have demonstrated toxicities that are unrelated to their cellulose content (ACGIH 1986, p. 113).

OSHA is proposing to reduce the PEL for this dust to 10 mg/m³ TWA total dust for cellulose dust containing less than 1 percent quartz. This limit is the limit OSHA is proposing for all of the "nuisance" dusts. The Agency preliminarily concludes that this reduced limit will protect exposed workers from safety and health risks associated with exposure to cellulose dust in the workplace. These adverse effects include eye and skin irritation, coughing, interference with vision, loss of the ability to concentrate, and accidents. The health evidence forms a reasonable basis for proposing a new limit for cellulose. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2-CHLORO-6-(TRICHLOROMETHYL) PYRIDINE (NITRAPYRIN)
CAS: 1929-82-4; Chemical Formula: $C_6H_3Cl_4N$
H.S. No. 1082

OSHA currently has no specific limit for nitrapyrin; however, OSHA's general nuisance dust limit of 15 mg/m³ TWA applies. The ACGIH recommends a TLV-TWA of 10 mg/m³ and a TLV-STEL of 20 mg/m³. Nitrapyrin is a crystalline substance.

Nitrapyrin's very low vapor pressure limit makes hazardous inhalation exposures unlikely. Torkelson (as cited in ACGIH 1986, p. 428) has reported feeding dogs and rats a dosage of 15 mg/kg daily for 93 days. He observed no adverse effects in appearance, behavior, growth, food consumption, body and organ weight, mortality, or blood chemistry, and no tissue or organ changes.

OSHA proposes a PEL of 10 mg/m³ TWA for this dust, which is the limit that OSHA is proposing for all nuisance dusts to protect workers from the health and safety risks associated with exposure to these dusts. With regard to the 20-mg/m³ STEL, the ACGIH (1986) provided no basis for this limit. OSHA therefore requests additional information that will assist the Agency in determining the need for the 20-mg/m³ STEL. The health evidence forms a reasonable basis for proposing a new limit for nitrapyrin. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CLOPIDOL (COYDEN)
CAS: 2971-90-6; Chemical Formula: $C_7H_7Cl_2NO$
H.S. No. 1095

OSHA has no current limit specifically for clopidol; however, OSHA's general nuisance dust limit of 15 mg/m³ TWA applies. The ACGIH recommends a TLV-TWA of 10 mg/m³ and a TLV-STEL of 20 mg/m³. Clopidol is a solid.

Clopidol has a low reported acute oral toxicity. The oral LD_{50} in rats, rabbits, and guinea pigs is greater than 8 g/kg (Dow Chemical Company 1973). Long-term (two-year) studies of rats and dogs fed at levels of 15 mg/kg and 5 mg/kg per day, respectively, showed no adverse effects. Similarly, there were no adverse effects on fertility, gestation, viability, or lactation in rats and rabbits, and no increase in teratogenicity (Dow Chemical Company 1973). The chronic toxicity of clopidol is also reported to be low (ACGIH 1986, p. 141).

OSHA is proposing a PEL of 10 mg/m³ TWA for clopidol, the same limit as for all nuisance dusts. OSHA preliminarily concludes that this limit will protect workers from the health and safety risks associated with exposure to these dusts. OSHA notes that the ACGIH (1986) provided no basis for the 20-mg/m³ STEL recommendation. OSHA requests additional information that will assist the Agency in determining the need for a STEL for clopidol. The health evidence forms a reasonable basis for proposing a new limit for clopidol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CRAG HERBICIDE (SESONE)

CAS: 136–78–7; Chemical Formula: $C_8H_7Cl_2NaO_2S$
H.S. No. 1102

OSHA currently applies a TWA limit of 15 mg/m³ for crag herbicide; this is the Agency's limit for all inert dusts. The ACGIH recommends a TLV–TWA of 10 mg/m³ for this colorless, odorless, non-combustible solid.

An early study reported an oral LD_{50} in rats of 1500 mg/kg for this herbicide (Smyth 1956). At high concentrations, crag herbicide is a gastrointestinal irritant (NIOSH 1984). Rats fed a diet containing 60 mg sesone/100 gm experienced minor liver damage; when fed 20 mg sesone/100 gm of diet for 2 years, rats showed no adverse effects (ACGIH 1986, p. 519). In 1984, NIOSH reported the oral LD_{50} in rats to be 730 mg/kg. There are no reported incidents of human poisonings associated with the use of sesone.

OSHA is proposing a reduction in the PEL to 10 mg/m³ TWA, the limit being proposed for all nuisance dusts. OSHA preliminarily concludes that this level will protect exposed workers from the safety and health hazards potentially associated with exposures to these dusts. These risks include accidents, interference with vision, and eye and skin irritation. This health evidence forms a reasonable basis for proposing a new limit for crag herbicide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DICYCLOPENTADIENYL IRON
CAS: 102–54–5; Chemical Formula: $C_{10}H_{10}Fe$
H.S. No. 1133

OSHA currently regulates dicyclopentadienyl iron under its nuisance dust limit of 15 mg/m³. The ACGIH recommends a TLV–TWA of 10 mg/m³ for this bright-orange, crystalline solid that smells like camphor.

Available evidence in animals suggests that dicyclopentadienyl iron has a relatively low order of oral toxicity. In mice, the oral LD_{50} has been reported as 600 mg/kg (Madinaveitia 1956). In rats, 1000 mg/kg has been reported as the lethal dose, and subacute oral toxicity tests have shown no fatalities when 10 feedings of 200 mg/kg were given over a 2-week period (E.I. du Pont de Nemours and Company 1955, as cited in ACGIH 1986, p. 195). Madinaveitia (1956) has determined that this substance is a hematinic agent in animals.

OSHA proposes an 8-hour TWA limit of 10 mg/m³ for dicyclopentadienyl iron. The Agency preliminarily concludes that this limit will protect workers against the risk of hematinic effects potentially associated with occupational exposure to this substance at the levels permitted in the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for dicyclopentadienyl iron. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

EMERY
CAS: 112–62–9; Chemical Formula: Al_2O_3
H.S. No. 1155

OSHA currently regulates emery at an 8-hour TWA of 15 mg/m³ TWA, the Agency's limit for all nuisance dusts. The ACGIH recommends a limit of 10 mg/m³ TWA, total dust, for emery containing less than 1 percent quartz. Emery is impure corundum (aluminum oxide) and is found in certain mineralogical deposits.

The only report of ill effects from emery dust inhalation is a report of a case of pneumoconiosis occurring in France, and it is questionable whether this incident was caused by emery dust or silica impurities in the dust (*Archives des Maladies Professionelles de Medcin du Travail et de Securite* 1970). Exposure to emery dust containing less than 1 percent silica produces little if any effect on the health of exposed workers; it does not affect the lungs or produce organic disease at commonly encountered levels (ACGIH 1986, pp. 21, 229).

OSHA is therefore proposing a PEL of 10 mg/m³ TWA, total dust, for emery, in keeping with the Agency's decision to lower the TWA for all nuisance dusts. OSHA preliminarily concludes that this limit will prevent the safety and health risks associated with exposures to dusts in the workplace; these risks include the danger of accidents, interference with vision, distraction, and skin and eye irritation. The health evidence forms a reasonable basis for proposing a new limit for emery. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FERBAM
CAS: 14484–64–1; Chemical Formula: $[(CH_3)_2NCS_2]_3Fe$
H.S. No. 1176

OSHA currently applies its general nuisance dust limit of 15 mg/m³ TWA to ferbam. The ACGIH recommends a TLV–TWA of 10 m/gm³ for this odorless black solid.

Ferbam, which is a fungicide, has been reported to have an oral LD_{50} of more than 17 mg/kg in rats, but rabbits and guinea pigs demonstrated less sensitivity to this substance (Hodge, Maynard, Downs, and Blanchet 1952). Thirty-day dietary studies of rats showed no effect at ferbam doses of 0.01 percent, with fatalities occurring at 0.5 percent. Dogs showed no adverse effects when fed 25 mg/kg of ferbam daily for 6 months.

Inhalation of ferbam affects the upper respiratory tract in humans, in a manner typical of airborne exposures to inert dusts.

OSHA is proposing to reduce the PEL to a 10-mg/m³ 8-hour TWA because the Agency has decided that a decrease in the limit from 15 to 10 mg/m³ is warranted for all the nuisance dusts. The Agency preliminarily concludes that this reduction is necessary to prevent the health and safety risks associated with workplace exposures to these dusts. These risks include skin and eye irritation, on-the-job accidents, and interference with vision. The health evidence forms a reasonable basis for proposing a new limit for ferbam. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FIBROUS GLASS DUST
CAS: None; Chemical Formula: None
H.S. No. 1178

Fibrous glass dust is used primarily for thermal and acoustical insulation of residential and commercial buildings. There is currently no OSHA limit governing occupational exposure to fibrous glass dust. The ACGIH (1986) has established a 10-mg/m³ TLV–TWA, reflecting its belief that a nuisance-dust limit is appropriate. NIOSH (1977) recommended a 5-mg/m³ 10-hour TWA limit for total dust and a 3-fibers/cc limit for airborne fibers less than 3.5 um in diameter and longer than 10 um in length.

Epidemiologic studies of workers exposed to fibrous glass dust have generally failed to detect any significant increase in respiratory effects. One study of 2,028 workers (Nasr et al. 1976) did not identify any increased prevalence of abnormal radiographic findings among production workers compared to office workers; results of spirometric tests and administration of a chronic bronchitis questionnaire did not discern any difference in health between workers with the heaviest exposure and those with minimal exposure. Another study of 416 retired workers reported no difference in overall mortality or morbidity rates compared to general population rates (Enterline and Henderson 1975). Bayliss et al. (1976) failed to find any excess in overall mortality or lung cancer among 1,448 workers, but did report an excess of

mortality from nonmalignant respiratory disease; the authors could not attribute this excess to fibrous glass because smoking histories were not generally available. A review of 691 physicians' reports of adverse effects caused by exposure to vitreous fibers identified 66 reports of nondisabling upper respiratory tract symptoms (Milby and Wolf 1969).

In animal studies, intratracheal injection of thin glass fibers longer than 10 um into guinea pigs produced peribronchiolar fibrosis (Kuschner and Wright 1976). When such fibers were injected into the abdomen of rats, a dose-related increase in sarcomas and mesotheliomas resulted (Stanton and Wrench 1972; Wagner et al. 1973; Pott and Friedrichs 1972). The response mimics that found with asbestos, but the magnitude of the response is generally less than is found with asbestos. NIOSH (1977) did not consider fibrous glass to present a carcinogenic hazard after reviewing these data.

Based on the lack of reported adverse health effects in epidemiologic studies, the ACGIH (1986) considered fibrous glass dust to be essentially a nuisance dust and applied a 10-mg/m³ TLV–TWA. In contrast, NIOSH (1977) concluded that "available data are sufficient to demonstrate that fibrous glass does not act like an inert or nuisance dust because it can produce fibrosis in animals and respiratory tract irritation in humans" (NIOSH 1977, p. 94). Relying on several investigations that showed a lack of adverse effects among workers exposed to mean respirable fiber concentrations generally less than 5 to 6 f/cc, NIOSH recommended that exposures be limited to 3 f/cc for fibers 3.5 um or less in diameter and greater than 10 um in length. In addition, NIOSH recommended that exposures to total fibrous glass dust be limited to 5 mg/m³ as a 10-hour TWA.

The 10-mg/m³ TLV–TWA considers only the health effects associated with fibrous glass particles. However, the PEL will also be applied by OSHA to situations where the fibrous form of this material is present. Recent concerns have emerged regarding the potential carcinogenicity of the long fibers (TIMA 1988). While a 3-fibers/cc limit for long, thin fibers has also been proposed by NIOSH, it is impossible in this rulemaking to adequately evaluate that limit for the fibrous form of this substance. Therefore, as an interim measure, OSHA proposes that a 5-mg/m³ TWA be adopted as the PEL for fibrous glass dust. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for fibrous glass dust if the Agency determines that this limit will substantially reduce significant risk. Because of the concern with the fibrous forms of this substance, feasibility is not expected to be a problem at this level. If future information and priorities indicate the need for a more restrictive standard for the fibrous form of this material, OSHA will initiate individual-substance rulemaking.

GLYCERIN (MIST)
CAS: 56–81–5; Chemical Formula: $CH_2OHCHOHCH_2OH$
H.S. No. 1188

OHSA currently has no specific limit for glycerin mist, although this substance is currently regulated at 15 mg/m³ as a general nuisance dust. The ACGIH recommends a TLV–TWA of 10 mg/m³. Glycerin is an oily hygroscopic liquid with a warm, sweet taste.

Glycerin was long considered to be nontoxic; however, more recent information has indicated that the mist may be injurious to the kidneys at very high exposure levels (Campanacci 1965). Ackerman, Bassler, and Wagner (1975) have reported that glycerin mist is easily metabolized and excreted. In the adult human of average weight, 2 grams of glycerol can be metabolized and excreted in an 8-hour workday. At this metabolic and elimination rate, the ACGIH believes that no ill effects are likely to occur as a result of exposure at or below 10 mg/m³ as an 8-hour TWA, the level set for nuisance dusts (ACGIH 1986, p. 286).

OSHA proposes a limit of 10 mg/m³ TWA for glycerin mist, which is the level the Agency is proposing for all inert dusts. The health evidence forms a reasonable basis for proposing a new limit for glycerin mist. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk. However, OSHA notes that glycerin may not be truly inert, as evidenced by the study of Campanacci (1943). The Agency specifically requests comments on the toxicity (if any) of exposures to various levels of glycerin.

GRAPHITE, SYNTHETIC
CAS: None; Chemical Formula: None
H.S. No. 1191A

OSHA currently has no specific standard for synthetic graphite but regulates it as a nuisance dust. OSHA's 8-hour TWA for all nuisance dusts is 15 mg/m³. The ACGIH recommends a TLV–TWA limit of 10 mg/m³ for graphite as total dust.

Synthetic graphite is a crystalline form of carbon made from high-temperature treatment of coal or petroleum products; it has the same properties as natural graphite. Meiklejohn reported that synthetic graphite injected intraperitoneally in mice produced effects characteristic of inert dusts (1958).

In humans, exposure to natural graphite has long been associated with the development of pneumoconiosis (Koopman 1924; Ruttner et al. 1952; Pendergass et al. 1967). Lister (1961, 1972) reported fibrotic changes in the lungs of a worker who had been engaged for 17 years in the production and milling of synthetic graphite. Other reports of lung injury caused by exposure to graphite have not distinguished between the form of the graphite (i.e., natural or synthetic) causing the injury; in addition, exposures to impurities, such as quartz silica, were involved in many of the reported cases (ACGIH 1986, p. 291).

OSHA is proposing to reduce the 8-hour TWA limit for all the nuisance dusts from 15 mg/m³ to 10 mg/m³, to protect against the health and safety risks potentially associated with dust exposures in the workplace. The health evidence forms a reasonable basis for proposing a new limit for synthetic graphite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk. However, the Agency notes that occupational exposure to synthetic graphite has been associated with pneumoconiosis, and preliminarily concludes that a lower limit may be appropriate. Specific comment is solicited on the exposure levels and health effects associated with synthetic graphite related occupational disease.

GYPSUM, TOTAL DUST
CAS: 7778–18–9; Chemical Formula: $CaSO_4 \cdot H_2O$
H.S. No. 1192

The current OSHA limit for gypsum is an 8-hour TWA of 15 mg/m³, the Agency's current limit for all inert dusts. The ACGIH recommends a TWA of 10 mg/m³, measured as total dust, for gypsum and other inert particulates. Gypsum exists as either colorless or white crystals.

The ACGIH (1986) states that gypsum does not "produce significant organic disease or toxic effect when exposures are kept under reasonable control." Exposures in excess of the recommended limit may result in reduced visibility, deposits of gypsum dust in the eyes, ears, and nasal passages, and skin irritation.

OSHA is proposing to reduce the current limit for gypsum total dust to 10 mg/m³ as an 8-hour TWA, which is the limit being proposed for all of the inert particulates. The Agency preliminarily concludes that this limit will protect exposed workers from the safety and health risks associated with exposures to gypsum or other dusts at higher levels. These risks include eye and skin irritation, interference with vision, and safety accidents. The health evidence forms a reasonable basis for proposing a new limit for gypsum total dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

KAOLIN, TOTAL DUST
CAS: None; Chemical Formula: $H_2Al_2Si_2O_8O \cdot H_2O$
H.S. No. 1230

OSHA's current limit for kaolin is 15 mg/m³, measured as total dust; this is the Agency's current limit for all inert particulates. The ACGIH recommends a TLV–TWA of 10 mg/m³, also measured as total dust. Kaolin may be a white powder or a white or yellow-white earthy mass.

Exposure to excess amounts of kaolin dust or other inert particulates may cause reduced visibility in the workplace, injury to the skin or mucous membranes, and a buildup of dust deposits in the eyes, ears, and nasal passages (ACGIH 1986).

OSHA is proposing a PEL of 10 mg/m³ TWA for kaolin, measured as total dust, which is the limit being proposed for all of the inert particulates. The Agency preliminarily concludes that this limit will protect exposed workers from the safety and health risks potentially associated with exposure to the dusts at higher levels. These risks include skin and mucous membrane injury, accumulations of kaolin deposits in the eyes, ears and nose, and reduced visibility in the workplace, which may endanger worker safety. The health evidence forms a reasonable basis for proposing a new limit for kaolin, measured as total dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

LIMESTONE, Total Dust
CAS: 1317–65–3; Chemical Formula: $CaCO_3$
H.S No. 1232

The current OSHA PEL for limestone is an 8-hour TWA of 15 mg/m³, as total dust. The ACGIH recommends 10 mg/m³ TWA for limestone, measured as total dust. Limestone is a hard white solid.

Exposure to limestone dust has not been associated with the development of pneumoconiosis, and ACGIH considers it to be a nuisance dust (see discussion on calcium carbonate above).

Exposure to excess levels of limestone dust may result in deposits in the eyes, ears, and nasal passages, or may injure the skin or mucous membranes (ACGIH 1986). OSHA proposes an 8-hour TWA of 10 mg/m³ for limestone dust, the limit being proposed for all of the nuisance dusts and particulates. The Agency preliminarily concludes that this limit will reduce the safety and health hazards posed to exposed employees by nuisance dusts in the workplace. The health evidence forms a reasonable basis for proposing a new limit for limestone dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MAGNESITE, TOTAL DUST
CAS: None; Chemical Formula: $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$(approx)
H.S. No. 1233

OSHA's existing PEL for magnesite is 15 mg/m³, measured as total dust; this is the Agency's limit for all inert particulates. The ACGIH recommends a TLV–TWA of 10 mg/m³, also measured as total dust. Magnesite occurs as a white powder.

Magnesite is considered by both OSHA and the ACGIH to be one of the "nuisance dusts," which "do not produce significant organic disease or toxic effect when exposures are kept under reasonable control" (ACGIH 1986). Exposure to excess levels of magnesite or the other nuisance particulates in the workplace causes skin or mucous membrane irritation resulting from contact with the magnesite itself or from rigorous cleansing procedures necessary for removing the dust; buildup of dust deposits in the eyes, ears, and nasal passages; and reduced visibility in the workplace.

OSHA is proposing a PEL of 10 mg/m³ TWA for magnesite, measured as total dust. This is the limit being proposed for all of the inert particulates. The Agency preliminarily concludes that this limit is necessary to protect exposed workers from the health and safety risks potentially associated with exposure to magnesite or other inert dusts. These risks include skin and mucous membrane injury, the deposition of magnesite deposits in the eyes, ears, and nose, and reduced workplace visibility, which may endanger employee safety. The health evidence forms a reasonable basis for proposing a new limit for magnesite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MAGNESIUM OXIDE (FUME)
CAS: 1309–48–4 Chemical Formula: MgO
H.S. No. 1234

OSHA's current limit for magnesium oxide (as fume) is 15 mg/m³ as an 8-hour TWA, the Agency's limit for inert dusts. The ACGIH recommends a TLV–TWA limit of 10 mg/m³ for the fume of this white, odorless, very fine powder.

Slight reactions (not further specified) have been reported in human subjects after exposures of less than 10 minutes to freshly generated MgO fume at concentrations of from 400 to 600 mg/m³ Drinker, Thomson, and Finn 1927). Animal and human studies of magnesium oxide fume exposure have shown toxicities less marked than but similar to those attributable to zinc oxide fume (Drinker and Drinker 1928). The symptoms of exposure include those of metal fume fever (fever, chills, muscular pain, nausea, and vomiting) and leukocytosis, symptoms analogous to those caused by exposure to zinc oxide fume.

OSHA is proposing a PEL of 10 mg/m³ TWA for magnesium oxide fume, the limit OSHA is proposing for all of the toxicologically inert nuisance particulates included in this rulemaking. OSHA preliminarily concludes that this limit will protect exposed workers from the safety and health risks potentially associated with exposures to these dusts in the workplace. These risks include accidents, skin and eye irritation, and interference with vision. The health evidence forms a reasonable basis for proposing a new limit for magnesium oxide fume. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MALATHION
CAS: 121–75–5; Chemical Formula: $C_{10}H_{19}O_6PS_2$
H.S. No. 1235

Both OSHA and NIOSH have 15-mg/m³ limits for malathion (and OSHA has a skin notation); the ACGIH TLV for this substance is 10 mg/m³ as a TWA, also with a skin notation.

Malathion is a widely used organophosphorus insecticide having a relatively low level of toxicity; some authors have determined that malathion is approximately 1/100th as toxic as parathion (Johnson et al. 1952). Rats fed malathion at a concentration of 100 ppm for 2 years exhibited no toxic effects (Hazleton and Holland 1953). Several occupational and research exposures

involving scientists or human volunteers produced no change in blood cholinesterase or other effects (Rider et al. 1959; Hayes et al. 1960; Culver et al. 1956).

Fatalities have been reported in the Japanese and Indian literature, but these deaths have always involved extremely high doses of malathion (Chabra 1970; Horiguchi 1973). Thus, malathion's principal workplace effect is that it acts like a nuisance dust. NIOSH concurs in this view (NIOSH 1978i) and recommends a higher TWA (15 mg/m³) for this substance than would be permitted by the ACGIH.

The 10-mg/m³ TLV–TWA is part of a generally accepted, broad guideline to limit exposure to nuisance dusts; the 15-mg/m³ REL represents an earlier approach to the control of these substances. As discussed in this section, nuisance dusts must be controlled to prevent skin, respiratory tract, and eye irritation, as well as a variety of other effects. This level is readily attainable in the workplace, using generally available industrial hygiene practices. OSHA is therefore proposing a PEL of 10 mg/m³ TWA for malathion with a skin notation. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for malathion if the Agency determines that this limit will substantially reduce significant risk.

MARBLE, TOTAL DUST
CAS: 1317–65–3; Chemical Formula: None
H.S. No. 1239

OSHA currently has no specific limit for marble dust, but regulates this substance as a nuisance dust, for which the 8-hour TWA limit as total dust is 15 mg/m³. The ACGIH has established an 8-hour TLV–TWA of 10 mg/m³ for marble dust as total dust containing less than 1 percent quartz. Marble dust, a metamorphic form of calcium carbonate dust, is an odorless and tasteless powder or crystal.

OSHA is proposing an 8-hour TWA limit of 10 mg/m³ for marble dust as total dust containing less than 1 percent quartz. This is the limit being proposed by the Agency for all nuisance dusts and inert particulates. OSHA preliminarily concludes that this limit will protect exposed workers from the safety and health risks associated with exposure to the inert dusts at higher levels. These risks include the danger of accidents caused by interference with vision and distraction, and eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for marble dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHOXYCHLOR
CAS: 72–43–5; Chemical Formula: $C_{16}H_{15}Cl_3O_2$
H.S. No. 1246

OSHA currently applies its 15-mg/m³ TWA limit for nuisance dusts to methoxychlor. The ACGIH recommends a limit of 10 mg/m³ TWA for this white crystalline solid, which is assigned the limit for all inert dusts.

Methoxychlor has a low level of toxicity. The reported oral LD_{50} for rats is 6000 mg/kg (Lehman 1954). Lehman also determined that 100 ppm for 2 years is the lowest dietary level producing no effect in rats: this corresponds to a level of 350 mg/man/day. Results of another dietary study indicated that rats fed 200 ppm methoxychlor for 2 years were not affected in terms of growth or survival (Hodge, Maynard, and Blanchet 1952). Tegeris and co-workers reported that dogs fed 1 g/kg daily for 6 months showed weight loss; most animals died within 9 weeks when the dietary level was increased to 2 g/kg daily (Tegeris, Earl, Smalley, and Curtis 1966). Morgan and Hickenbottom (1978) reported that male Holtzman rats fed 10, 40, 160, or 640 mg/kg for 24 hours showed no liver abnormalities. Extrapolating from animal data, Lehman estimated the dose levels that would produce toxic effects in humans as follows: The fatal oral dose would be 450 grams; adverse health effects would occur at 6430 mg/kg orally; and 2414 mg/kg is the level at which dermal effects would be predicted to occur (Lehman 1954).

OSHA is proposing to reduce the existing 8-hour TWA limit from 15 mg/m³ to 10 mg/m³ to reduce the health and safety risks of exposure to the inert dusts in the workplace. These risks include interference with vision, skin and eye irritation, and accidents. The health evidence forms a reasonable basis for proposing a new limit for methoxychlor. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MINERAL WOOL FIBER
CAS: None; Chemical Formula: None
H.S. No. 1277

OSHA currently has no limit specifically for mineral wool fiber, but this substance is covered by the Agency's 15-mg/m³ 8-hour TWA limit for all inert dusts and particulates. The ACGIH recommends an 8-hour TWA limit of 10 mg/m³ for mineral wool fiber as total dust containing less than 1 percent quartz. Rock or mineral wool is composed of mineral fibers produced by blowing steam or air through molten furnace slag; the fibers contain less than 1 percent quartz, and the substance is therefore vitreous.

In a study of cats, the only ill effects of inhalation that were observed were pulmonary changes attributed to silicate deposition (Fairhall, Webster, and Bennett 1935). A Russian study showed that mineral wool dust containing little free silica and moderate amounts of combined silica produced moderate diffuse and nodular sclerosis in the lungs of rats after 2 to 3 months (Grimailovskaya et al. 1957). The ACGIH (1986, p. 414) states that these conclusions are suspect, however, because rat lungs show only cellular foci even after 2 to 3 months of exposure to heavy quartz dust; the ACGIH believes that the Soviet investigators were not familiar with the chronic bronchitis that is endemic in rats.

Chronic exposure of 84 workers to mineral wool (with a free silica content of no more than 0.5 percent) for from 7 to 29 years resulted in no X-ray evidence of silicosis (Carpenter and Spolyor 1945).

OSHA is proposing a PEL of 10 mg/m³ TWA for mineral wool fiber as total dust containing less than 1 percent quartz. This is the limit being proposed for all inert or "nuisance" particulates. The Agency preliminarily concludes that this limit will protect workers against the safety risks associated with on-the-job exposures to inert particulates; these risks include interference with vision, accidents caused by the distracting effects of these substances, eye irritation, and irritations of the skin and mucous membranes. The health evidence forms a reasonable basis for proposing a new limit for mineral wool fiber. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MOLYBDENUM (INSOLUBLE COMPOUNDS)
CAS: 7439–98–7; Chemical Formula: None
H.S. No. 1278

OSHA has a current limit of 15 mg/m³ TWA for the insoluble compounds of molybdenum, which include molybdenum metal and the dioxide. This is the Agency's limit for all inert dust and particulates. The ACGIH recommends a TLV–TWA of 10 mg/m³ as molybdenum. Molybdenum is a silver-white metal or a dark-gray or black powder.

In general, the compounds of molybdenum have a low order of toxicity. The insoluble compounds of molybdenum have not been reported to have any definite toxicities, although no specific exposure data are available.

Mogilvskaya (1950) concluded that the dust of molybdenum metal and molybdenum dioxide caused only transitory irritation of mucosal surfaces in white mice after an intensive dusting for 1 hour; in a similar 30-day exposure, the metal and the dioxide proved only minimally poisonous.

OSHA is proposing a PEL for the insoluble compounds of molybdenum of 10 mg/m³ TWA, measured as molybdenum. This is the limit being proposed for all inert dusts and particulates. The Agency preliminarily concludes that this limit will protect workers from the safety and health risks of overexposure to inert particulates. These risks include distraction and interference with vision, which can lead to safety accidents, and eye, nose, and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for molybdenum. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

NUISANCE PARTICULATES
CAS: None; Chemical Formula: None
H.S. No. 1294

OSHA, currently regulates nuisance dusts at an 8-hour TWA limit of 15 g/m³ as total dust. The ACGIH recommends a TLV-TWA of 10 mg/m³ (as total dust) for nuisance particulates having a quartz content of less than 1 percent. Nuisance particulates are air-suspended particles having diameters of greater than respirable size.

According to the ACGIH:

> Nuisance particulates differ from fibrogenic dusts in that the former produce little adverse effect on the lungs and do not cause organic disease or toxic effects when exposures are reasonably controlled; fibrogenic dusts, on the other hand, cause the formation of pulmonary scar tissue when they are inhaled in excessive amounts. Nuisance dusts are sometimes referred to as "biologically inert," and, in the sense that they do not affect the architecture of pulmonary air spaces, do not form collagen or scar tissue, and do not cause irreversible tissue damage, this term is appropriate. Excessive concentrations of nuisance dusts may reduce visibility, cause deposits in the eyes, ears, and nasal passages, or injure the skin or mucous membranes by mechanical action or by the rigorous skin-cleansing procedures necessary for their removal (ACGIH 1986, p. 445).

OSHA proposes an 8-hour TWA limit of 10 mg/m³ as total dust, for nuisance particulates containing less than 1 percent quartz. The Agency preliminarily concludes that this limit will protect workers against the safety and health risks associated with exposure to excessive concentrations of these dusts, including reduced visibility, deposits in the eyes, ears, and nasal passages, and skin injury. The health evidence forms a reasonable basis for proposing a new limit for nuisance particulates. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PENTAERYTHRITOL, TOTAL DUST
CAS: 115-77-5; Chemical Formula: $C(CH_2OH)_4$
H.S. No. 1305

OSHA currently has no separate limit for pentaerythritol, but this substance is classified as a nuisance dust and is regulated at 15 mg/m³ TWA, the Agency's limit for all such dusts. The ACGIH recommends a TLV-TWA of 10 mg/m³ for total dust containing less than 1 percent quartz. Pentaerythritol is an odorless, white, crystalline solid.

Pentaerythritol has a low acute toxicity and only mild irritative effects. Rats exposed at 11,000 mg/m³ for 6 hours were reported to show no ill effects from a single exposure, and rats, dogs, and guinea pigs exposed 6 hours daily for 90 days also showed no effects (Keplinger and Kay 1964). The oral LD_{50}s in guinea pigs and mice are 11.3 g/kg and 22.5 g/kg, respectively; rats survived oral doses as high as 16 g/kg. At higher doses, animals displayed diarrhea, tremors, ataxia, and loss of righting reflex (Keplinger and Kay 1964). Daily applications of a saturated aqueous solution of technical pentaerythritol to rabbit skin produced no significant irritation; a single application of 10 g/kg aqueous paste on intact or abraded rabbit skin produced no evidence of percutaneous absorption (Keplinger and Kay 1964; Hercules, Inc., as cited in ACGIH 1986, p. 462). Instillation of a 50-percent aqueous suspension into the conjunctival sac of rabbits' eyes resulted in slight transient irritation (Hercules, Inc., as cited in ACGIH 1986, p. 462).

Human volunteers are reported to have eliminated 85 percent of dietary pentaerythritol unchanged in the urine within 30 hours. A slight and transient increase in apparent blood sugar that was proportional to the ingested dose appeared in these subjects soon after administration (Berlow, Barth, and Snow 1958).

OSHA is proposing an 8-hour PEL of 10 mg/m³ TWA for pentaerythritol, which is the level the Agency is proposing for all nuisance dusts. The Agency preliminarily concludes that this limit will protect exposed employees from the safety and health risks potentially associated with exposure to this substance at higher levels. These risks include the risk of accidents and of eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for pentaerythritol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PERLITE
CAS: None; Chemical Formula: None
H.S. No. 1310

OSHA currently regulates perlite as a nuisance dust at an 8-hour PEL of 15 mg/m³. The ACGIH recommends a TLV-TWA of 10 mg/m³ for perlite as total dust containing less than 1 percent quartz. Perlite is a natural volcanic glass. It is essentially an amorphous mineral consisting of fused sodium potassium aluminum silicate.

Perlite is reported to have a free silica content varying from zero to 3 percent (Anderson, Selvig, Baur et al. 1956; Perlite Institute, as cited in ACGIH 1986, p. 467). In its processed crude and expanded forms, perlite is reported to have a measurable quartz content of 0.4 percent quartz and 0.2 percent cristobalite (Sheckler, as cited in ACGIH 1986, p. 467). There are no published reports of adverse physiologic effects from exposure to perlite dust.

OSHA has preliminarily concluded that perlite is non-toxic when airborne concentrations are maintained at levels of 10 mg/m³ or below and when its quartz content is limited to a level below 1 percent crystalline silica. For these reasons, the Agency proposes a PEL of 10 mg/m³ TWA for total perlite dust containing less than 1 percent quartz, which is the limit being proposed for all nuisance particulates. OSHA believes that this limit will protect exposed workers from the risk of safety and health hazards associated with workplace exposures to inert particulates; these risks include the danger of accidents, interference with vision, and eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for perlite. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PICLORAM
CAS: 1918-02-1; Chemical Formula: $C_6H_3Cl_3N_2O_2$
H.S. No. 1328

OSHA currently has no limit for picloram. The ACGIH recommends a TLV-TWA of 10 mg/m³ and a TLV-STEL of 20 mg/m³ for this white powder, which has an odor like that of chlorine.

Picloram has low acute oral toxicity, with LD_{50} values of 3.75 g/kg for rats, 1.5

g/kg for mice, and 2.0 g/kg for rabbits (NIOSH 1979). Two-year feeding studies showed no ill effects in albino rats and beagle dogs from ingestion of doses up to and including 150 mg/kg/day (McCallister and Leng 1969). At 225 mg/kg/day, rats displayed moderate liver and kidney changes and, in females, slight body weight loss after 90 days (McCallister and Leng 1969). McCallister and Leng (1969) reported no fertility, reproduction, or lactation effects in albino rats fed at levels of up to 3000 ppm (0.3 percent) in a 3-generational study. However, maternal toxicity in rats was reported at dietary levels of 750 and 1000 mg/kg administered during days 6 through 15 of gestation, but neither teratogenic nor neonatal effects were observed when sub-toxic or maternally toxic doses of picloram were administered during organogenesis (Thomson et al. 1972). The National Cancer Institute (NCI) has concluded that picloram is not carcinogenic in mice or rats (NCI 1977).

OSHA proposes a TWA limit of 10 mg/m³ and a 15-minute STEL of 20 mg/m³ for picloram. The Agency preliminarily concludes that this combined limit will minimize the risk of systemic effects, such as liver and kidney damage, potentially associated with exposure to this substance in the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for picloram. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PLASTER OF PARIS, Total Dust
CAS: None; Chemical Formula: CaO_4S
H.S. No. 1331

Plaster of Paris is a fine white powder. OSHA's Z-3 table lists an 8-hour TWA exposure limit of 15 mg/m³ for Plaster of Paris. This is the Agency's limit for all of the inert particulates and dusts. The ACGIH has established a 10-mg/m³ TWA for Plaster of Paris, measured as total dust.

Where occupational exposures to Plaster of Paris have been limited, no toxic effects or organic diseases of the lungs have occurred (see discussion on calcium sulfate above). Exposure to excessive levels of dust in the work area may result in reduced visibility or injury to the skin or mucous membranes from the dust itself, or damage to the skin from the rigorous skin-cleansing procedures required to remove the dust (ACGIH 1986).

OSHA is proposing an 8-hour TWA of 10 mg/m³ for Plaster of Paris dust. The Agency preliminarily concludes that this limit will reduce the risk of the safety and health hazards described above, which include accidents, interference with vision and concentration, and skin and eye irritation. The health evidence forms a reasonable basis for proposing a new limit for plaster of paris dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PORTLAND CEMENT
CAS: 65997-15-1; Chemical Formula: None
H.S. No. 1333

OSHA currently has a limit of 50 mppcf (approximately 15 mg/m³) for Portland cement containing less than 1 percent crystalline silica. The ACGIH recommends a TLV-TWA of 10 mg/m³ for Portland cement as total dust containing less than 1 percent quartz. Portland cement refers to a class of hydraulic cements that are odorless gray powders containing less than 1 percent crystalline silica. Portland cement is insoluble in water and contains tri- and di-calcium silicate, with varying amounts of alumina, tricalcium aluminate, and iron oxide.

Intraperitoneal injection of Portland cement in guinea pigs produced an absorptive reaction, which is typical of inert particulates. Portland cement is eventually eliminated from tissue and is generally considered harmless when ingested (Miller and Sayers 1941).

In a study of industrial exposures, Gardner and associates (1939) found no evidence of Portland-cement-related pneumoconiosis in 2,278 workers who had been heavily exposed to this substance for prolonged periods of time (Gardner, Durkan, Brumfiel, and Sampson 1939). Conflicting reports of pneumoconiosis (Parmeggiani 1951; Prosperi and Barsi 1957) are attributed to the presence of silica in the inhaled dust rather than to exposure to Portland cement itself (ACGIH 1986, p. 494). Cement dermatitis does occur among exposed workers, however, as a consequence of the alkaline, abrasive, and hygroscopic properties of the wet cement, which cause general irritation of the skin (Schwartz, Tulipan, and Birmingham 1957).

OSHA is proposing an 8-hour TWA PEL of 10 mg/m³ for Portland cement as total dust containing less than 1 percent quartz. The Agency preliminarily concludes that this limit will protect workers against the safety risks associated with on-the-job exposures to inert particulates. These risks include interference with vision, accidents caused by the distracting effects of these substances, eye irritation, and irritation of the skin and mucous membranes. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for Portland cement if the Agency determines that this limit will substantially reduce significant risk. In addition, revising the limit to 10 mg/m³ TWA will simplify employee exposure monitoring for Portland cement, since gravimetric rather than impinger methods can be used.

ROUGE, TOTAL DUST
CAS: None; Chemical Formula: None
H.S. No. 1351

OSHA currently has no specific limit for rouge, but regulates this substance as a nuisance dust under the Agency's nuisance dust standard of 15 mg/m³ as an 8-hour TWA. The ACGIH has established an 8-hour limit of 10 mg/m³ TWA for rouge as total dust containing less than 1 percent quartz. Rouge is a high-grade red pigment, composed mainly of ferric oxide, that is used as a polishing agent for glass, jewelry, etc.

Rouge is a biologically inert substance. There are no studies demonstrating any effects of exposure to rouge in either animals or humans.

OSHA is proposing an 8-hour TWA of 10 mg/m³ for total dust, the limit being proposed by the Agency for all inert particulates and nuisance dusts. OSHA preliminarily concludes that this limit will protect workers from the health and safety risks associated with workplace exposure to higher levels of rouge and other nuisance dusts. These effects include reduced visibility and distraction, which may lead to accidents and injuries, and deposits in the ears, eyes, and nasal passages. In addition, rouge and other nuisance particulates can cause skin and mucous membrane irritation. The health evidence forms a reasonable basis for proposing a new limit for rouge. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SILICON
CAS: 7440-21-3; Chemical Formula: Si
H.S. No. 1359

OSHA's current Z Tables have no specific limit for silicon; however, silicon is currently regulated under OSHA's nuisance dust limit of 15 mg/m³ TWA. The ACGIH recommends a 10-mg/m³ 8-hour TWA for silicon, measured as total dust. Silicon is a black to gray, lustrous, needle-like crystal, which is used in the manufacture of semiconductors.

An early study by McCord, Fredrick, and Stolz (1937) reported no response in guinea pigs and rats injected intraperitoneally with silicon. A more

recent study (Schepers 1971) demonstrated pulmonary lesions in rabbits administered an intratracheal dose of 25 mg silicon dust.

OSHA is proposing an 8-hour TWA limit of 10 mg/m³ for silicon, the limit being proposed for all inert particulates. The Agency preliminarily concludes that this limit will reduce the safety and health risks potentially associated with exposure to this substance at the currently unregulated level. These risks include interference with vision, accidents, and eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for silicon. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SILICON CARBIDE
CAS: 409–21–2; Chemical Formula: SiC
H.S. No. 1360

OSHA currently regulates silicon carbide under its 15-mg/m³ nuisance dust limit. The ACGIH recommends 10 mg/m³ as an 8-hour TWA, measured as total dust. Silicon carbide is a green to blue-black irridescent crystal.

An animal study (Gardner 1923) showed that exposure to silicon carbide alone produced no changes in the lungs, while exposure of guinea pigs infected with tuberculosis to silicon carbide (6 hours/day, 5 days/week for one year) aggravated pulmonary tuberculosis to the extent that extensive fibrosis occurred. Guinea pigs exposed to silicon carbide dust and infected with the tubercle bacteria developed tuberculopneumoconiotic lesions (Gross, Westrick, and McNerney 1959). Miller and Sayers (1941) observed that intraperitoneal injection of guinea pigs produced no reaction.

Bruusgaard (1945) found that X-rays of 10 out of 32 workers exposed to average levels of 34 mppcf of silicon carbide for 15 years or more demonstrated pulmonary changes: these 10 workers also were tuberculin-positive. Miller, Davis, Goldman, and Wyatt (1953) described three cases of pulmonary reactions and hyperglobinemia in tungsten carbide industry workers; these authors concluded that exposure to silicon carbide was not a hazard unless the exposed workers already had pulmonary tuberculosis.

OSHA is proposing a 10-mg/m³ TWA limit for silicon carbide, as total dust. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of safety and health effects potentially associated with exposure to this inert particulate. The health evidence forms a reasonable basis for proposing a new limit for silicon carbide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

STARCH, TOTAL DUST
CAS: 9005–25–8; Chemical Formula: $(C_6H_{10}O_5)_n$
H.S. No. 1369

The current OSHA limit for starch is 15 mg/m³ as an 8-hour TWA, the Agency's limit for all inert particulates. The ACGIH recommends a TLV–TWA of 10 mg/m³ for starch as total dust that contains no asbestos and less than 1 percent crystalline silica. Starch is a white odorless powder.

Exposure to high concentrations of dust may result in impaired vision, or may cause injury to mucous membranes or skin. Injury may also result from vigorous skin-cleansing procedures necessary for the complete removal of starch (ACGIH 1986).

OSHA is proposing an 8-hour TWA of 10 mg/m³ for starch. The Agency preliminarily concludes that this limit will reduce the risk of safety accidents, eye and skin irritation, and interference with concentration and vision that may result from exposure to high levels of inert dusts in the workplace. The health evidence forms a reasonable basis for proposing a new limit for starch. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SUCROSE, TOTAL DUST
CAS: 57–50–1; Chemical Formula: $C_{12}H_{22}O_{11}$
H.S. No. 1374

The current OSHA 8-hour TWA limit for sucrose is 15 mg/m³ as total dust, the Agency's limit for all nuisance dusts. The ACGIH includes sucrose in its grouping of nuisance particulates that "do not produce significant organic disease or toxic effect when exposures are kept under reasonable control" (1986), and has therefore established a TLV–TWA limit of 10 mg/m³ for sucrose as total dust containing no asbestos and less than 1 percent quartz. Sucrose is found in the form of white crystals.

Exposure to excess levels of sucrose dust can cause skin and eye irritation, interference with vision, and distraction from the task at hand.

OSHA is proposing an 8-hour TWA of 10 mg/m³ for sucrose dust, the limit being proposed for all of the inert particulates. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of the health and safety hazards described above. The health evidence forms a reasonable basis for proposing a new limit for sucrose dust. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TEMEPHOS
CAS: 3383–96–8; Chemical Formula: $C_{16}H_{20}O_6P_2S_3$
H.S. No. 1383

The current OSHA Z tables have no specific limit for exposure to temephos, a cholinesterase-inhibiting insecticide. Temephos is currently regulated under OSHA's nuisance dust limit of 15 mg/m³. The ACGIH limit is 10 mg/m³ as an 8-hour TWA. Temephos may be a white crystalline solid or a viscous brown liquid.

In rats and mice, temephos has an acute oral LD_{50} of 400 mg/kg or greater. Various animal species tolerated doses of 10 mg/kg without clinical effect and 1 mg/kg without effect on cholinesterase activity (Gaines, Kimbrough, and Laws 1967). Laws et al. (1967) revealed that human volunteers consuming oral doses of temephos at levels of 256 mg/man/day for 5 days, or 64 mg/man/day for 4 weeks, evidenced no detectable effects on erythrocyte or plasma cholinesterase levels. Murphy and Cheever (1972) reported that 1 mg of temephos per liter of drinking water produces no effect. These authors found that rat liver carboxylesterases were at least 30 times more sensitive to inhibition from temephos than cholinesterases. Assuming that human liver carboxylesterases are proportionately more sensitive than cholinesterases, it is estimated that significant inhibition of these carboxylesterases could occur as a result of consuming 2 liters of drinking water containing 1 mg/L of temephos. Although nonspecific liver carboxylesterase is not critical for normal physiologic function, adverse effects on this enzyme could increase the susceptibility of exposed individuals to chemicals and drugs that contain carboxylesterase linkages (ACGIH 1986, p. 557).

The ACGIH derived the limit of 10 mg/m³ TWA for temephos from studies of malathion, which has an acute LD_{50} of 2100 mg/kg in rats, or roughly one-half that of temephos. Because humans tolerate 16 mg/day oral doses of malathion without effects on blood cholinesterase levels, the ACGIH believes the 10 mg/m³ limit is appropriate for temephos (ACGIH 1986, p. 557).

OSHA is proposing a limit of 10 mg/m³ for temephos. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of cholinesterase inhibition and reduction in carboxylesterase activity

potentially associated with exposure to this substance. This health evidence forms a reasonable basis for proposing a new limit for temephos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

4,4'-THIOBIS (6-TERT-BUTYL-n-CRESOL)
CAS: 96-69-5; Chemical Formula: $C_{22}H_{30}O_2S$
H.S. No. 1391

OSHA currently regulates 4,4'-thiobis under its general nuisance dust limit of 15 mg/m³ TWA. The ACGIH limit is 10 mg/m³ as an 8-hour TWA, the limit established by the ACGIH for all of the inert dusts. 4,4'-Thiobis is a light gray to tan powder with a slightly aromatic odor.

In a 30-day study, rats fed diets of 500 ppm 4,4'-thiobis exhibited normal weight gain; those rats fed five times this amount exhibited enlarged livers and a reduced rate of weight gain (Lefaux 1968, as cited in ACGIH 1986, p. 570). In a 90-day study reported by the same author, rats fed 50 ppm showed no toxic effects, but male rats fed 500 ppm ate and grew at a slightly lower rate. No pathologic changes were observed in the 500 ppm-dosed rats. A dose of 5 g/kg of 4,4'-thiobis proved lethal to rats, with the predominant symptom being gastroenteritis.

OSHA is proposing an exposure limit of 10 mg/m³ as an 8-hour TWA for 4,4'-thiobis. The Agency preliminarily concludes that this limit will protect exposed workers from the risks to safety and health potentially posed by workplace exposures to this and other nuisance dusts. These risks include distraction and interference with vision, which may cause safety accidents, and eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for 4,4'-thiobis. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TITANIUM DIOXIDE
CAS: 13463-67-7; Chemical Formula: TiO_2
H.S. No. 1396

OSHA's existing PEL for titanium dioxide is 15 mg/m³ as an 8-hour TWA; this is the Agency's current limit for inert particulates. A 10-mg/m³ 8-hour TWA, measured as total dust, has been established by the ACGIH. Titanium dioxide is a white crystalline solid.

Miller and Sayers (1941) reported that intraperitoneal injections of titanium dioxide in guinea pigs showed a tendency to remain in the injected tissues but not to produce a proliferative response; these authors consider it an inert dust. A study by Grandjean (1956) in which rats were administered 50 mg of titanium dioxide intratracheally showed pigmented dust deposits in the lungs. In addition, evidence of infection appeared in the alveoli of one rat and diffuse fibrosis was found in the lungs of a separate test animal. No nodule formation was observed (Grandjean et al. 1956). Another study by Dale (1973) revealed thickening of the walls of the alveoli in the lungs of rabbits injected with titanium dioxide dust; however, lungs had returned to normal 3 months post-treatment. Feeding studies of rats and mice at doses of 2.5 percent or 5 percent titanium dioxide for 103 weeks revealed no signs of carcinogenicity in either species (National Cancer Institute 1978). From these data, the ACGIH determined that there exists "no evidence of danger to health from the inhalation of titanium dioxide dust in concentrations of air that do not exceed 10 mg/m³ total dust containing less than 1 percent quartz" (1986).

OSHA proposes an 8-hour TWA of 10 mg/m³, the limit being proposed for all inert particulates. The Agency preliminarily concludes that this limit will protect workers from the health and safety risks potentially associated with exposure to airborne particulates at higher levels. These risks include accidents, interference with vision, and eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for titanium dioxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

VEGETABLE OIL MIST (EXCEPT CASTOR OIL, CASHEW NUT, OR SIMILAR IRRITANT OILS)
CAS: 8008-89-7; Formula: None
H.S. No. 1423

Vegetable oil is a pale-yellow oily liquid. The current OSHA standard for vegetable oil mist is 15 mg/m³, the limit applying to all inert dusts at present. The ACGIH has established a 10-mg/m³ 8-hour TWA for all nuisance dusts.

Occupational exposure to this group of dusts is associated with a variety of health and safety hazards. For example, these substances interfere with vision; cause coughing, eye tearing, and irritation; and, by distracting affected employees from the task at hand, can lead to on-the-job accidents and injuries. In addition, the vigorous cleansing necessary to remove the oil mist from the skin may cause skin irritation.

OSHA is proposing to reduce the existing limit for dusts in this category to 10 mg/m³ TWA. The Agency preliminarily concludes that this limit will avoid the risks described above, which include both safety and health risks to exposed employees. The health evidence forms a reasonable basis for proposing a new limit for vegetable oil. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ZINC STEARATE
CAS: 557-01-1; Chemical Formula: $Zn(C_{18}H_{35}O_2)_2$
H.S. No. 1434

OSHA currently regulates zinc stearate as a nuisance dust with a limit of 15 mg/m³ 3 TWA, total dust. The ACGIH has established an 8-hour TWA of 10 mg/m³ for zinc stearate, measured as total dust. Zinc stearate is a white powder.

A report in *Folia Medica* (1957) documented the case of a worker exposed to zinc stearate dust for 30 years who died from extensive fibrosis of the lungs. More recent studies have revealed incidences of pulmonary fibrosis associated with encephalopathy that stemmed directly from exposure to aluminum dust, which is frequently coated with stearic acid (*British Journal of Industrial Medicine* 1962); the ACGIH (1986, p. 646) is uncertain of the relevance of this report to zinc stearate exposures.

Observations of long-term workers exposed to this dust in the rubber industry revealed no adverse effects of exposure (B.F. Goodrich Rubber Company, private communication, as cited in the ACGIH 1986, p. 646). The ACGIH considers zinc stearate dust to be biologically inert and has assigned a nuisance dust limit to this substance.

OSHA is proposing a 10-mg/m³ limit for this dust (measured as total dust) because the Agency believes that all of its nuisance dust limits should be decreased to 10 mg/m³ as 8-hour TWAs. The Agency believes that this limit will prevent the safety and health risks associated with high workplace exposures to these dusts. These risks include accidents, interference with vision, and eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for zinc stearate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ZINC OXIDE, TOTAL DUST
CAS: 1314-13-2; Chemical Formula: ZnO
H.S. No. 1438

Zinc oxide dust is a white or pale-yellow powder. OSHA currently has no exposure limit specifically for zinc oxide as total dust. The ACGIH established a limit of 10 mg/m³ as an 8-hour TWA for zinc oxide, measured as total dust.

According to Turken and Thompson (1926), exposure to finely divided zinc oxide dust can produce effects similar to those for metal fume fever. Beeckmans and Brown (1963) reported that catalytically active zinc oxide dust is more toxic when treated with ultraviolet light. Aside from these considerations, the ACGIH considered zinc oxide dust to be a nuisance dust.

OSHA is proposing a limit of 10 mg/m³ for zinc oxide as total dust, the same as for all nuisance dusts. The Agency preliminarily concludes that this limit will protect exposed individuals from the risk of exposure to this dust in the workplace, which can result in safety and health hazards such as accidents, skin and respiratory irritation, and interference with vision. The health evidence forms a reasonable basis for proposing a new limit for zinc oxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

OSHA's Current 8-hour inert or nuisance dust standard (29 CFR 1910.1000, Table Z–3) was adopted from the 1968 ACGIH TLV–TWA of 15 mg/m³ for total dust and 5 mg/m³ for respirable dust. At the time, the ACGIH considered the 15 mg/m³ value to be "an acceptable limit of good hygienic practice" based on the then prevailing "lack of knowledge" of any adverse effects at exposure levels below this value (ACGIH Documentation 1966). Shortly after OSHA adopted the ACGIH's 1968 limit, the ACGIH revised its limit downward to 10 mg/m³ for total dust and 5 mg/m³ for respirable dust. In justifying this reduction, the ACGIH noted that the lower levels would "result in appreciable improvement of working conditions in plants where the old limit of 15 mg/m³ formerly prevailed" (ACGIH 1971, p. 190).

OSHA preliminarily concludes that the proposed TWA limit of 10 mg/m³ for this group of substances that cause a variety of adverse effects will substantially reduce the risk of upper respiratory tract, eye, and skin irritation and of danger to the safety of workers distracted by the presence of these substances in the workplace. The health evidence forms a reasonable basis for proposing revised or new limits for nuisance dusts. OSHA will establish new limits for the nuisance dusts if the Agency determines that these limits will substantially reduce significant risks.

11. Substances for Which Limits Are Based on Avoidance of Odor and Taste Effects

Introduction

This category includes four substances that have obnoxious odors. The Agency recognizes that working in atmospheres containing detectable concentrations of these substances will endanger workers by distracting them from the task at hand and creating safety hazards. For three of these substances, OSHA is retaining its current 8-hour TWAs. For one substance, propylene glycol monomethyl ether, a new limit is being proposed. OSHA is proposing the retention or adoption of these limits based on the data described below, which show a NOE level for these intolerable taste and odor effects. Table C11–1 shows the substances included in this group and their OSHA and ACGIH limits, as well as their CAS and HS numbers.

Description of the Health Effects

The substances in this group have obnoxious odors and cannot willingly be tolerated by most workers for any extended period of time. Because odor detection occurs at very low concentrations for many of these chemicals, the proposed limit has been set at a level below the concentration at which the odor is intolerable to employees.

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TABLE C11-1. Substances for Which Limits Are Based on Avoidance of Odor and Taste Effects

Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1226 Isopropyl ether+	108-20-3	500 ppm TWA	250 ppm TWA 310 ppm STEL	—
1314 Phenyl ether (vapor)+	101-84-8	1 ppm TWA	1 ppm TWA 2 ppm STEL	—
1343 Propylene glycol monomethyl ether	107-98-2	—	100 ppm TWA 150 ppm STEL	—
1427 Vinyl toluene+	25013-15-4	100 ppm TWA	50 ppm TWA 100 ppm STEL	—

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ The existing OSHA limit for this substance is being retained.

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The evidence for each of the substances in this group describes their adverse effects both in animals and humans. These effects, which range from nausea to narcosis, generally occur at levels higher than the limits for these substances, which are based not only on toxicological effects but also on the basis of the intolerable odors associated with their presence in workroom air. Because odor effects range in severity from distracting to intolerable, these limits have been set at the concentration at which the odor becomes so seriously objectionable as to create a risk of safety hazards.

Dose-Response Relationships and Odor Effects

Odor effects are threshold effects, although there is wide variation in individual odor response, i.e., in the ability to detect odor. Because of this wide variation and the phenomenon of olfactory fatigue, odor is not a reliable indicator of airborne concentrations and should not be relied on to provide a warning of overexposure. The following paragraphs describe OSHA's preliminary findings with respect to the substances in this group.

ISOPROPYL ETHER
CAS: 108-20-3; Chemical Formula: $(CH_3)_2CHOCH(CH_3)_2$
H.S. No. 1226

OSHA currently has a limit of 500 ppm TWA for isopropyl ether. The ACGIH recommends a TLV-TWA of 250 ppm and a TLV-STEL of 310 ppm for this liquid, which has a sharp, sweet odor similar to that of ether.

Animal studies have shown that exposures to high concentrations cause narcosis and death (Machle, Scott, and Treon 1939). Twenty exposures at a 1-percent vapor concentration produced intoxication and depression but no significant blood or weight changes. In rabbits, the minimum lethal dose has been reported to be 5 to 6.5 g/kg. The liquid is an irritant to the skin and mucous membranes and causes dermatitis in rabbits on repeated exposure (Machle, Scott, and Treon 1939).

Humans exposed for 15 minutes at 300 ppm experienced no irritation but complained about the objectionable odor of isopropyl ether; eye and nose irritation was experienced as a result of 5-minute exposures to 800 ppm. A 15-minute exposure to 500 ppm was not reported by subjects to be irritating (Silverman, Schulte, and First 1946).

The available health evidence for this substance may not be sufficient to support a revision of the current limit, and OSHA is accordingly retaining its current limit. However, there may be other health effects information on isopropyl ether, and OSHA is specifically requesting any available information from the public to support lower limits for this substance. The public may also wish to address the topic of material impairment of health, as discussed in section 6(b) of the Act.

PHENYL ETHER
CAS: 101-84-8; Chemical Formula: $(C_6H_5)_2O$
H.S. No. 1314

OSHA currently has an 8-hour TWA limit of 1 ppm for phenyl ether. The ACGIH recommends the same TWA and the addition of a 2-ppm 15-minute STEL for phenyl ether vapor. Phenyl ether is a colorless liquid or solid with a low volatility; its vapor has a disagreeable odor.

The acute oral lethal dose is approximately 4 g/kg for rats and guinea pigs, and single doses of between 1 and 2 g/kg administered to various species have shown no liver, spleen, kidney, thyroidal or gastrointestinal toxicities in surviving animals (Vogel, Snyder, and Schulman 1964). Repeated inhalation studies in rats, rabbits, and dogs have shown that 20 exposures to 4.9 ppm for 5 days per week, 7 hours per day produced no adverse effects. Eye and nasal irritation were observed in rats and rabbits exposed at 10 ppm (Hefner, Leong, Kociba, and Gehring 1975). Skin and eye irritation have been reported only as a result of prolonged undiluted exposures. There is no evidence that skin absorption presents a health hazard (ACGIH 1986, p. 475).

The primary complaints associated with human exposures to phenyl ether vapor are of disagreeable odor and occasional nausea (Hake and Rowe, as cited in Patty 1963, p. 1698).

The available health evidence for this substance may not be sufficient to support a revision of this current limit, and OSHA is therefore retaining its limit for phenyl ether. However, there may be other health effects information on phenyl ether, and OSHA is specifically requesting any available information from the public to support lower limits for this substance. The public may also wish to comment on the topic of material impairment of health, as discussed in section 6(b) of the Act.

PROPYLENE GLYCOL MONOMETHYL ETHER
CAS: 107-98-2; Chemical Formula: $CH_3OCH_2CHOHCH_3$
H.S. No. 1343

OSHA has no current standard for propylene glycol monomethyl ether (PGME). The ACGIH recommends a TWA of 100-ppm and a STEL of 150 ppm; NIOSH has no REL.

Exposure to propylene glycol monomethyl ether causes anesthesia at a level of approximately 1000 ppm, eye tearing at levels above 100 ppm, and an objectionable odor at 100 ppm (Stewart, Baretta, Dodd, and Torkelson 1970). Ingestion of 3 g/kg in a 35-day period caused minor changes in the livers and kidneys of rats, and repeated dermal applications of 7 to 10 ml/kg/day caused death in rats treated over a 90-day period (Rowe, McCollister, Spencer et al. 1954).

The proposed PELs for PGME of 100 ppm TWA and 150 ppm STEL are designed to protect workers from experiencing this objectionable effect, which is seriously distracting. In addition, the proposed levels will ensure that workers will not experience the eye irritation reported to be associated with exposures to propylene glycol monomethyl ether at levels above 100 ppm. OSHA preliminarily finds that the proposed limits will reduce the risks potentially associated with previously uncontrolled exposures to this substance. The health evidence forms a reasonable basis for proposing a new limit for propylene glycol monomethyl ether.

VINYL TOLUENE
CAS: 25013-15-4; Chemical Formula: $CH_3C_6H_4CH=CH_2$
H.S. No. 1427

The current OSHA standard for vinyl toluene is 100 ppm as an 8-hour TWA. The ACGIH recommends a TWA of 50 ppm with a 100-ppm short-term exposure limit. Vinyl toluene is a colorless liquid with a strong, disagreeable odor.

Wolf, Rowe, McCollister et al. (1956) noted fatty degeneration of the liver and an increase in kidney and liver weights in rats, guinea pigs, rabbits, and monkeys exposed to approximately 100 7- to 8-hour exposures of vinyl toluene at 1250 ppm. Some deaths occurred among the rats in this group. Animals exposed to vinyl toluene at 600 ppm appeared normal and showed no blood or urine abnormalities, no gross or microscopic tissue changes, and no changes in growth rate or organ weight (Wolf, Rowe, McCollister et al. 1956).

Human volunteers reported eye and nose irritation at 400 ppm, and objectionable odor at 300 ppm. At 50 ppm, the odor of vinyl toluene was detectable, but no irritation was experienced (ACGIH 1986, p. 630).

The available health evidence for this substance may not be sufficient to support a revision of the current limit, and OSHA is accordingly retaining its limit. However, there may be other

health effects information on vinyl toluene, and OSHA is specifically requesting any available information on vinyl toluene from the public to support lowering the limit for this substance. The public may also wish to comment on the topic of material impairment of health, as discussed in section 6(b) of the Act.

Preliminary Conclusions

For the one chemical in this group for which OSHA is proposing a new limit, the Agency preliminarily finds that exposure at the uncontrolled levels currently permitted places workers at risk of experiencing the adverse effects associated with this noxious substance. These effects include irritation, distraction, discomfort, and, if exposure is sufficiently severe, danger to affected employees and their co-workers. This risk is created by the safety risks generated by propylene glycol monomethyl ether's intolerable odor.

For the three substances—isopropyl ether, phenyl ether, and vinyl toluene—for which OSHA is at present retaining its current limits, the available health evidence may not be sufficient to support a revision of these limits. However, OSHA is soliciting additional information from the public on the health effects associated with occupational exposure to these substances to support revision or retention of these limits. At the time of the final rule, OSHA will make a final determination, based on the best available evidence, of whether to retain or revise the limits for these substances.

12. Substances for Which Proposed Limits are Based on Avoidance of Adverse Health Effects Caused by Exposure to Analogous Substances

Introduction

OSHA is proposing limits for 73 substances on the basis of their toxicologic and structural similarities to other chemical substances that create significant risks of systemic toxicity, ocular effects, kidney or liver damage, and other similarly adverse health effects. For 46 of these substances, OSHA has not previously had Z table limits. For an additional 12 substances, OSHA is proposing to reduce the 8-hour TWA, and in 13 cases, the Agency is proposing to retain its 8-hour limit and to add a STEL to supplement the TWA. OSHA proposes to delete the 8-hour limit and add a ceiling in the case of acetic anhydride and to delete a ceiling limit and add an 8-hour TWA for another substance. Table C12–1 shows these substances, their CAS and HS numbers, and their current OSHA and ACGIH limits. NIOSH has RELs for four substances in this category.

Description of the Health Effects

The health effects associated with occupational exposures to the diverse group of substances shown in Table C12–1 vary widely, ranging from sensory irritation, systemic toxicity, ocular effects, and neuropathy to renal and liver damage. This variation in target organs reflects the fact that the substances in this group have not been grouped on the basis of their toxic effects or mechanism of action; instead, they are considered together because the specific limits proposed for them have been determined on the basis of toxic effects caused by exposure to analogous chemicals. Table C12–2 shows these substances, along with their adverse health effects and analogous compounds.

The use of analogy is a reasonable basis for making estimates because of the similarities in structure and activity of these substances. Industrial hygienists frequently use this approach. The limits for these chemicals have thus been set based on dose-response information for other compounds that are of similar chemical structure or that have a similar mechanism of action. For example, limits are being proposed for a number of compounds that are known cholinesterase inhibitors (including diazinon, disulfoton, and monocrotophos); since direct dose-response data are not available, OSHA has proposed limits that are similar to the proposed limit for parathion, another cholinesterase inhibitor for which adequate dose-response data are available.

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TABLE C12-1. Substances for Which Limits Are Based on Analogy to Related Compounds

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1003 Acetic anhydride	108-24-7	5 ppm TWA	5 ppm Ceiling	--
1009 Acrylic acid	79-10-7	--	10 ppm TWA	--
1015 Aluminum (alkyls)	7429-90-5	--	2 mg/m^3 TWA	--
1018 Aluminum (soluble salts)	7429-90-5	--	2 mg/m^3 TWA	--
1040 Boron tribromide	10294-33-4	--	1 ppm Ceiling	--
1043 Bromine pentafluoride	7789-30-2	-	0.1 ppm TWA	--
1048 n-Butyl acrylate	141-32-2	--	10 ppm TWA	--
1055 o-sec-Butylphenol	89-72-5	-	5 ppm TWA, Skin	--
1059 Calcium hydroxide	1305-62-0	-	5 mg/m^3 TWA	--
1060 Calcium oxide	1305-78-8	5 mg/m^3 TWA	2 mg/m^3 TWA	--
1074 Carbonyl fluoride	353-50-4	-	2 ppm TWA 5 ppm STEL	--
1075 Catechol	120-80-9	--	5 ppm TWA	--
1081 1-Chloro-1-nitro-propane	600-25-9	20 ppm TWA	2 ppm TWA	--

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1098 Cobalt carbonyl	10210-68-1	-	0.1 mg/m^3 TWA	--
1099 Cobalt hydrocarbonyl	16842-03-8	-	0.1 mg/m^3 TWA	--
1118 Diazinon	333-41-5	-	0.1 mg/m^3 TWA, Skin	-
1121 1,1-Dichloro-1-nitro-ethane	594-72-9	10 ppm Ceiling	2 ppm TWA	--
1125 p-Dichlorobenzene	106-46-7	75 ppm TWA	75 ppm TWA 110 ppm STEL	--
1128 Dichloromono-fluoromethane	75-43-4	1000 ppm TWA	10 ppm TWA	--
1135 Diethyl ketone	96-22-0	-	200 ppm TWA	--
1138 Diethylenetriamine	111-40-0	-	1 ppm TWA, Skin	--
1148 Dipropyl ketone	123-19-3	-	50 ppm TWA	-
1150 Diquat	85-00-7	-	0.5 mg/m^3 TWA	--
1152 Disulfoton	298-04-4	-	0.1 mg/m^3 TWA	--

TABLE C12-1. Substances for Which Limits Are Based on Analogy to Related Compounds (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1154 Divinyl benzene	108-57-6	-	10 ppm TWA	--
1156 Endosulfan	115-29-7	--	0.1 mg/m^3 TWA, Skin	--
1181 Fonofos	944-22-9	-	0.1 mg/m^3 TWA, Skin	--
1182 Formamide	75-12-7	-	20 ppm TWA 30 ppm STEL	--
1186 Germanium tetra-hydride	7782-65-2	--	0.2 ppm TWA	--
1212 Indene	95-13-6	-	10 ppm TWA	--
1214 Iodoform	75-47-8	--	0.6 ppm TWA	--
1219 Isobutyl alcohol	78-83-1	100 ppm TWA	50 ppm TWA	--
1220 Isooctyl alcohol	26952-21-6	-	50 ppm TWA, Skin	--
1229 n-Isopropylaniline	643-28-7	-	2 ppm TWA, Skin	--
1231 Ketene	463-51-4	0.5 ppm TWA	0.5 ppm TWA 1.5 ppm STEL	--
1244 Methacrylic acid	79-41-4	-	20 ppm TWA	--

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1247 4-Methoxyphenol	150-76-5	--	5 mg/m^3 TWA	--
1250 Methyl acetylene-propadiene mixture	74-99-7	1000 ppm TWA	1000 ppm TWA 1250 ppm STEL	--
1256 Methyl demeton	8022-00-2	--	0.5 mg/m^3 TWA, Skin	--
1257 Methyl ethyl ketone peroxide	1338-23-4	--	0.2 ppm Ceiling	--
1258 Methyl formate	107-31-3	100 ppm TWA	100 ppm TWA 150 ppm STEL	--
1259 Methyl iodide	74-88-4	5 ppm TWA, Skin	2 ppm TWA, Skin	Lowest feasible limit
1260 Methyl isoamyl ketone	110-12-3	--	50 ppm TWA	50 ppm TWA
1262 Methyl isopropyl ketone	563-80-4	--	200 ppm TWA	--
1265 Methyl parathion	298-00-0	--	0.2 mg/m^3 TWA, Skin	0.2 mg/m^3 TWA

TABLE C12-1. Substances for Which Limits Are Based on Analogy to Related Compounds (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1268 Methylcyclohexane	108-87-2	500 ppm TWA	400 ppm TWA	--
1271 Methylcyclopentadienyl Mn tricarbonyl	12108-13-3	--	0.2 mg/m^3 TWA, Skin	--
1279 Monocrotophos	6923-22-4	--	0.25 mg/m^3 TWA	--
1281 Morpholine	110-91-8	20 ppm TWA, Skin	20 ppm TWA 30 ppm STEL, Skin	--
1286 Nitric acid	7697-37-2	2 ppm TWA	2 ppm TWA 4 ppm STEL	2 ppm TWA
1287 p-Nitroaniline	100-01-6	6 mg/m^3 TWA, Skin	3 mg/m^3 TWA, Skin	--
1292 Nitrotoluene	1321-12-6	5 ppm TWA, Skin	2 ppm TWA, Skin	--
1293 Nonane	111-84-2	--	200 ppm TWA	--
1299 Oxalic acid	144-62-7	1 mg/m^3 TWA	1 mg/m^3 TWA 2 mg/m^3 STEL	--
1309 Perchloryl fluoride	7616-94-6	3 ppm TWA	3 ppm TWA 6 ppm STEL	--

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1320 Mevinphos (Phosdrin)	7786-34-7	0.1 mg/m^3 TWA, Skin	0.1 mg/m^3 TWA 0.3 mg/m^3 STEL, Skin	--
1323 Phosphorus oxychloride	10025-87-3	--	0.1 ppm TWA 0.5 ppm STEL	--
1324 Phosphorus pentasulfide	1314-80-3	1 mg/m^3 TWA	1 mg/m^3 TWA 3 mg/m^3 STEL	--
1326 Phthalic anhydride	85-44-9	2 ppm TWA	1 ppm TWA	--
1335 Propargyl alcohol	107-19-7	--	1 ppm TWA, Skin	--
1336 Propionic acid	79-09-4	--	10 ppm TWA 15 ppm STEL	--
1338 n-Propyl acetate	109-60-4	200 ppm TWA	200 ppm TWA 250 ppm STEL	--
1339 n-Propyl alcohol	71-23-8	200 ppm TWA	200 ppm TWA 250 ppm STEL, Skin	--
1344 Propylene oxide	75-56-9	100 ppm TWA	20 ppm TWA	--

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL
1361 Silicon tetrahydride	7803-62-5	-	5 ppm TWA	--
1379 Sulfuryl fluoride	2699-79-8	5 ppm TWA	5 ppm TWA 10 ppm STEL	--
1393 Thionyl chloride	7719-09-7	--	1 ppm Ceiling	--
1402 Tributyl phosphate	126-73-8	5 mg/m^3 TWA	2.5 mg/m^3 TWA	--
1404 Trichloroacetic acid	76-03-9	-	1 ppm TWA	-
1411 Trimethylamine	75-50-3	-	10 ppm TWA 15 ppm STEL	-
1420 n-Valeraldehyde	110-62-3	-	50 ppm TWA	-
1432 m-Xylene-alpha, alpha', diamine	1477-55-0	-	0.1 mg/m^3 Ceiling, Skin	--
1433 Xylidine	1300-73-8	5 ppm TWA, Skin	2 ppm TWA, Skin	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

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It is important to note that the establishment of a limit on the basis of analogy to other substances does not reflect a lack of information showing that the substance is toxic; acute animal data are available demonstrating the toxicity of all of the substances for which limits are being proposed in this category, and cases of human poisoning caused by exposure to many of them are reported. Thus the proposed limits reflect more than theoretical considerations of chemical structure and physiologic reaction: The hazardous nature of exposure has been demonstrated beyond doubt, although the precise level at which it will occur cannot be foretold with certainty.

The following sections describe OSHA's preliminary findings for the substances in this grouping.

TABLE C12-2.—SUMMARY OF RATIONALE FOR LIMITS BASED ON ANALOGY TO RELATED COMPOUNDS

H.S. No./Chemical name	Compound on which limit is based	Associated health effects
1003 Acetic anhydride	Acetic acid	Sensory irritation.
1009 Acrylic acid	Acetic acid	Sensory irritation.
1015 Aluminum (alkyls)	Welding fumes	Respiratory irritation.
1018 Aluminum (soluble salts)	Hydrolysis to hydrogen chloride.	Sensory irritation.
1040 Boron tribromide	Hydrogen bromide	Sensory irritation.
1043 Bromine pentafluoride	Chlorine terifluoride	Systemic injury.
1048 n-Butyl acrylate	Methyl acrylate	Acute toxicity.
1055 o-sec-Butylphenol	Phenol and cresol	Respiratory, liver, and kidney effects.
1059 Calcium hydroxide	Sodium hydroxide	Sensory irritation.
1060 Calcium oxide	Sodium hydroxide	Sensory irritation.
1074 Carbonyl fluoride	Hydrolysis to hydrogen fluoride.	Sensory irritation.
1075 Catechol	Phenol	Peripheral vasoconstriction, renal tubule degeneration.
1081 1-Chloro-1-nitropropane	Nitropropane	Acute toxicity, damage to heart muscle, liver, and kidneys.
1098 Cobalt carbonyl	Nickel carbonyl	Systemic toxicity.
1099 Cobalt hydrocarbonyl	Nickel carbonyl	Systemic toxicity.
1118 Diazinon	Parathion	Cholinesterase inhibition.
1121 1,1-Dichloro-1-nitroethane	Related compounds	Systemic toxicity.
1125 p-Dichlorobenzene	o-Dichlorobenzene	Neurological effects, cataract formation.
1128 Dichlorofluoromethane	Chloroform	Hepatotoxicity, cardiac sensitization.
1135 Diethyl ketone	Methyl propyl ketone	Acute toxicity.
1138 Diethylenetriamine	Ethylamine	Irritation, sensitization.
1148 Dipropyl ketone	Methyl isobutyl ketone	Acute toxicity.
1150 Diquat	Paraquat	Ocular effects.
1152 Disulfoton	Parathion	Cholinesterase inhibition.
1154 Divinyl benzene	Styrene	Sensory irritation.
1156 Endosulfan	Aldrin, Dieldrin	Neurological effects.
1181 Fonofos	Ethyl parathion	Cholinesterase inhibition.
1182 Formamide	Dimethyl formamide	Acute toxicity.
1186 Germanium tetrahydride	Stibine	Acute toxicity.
1212 Indene	Naphthalene	Sensory irritation.
1214 Iodoform	Methyl iodide	Acute toxicity.
1219 Isobutyl alcohol	n-Butanol	Acute toxicity.
1220 Isooctyl alcohol	Isoamyl alcohol	Sensory irritation.
1229 n-Isopropylaniline Aniline	N,N-dimethylaniline	Acute toxicity.
1231 Ketene	Phosgene	Sensory irritation.
1244 Methacrylic acid	Acrylic acid	Sensory irritation.
1247 4-Methoxyphenol	Hydroquinone	Ocular effects.
1250 Methyl acetylene-propadiene mixture	Methyl acetylene	Hygienic standard (absence of demonstrated health effects).
1256 Methyl demeton	Demeton	Ocular effects, respiratory effects, inner ear irritation.
1257 Methyl ethyl ketone peroxide	Benzoyl peroxide, hydrogen peroxide.	Sensory irritation.
1258 Methyl formate	Methyl acetate	Sensory irritation.
1259 Methyl iodide	Methyl bromide	CNS effects.
1260 Methyl isoamyl ketone	Methyl isobutyl ketone	Neuropathy.
1262 Methyl isopropyl ketone	Diethyl ketone, methyl propyl ketone.	Narcosis sensory irritation.
1265 Methyl parathion	Parathion	Cholinesterase inhibition.
1268 Methylcyclohexane	Heptane	Acute toxicity.
1271 Methylcyclopentadienyl manganese tricarbonyl	Tetraethyl lead	Central nervous system effects, chronic lung effects.
1279 Monocrotophos	Cholinesterase inhibitors	Cholinesterase inhibition.
1281 Morpholine	Ammonia	Kidney and liver degeneration, sensory irritation.
1286 Nitric acid	Hydrogen chloride, sulfuric acid.	Sensory irritation.
1287 p-Nitroaniline	Aniline	Methemoglobin formation.
1292 Nitrotoluene	Aniline	Methemoglobin formation.
1292 Nitrotoluene	Aniline	Methemoglobin formation.
1293 Nonane	Octane	Acute toxicity.
1299 Oxalic acid	Sulfuric acid, phosphoric acid.	Irritation, burns.
1309 Perchloryl fluoride	Fluoride	Fluorosis.
1320 Phosdrin (Mevinphos)	Parathion	Cholinesterase inhibition.
1323 Phosphorus oxychloride	Phosphorous trichloride	Sensory irritation, respiratory effects.
1334 Phosphorus pentasulfide	Hydrolysis to phosphoric acid.	Sensory irritation.
1326 Phthalic anhydride	Tetrachlorophthalic anhydride, maleic anhydride.	Sensory irritation.

TABLE C12-2.—SUMMARY OF RATIONALE FOR LIMITS BASED ON ANALOGY TO RELATED COMPOUNDS—Continued

H.S. No./Chemical name	Compound on which limit is based	Associated health effects
1335 Propargyl alcohol	Allyl alcohol	Acute toxicity.
1336 Propionic acid	Acetic acid	Sensory irritation.
1338 n-Propyl acetate	Isopropyl acetate, n-butyl acetate.	Sensory irritation.
1339 n-Propyl alcohol	Isopropyl alcohol	Sensory irritation.
1344 Propylene oxide	Ethylene oxide	Central nervous system depression, sensory irritation
1361 Silicon tetrahydride	Germane, stannane	Acute toxicity.
1379 Sulfuryl fluoride	Hydrogen fluoride	Fluorosis.
1393 Thionyl chloride	Hydrolysis to hydrogen chloride.	Sensory irritation.
1402 Tributyl phosphate	Triphenyl phosphate	Narcosis, cholinesterase inhibition.
1404 Trichloroacetic acid	2,2-Dichloropropionic acid.	Sensory irritation.
1411 Trimethylamine	Dimethylamine	Sensory irritation.
1420 n-Valeraldehyde	Saturated aliphatic	Sensory irritationaldehydes.
1432 m-Xylene-alpha, alpha', diamine	Phenylenediamine	Allergic respiratory sensitization.
1433 Xylidine	Aniline	Methemoglobin formation.

ACETIC ANHYDRIDE
CAS: 108-24-27; Chemical Formula: $(CH_3CO)_2O$
H.S. No. 1003

The current OSHA PEL for acetic anhydride is 5 ppm as an 8-hour TWA. The ACGIH has recommended a TLV of 5 ppm as a ceiling, based on analogy with acetic acid and the substance's irritant potential. Acetic anhydride is a colorless, mobile, strongly refractive liquid with a strong odor.

In one study, rats inhaling 1000 ppm of acetic anhydride for 4 hours survived, but 2000 ppm was fatal (Smyth 1956). In human studies, eye, nose, and throat irritation has been observed, and it has been suggested that bronchial and lung injury may occur as a consequence of exposure. (Henderson and Haggard 1943). Skin burns and serious corneal injury have been reported in industrial settings when workers came into contact with the liquid (McLaughlin 1946), and acetic anhydride is a marked lacrimator (Fairhall 1949).

In light of acetic anhydride's potential for acute toxicity, OSHA is proposing to replace the current 5-ppm 8-hour TWA with a 5-ppm ceiling. The Agency preliminarily concludes that this limit will protect workers from the risk of ocular and respiratory effects associated with high, short-term exposures to acetic anhydride at the current level. The proposed limit will substantially reduce this risk among industrially exposed workers. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for acetic anhydride if the Agency determines that this limit will substantially reduce significant risk.

ACRYLIC ACID
CAS: 79-10-7; Chemical Formula: $CH_2=CHCO_2H$
H.S. No. 1009

OSHA has no current permissible exposure limit for acrylic acid. The ACGIH has a recommended 8-hour TWA of 10 ppm. Acrylic acid is a colorless, corrosive liquid with a distinctive acrid odor.

Acrylic acid is known to polymerize explosively with amines, ammonia, oleum, and chlorosulfonic acid, and it is incompatible with strong alkalis and pure nitrogen. Occupational exposure to acrylic acid usually occurs when the chemical is used in the form of methyl, ethyl, or butyl esters in the manufacture of acrylic resins.

Data indicate that the oral LD_{50} in rats is between 0.25 and 0.5 mg/kg (Dow Chemical Company, 1977), and the skin absorption LD_{50} in rabbits is 0.95 ml/kg (Smyth et al. 1962). Another study indicates that rabbits given acrylic acid orally had no ill effects at a level of 0.025 mg/kg (Klimkina et al. 1969), and Gage reports that rats exposed to 80 ppm for 6 hours daily for 20 days showed no adverse effects (1970).

Case reports indicate that acute exposures to acrylic acid in workers have caused skin burns, eye burns, and upper respiratory effects (ACGIH, 1986, p. 14).

OSHA preliminarily concludes that an 8-hour TWA PEL of 10 ppm is necessary to protect exposed workers from the risk of nasal and eye irritation potentially associated with exposure to acrylic acid at the previously uncontrolled level. This limit will substantially reduce this risk and prevent recurrences of the burns and irritation previously associated with industrial exposures. The health evidence forms a reasonable basis for proposing a new limit for acrylic acid. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ALUMINUM (ALKYLS)
CAS: 7429-90-5; Chemical Formula: Al
H.S. No. 1015

ALUMINUM (SOLUBLE SALTS)
CAS: 7429-90-5; Chemical Formula: Al
H.S. No. 1018

OSHA currently has no permissible exposure limits for the soluble salts of aluminum or for the aluminum alkyls. The ACGIH recommends an 8-hour TLV-TWA limit of 2 mg/m³ for aluminum (soluble salts) and 2 mg/m³ for the aluminum alkyls.

The ACGIH's limits for aluminum soluble salts have been set on the basis of the amount of hydrolized acid, such as hydrochloric acid or sulphuric acid, in their acid compounds. For example, three mols of hydrochloric acid (HCl) hydrolize from one mol of aluminum chloride; since HCl has a PEL of 5 ppm, a PEL of 2 mg/m³ for aluminum chloride, a soluble salt of aluminum, would provide the same degree of protection from irritation as that provided by this current limit for HCl. The acute toxicity of aluminum chloride is generally representative of the toxicity of all of the soluble salts of aluminum. For the aluminum alkyls, toxicity data are sparse. However, all of the nonhalogenated alkyls decompose into aluminum oxide fume, and the halogenated alkyls are even more irritating because of acid hydrolysis.

OSHA proposes an 8-hour TWA limit of 2 mg/m³ for the soluble salts and the alkyls of aluminum. The Agency preliminarily concludes that these limits will protect against the risk of irritation and skin burns presented by the acidic nature of these substances, to which workers can presently be exposed at uncontrolled levels. The health evidence

forms a reasonable basis for proposing new limits for the alkyls and aluminum salts. At the time of the final rule, OSHA will promulgate new limits if the Agency determines that these limits will substantially reduce significant risk.

BORON TRIBROMIDE
CAS: 10294-33-4; Chemical Formula: BBr_3
H.S. No. 1040

OSHA currently has no limit for exposure to boron tribromide. The ACGIH recommends a 1-ppm ceiling limit for boron tribromide, which is a colorless, fuming liquid that is decomposed by water and alcohol.

Boron tribromide has a high potential for acute local irritation, and its potential for systemic toxicity is analogous to that of hydrogen bromide (HBr). On decomposition, one molecule of boron tribromide would be expected to produce three molecules of HBr (ACGIH 1986, p. 62).

Animals repeatedly exposed to boron tribromide develop pneumonia, and exposure at 100 ppm caused a uniformly high mortality rate in six laboratory species (Stokinger, Spiegel et al. 1953). Rats, rabbits, and mice exposed at 1.5, 3.4, or 12.8 ppm boron trifluoride developed pneumonitis and dental fluorosis, although at the lowest level tested, the evidence of pneumonitis was described as "marginal" (Torkelson, Sadek, and Rowe 1961).

Based on this evidence of boron tribromide's severe pulmonary toxicity at exposure levels below 4 ppm, OSHA preliminarily proposes a ceiling limit of 1 ppm. The Agency believes that this limit will protect workers from the risk of serious pulmonary damage associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for boron tribromide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

BROMINE PENTAFLUORIDE
CAS: 7789-30-2; Chemical Formula: BrF_5
H.S. No. 1043

OSHA has no current limit for bromine pentafluoride exposure. The ACGIH recommends a TLV-TWA of 0.1 ppm. This substance is a pale-yellow liquid at temperatures below 40.3°C; above this temperature, it is a colorless, pungent, and corrosive gas.

Bromine pentafluoride has been shown to be acutely toxic in animals. Animals exposed to bromine pentafluoride vapor at 500 ppm exhibited immediate symptoms of gasping, swollen eyelids, clouded corneas, tearing, salivation, and acute distress; these symptoms appeared after exposure for a period as short as 3 minutes. Exposures to 50 ppm were fatal after 30 minutes, and chronic exposures above 3 ppm resulted in severe nephrosis in some animals, as well as marked hepatosis and severe respiratory involvement (The Matheson Co., Inc., as cited in ACGIH, p. 66). Bromine pentafluoride is toxicologically more active than free, elemental fluorine, and its toxicity appears to be closely related to that of chlorine trifluoride (Horn and Wier 1955, 1956). Chlorine trifluoride has caused severe toxicity and some fatalities in dogs and rats exposed to an average concentration of 1.17 ppm 6 hours daily for 6 months (Horn and Wier 1955).

OSHA is proposing the adoption of a PEL of 0.1 ppm as an 8-hour TWA to prevent the risk of serious systemic injury potentially associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The Agency preliminarily concludes that this limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for bromine pentafluoride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

n-BUTYL ACRYLATE
CAS: 141-32-2; Chemical Formula: $C_7H_{12}O_2$
H.S. No. 1048

OSHA has no current limit for n-butyl acrylate. The ACGIH's Threshold Limit Value is a 10 ppm TWA. n-Butyl acrylate is a colorless, flammable liquid.

n-Butyl acrylate is a skin and eye irritant and is toxic to animals (rats) at inhalation doses of 1000 ppm for 4 hours (Treon, Sigmon, Wright, and Kitzmiller 1949).

In rabbits, the dermal LD_{50} for n-butyl acrylate was approximately 1800 mg/kg, compared to 1235 mg/kg for methyl acrylate (Smyth, Carpenter, and Weil 1951). n-Butyl acrylate has also been found to be mildly irritating to the skin and to produce corneal necrosis in the unwashed eyes of rabbits (Holland 1974, unpublished memo, as cited in ACGIH 1986, p. 75).

OSHA is proposing an 8-hour TWA PEL of 10 ppm for n-butyl acrylate, based on the similarity of the toxicological response of n-butyl acrylate to methyl acrylate, for which OSHA has a 10 ppm TWA limit. The Agency preliminarily concludes that this limit is necessary to reduce the risk of skin irritation and corneal necrosis to which workers could be exposed in the absence of an OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for n-butyl acrylate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

o-sec-BUTYLPHENOL
CAS No. 89-72-5; Chemical Formula: $C_2H_5(CH_3)CHC_6H_4OH$
H.S. No. 1055

OSHA has no current limit for o-sec-butylphenol. The ACGIH recommends a 5-ppm 8-hour TLV-TWA with a skin notation. o-sec-Butylphenol is a colorless liquid.

Animal studies indicate that contact with o-sec-butylphenol causes irritation of the skin, eyes, and respiratory tract, and may result in skin burns. A Dow Chemical Company study (1977, as cited in ACGIH 1986, p. 84) showed that the oral and skin absorption LD_{50}'s for guinea pigs ranged between 0.6 and 2.4 g/kg. Prolonged contact of o-sec-butylphenol with the skin of these animals resulted in burns, whereas direct application to the eyes did not cause corneal injury. The oral LD_{50} for rats is 2700 mg/kg (Sax 1984), and rats exposed to saturated air levels of this chemical survived for 7 hours (Dow Chemical Company 1977, as cited in ACGIH 1986, p. 84). The intravenous LD_{50} for mice is 6 mg/kg (Sax 1984).

Acute workplace exposures to o-sec-butylphenol have resulted in mild respiratory irritation and skin burns (ACGIH 1986, p. 84).

OSHA is proposing an 8-hour TWA limit of 5 ppm for o-sec-butylphenol, with a skin notation. The Agency preliminarily concludes that this limit is necessary to protect workers from the risk of eye and respiratory tract irritation and skin burns associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for o-sec-butylphenol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CALCIUM HYDROXIDE
CAS: 1305-62-0; Chemical Formula: $Ca(OH)_2$
H.S. No. 1059

OSHA currently has no limit for calcium hydroxide; the ACGIH recommends a TLV-TWA of 5 mg/m^3. Calcium hydroxide is a soft, white, odorless crystalline powder with an alkaline, bitter taste.

Calcium hydroxide is a moderately caustic irritant when it comes in contact with the skin, eyes, or mucous membranes of the upper respiratory tract. The oral LD_{50} in rats is reported to

be 7.34 g/kg (Smyth et al. 1969). Industrial experience with this substance has not shown a high incidence of adverse health effects. Calcium hydroxide has less alkalinity than the hydroxides of the alkali series, and the ACGIH has suggested that limits for exposures to calcium hydroxide should be based on its total alkalinity. According to the ACGIH, since calcium hydroxide has 2.5 times the alkalinity of sodium hydroxide, it should have a limit 2.5 times that of sodium hydroxide; this would set the limit for calcium hydroxide at 5 mg/m³.

OSHA is proposing an 8-hour TWA limit for calcium hydroxide of 5 mg/m³ to protect against the risk of skin, eye, and mucous membrane irritation caused by exposure to this substance at the uncontrolled levels permitted by the absence of any OSHA limit. The Agency preliminarily concludes that this limit will reduce the risk substantially. The health evidence forms a reasonable basis for proposing a new limit for calcium hydroxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CALCIUM OXIDE
CAS: 1305–78–8; Chemical Formula: CaO
H.S. No. 1060

OSHA currently has a limit of 5 mg/m³ for calcium oxide, and the ACGIH recommends a TLV–TWA of 2 mg/m³. Calcium oxide is a white or off-white powder.

Calcium oxide is known to be a caustic and irritating material (Sax 1984); it produces severe irritation on contact with the mucous membranes and moist skin. Significant irritation occurs from the local liberation of heat and the dehydration of tissues resulting from the alkalinity of the slaked particles (ACGIH 1986, p. 92). Sax (1984) considers calcium oxide "a powerful caustic to living tissue."

Exposure to calcium oxide can cause inflammation of the respiratory passages and ulceration of the nasal septum (National Safety Council 1936; Schwartz, Tulipan, and Birmingham 1957). The inhalation of calcium oxide dust has also been linked to reports of pneumonia (International Labour Office 1934). However, the most frequent adverse response associated with exposure to calcium oxide is irritation to the skin and eyes. The effects of exposure to calcium oxide are analogous to those of sodium hydroxide.

OSHA proposes a PEL of 2 mg/m³ TWA for calcium hydroxide to afford protection against the risk of skin and eye irritation. The Agency preliminarily concludes that a 2-mg/m³ 8-hour TWA will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for calcium oxide if the Agency determines that this limit will substantially reduce significant risk.

CARBONYL FLUORIDE
CAS: 353–50–4; Chemical Formula: COF_2
H.S. No. 1074

OSHA has no current limit for carbonyl fluoride. The ACGIH has established an 8-hour TWA limit of 2 ppm and a 15-minute STEL of 5 ppm for this colorless and essentially odorless gas.

The 1-hour LC_{50} for rats is 360 ppm, and the 4-hour LC_{50} for the same species is 90 ppm (ACGIH 1986, p. 111). Carbonyl fluoride hydrolyzes instantly on contact with moisture.

Repeated exposure of animals to carbonyl fluoride is known to have metabolic effects; it inhibits the fluoride-sensitive enzyme succinic dehydrogenase via hydrolysis of carbonyl fluoride to hydrogen fluoride (Scheel, McMillan, and Phipps 1968). Carbonyl fluoride is also a strong irritant to the eyes, skin, mucous membranes, and respiratory tract (Sax 1984).

OSHA is proposing an 8-hour TWA limit of 2 ppm and a 15-minute 5 ppm STEL for carbonyl fluoride; these limits are based on analogy to the 3-ppm TWA limit being proposed for hydrogen fluoride. The Agency preliminarily concludes that both a TWA and a STEL are necessary to provide protection against the risk of marked irritation and metabolic effects associated with exposure to carbonyl fluoride at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for carbonyl fluoride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CATECHOL (PYROCATECHOL)
CAS: 120–80–9; Chemical Formula: $C_6H_4(OH)_2$
H.S. No. 1075

OSHA currently has no established limit for catechol. The ACGIH recommends a TWA–TLV of 5 ppm. Catechol is a colorless crystalline solid that sublimes readily and thus occurs in the vapor state at room temperature.

Catechol is approximately 1.1 to 2.2 times more toxic than phenol, depending on the route of exposure (Acute Toxicity Studies With Catechol 1974, as cited in ACGIH 1986, p. 112). The oral LD_{50} in rats is 300 mg/kg, or approximately half that of phenol. Percutaneous toxicity for catechol in rabbits is 800 mg/kg, only slightly greater than the value for phenol. Eye and nose irritation, as well as muscular spasms and tremor, have been observed in rats at a concentration of 2800 mg/m³ catechol indicating that the acute respiratory toxicity of catechol is approximately one-third that of phenol (Acute Toxicity Studies with Catechol 1974, as cited in ACGIH 1985, p. 112). Metabolic data indicate that the urinary elimination rate of catechol in rabbits is only 10 percent of that of phenol (Williams 1959). In mice, catechol is easily absorbed through the skin and gastrointestinal tract (Forsyth and Quinel 1957). Additional data document a variety of dermal, respiratory, and systemic toxicities that are closely analogous to those of phenol in their metabolic actions (Harald, Nierenstein, and Road 1910; Dietering 1938; Cushny et al. 1940).

Exposure to catechol causes an increase in blood pressure, and, at high doses, kidney damage, eczematous dermatitis, and systemic illness (Harald, Nierenstein, and Road 1910; Dietering 1938; Cushny et al. 1940).

OSHA is proposing a permissible exposure limit of 5 ppm TWA for this substance. The Agency preliminarily concludes that this level will protect workers against the risk of dermal, respiratory, and systemic effects potentially associated with exposure to catechol in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for catechol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

1-CHLORO-1-NITROPROPANE
CAS: 600–25–9; Chemical Formula: $CH_3CH_2CHClNO_2$
H.S. No. 1081

OSHA's current time-weighted average limit for 1-chloro-1-nitropropane is 20 ppm. The ACGIH recommends a TLV–TWA of 2 ppm for this flammable liquid (ACGIH 1986). The ACGIH (1986, p. 132) notes that a 20-ppm 8-hour TWA "provides little margin of safety, even assuming no chronic effects."

1-Chloro-1-nitropropane is the most acutely toxic of the fungicides known as the chloronitropropanes. In an inhalation experiment, two rabbits were exposed for 6 hours to a concentration of 393 ppm, after which one rabbit died; at an average concentration of 2574 ppm, both rabbits died. Guinea pigs tested under the same conditions survived these exposures. The oral LD_{50} for rabbits determined in the same study

was between 50 and 100 mg/kg (Machle, Scott, Treon et al. 1945). Other members of this family of fungicides show lesser skin and lung irritation but do have higher ingestion toxicities (Patty 1963). Exposure to high concentrations of 1-chloro-1-nitropropane can cause heart muscle, liver, and kidney damage (Patty 1963).

OSHA is proposing an 8-hour TWA PEL of 2 ppm. The Agency preliminarily concludes that this limit will protect exposed employees from the risk of skin and upper respiratory irritation and of systemic toxicity potentially associated with 1-chloro-1-nitropropane exposure at the existing PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 1-chloro-1-nitropropane if the Agency determines that this limit will substantially reduce significant risk.

COBALT CARBONYL
CAS: 10210-68-1; Chemical Formula: $Co_2(CO)_4$
H.S. No. 1098

OSHA has no current limit for cobalt carbonyl. The ACGIH recommends a TLV-TWA of 0.1 mg/m³ (as cobalt) for this substance, which is a solid that decomposes at 50°C.

Sax (1984) reports that cobalt carbonyl has a moderate-to-high order of toxicity by the oral route. The oral LD_{50} in mice is 377.7 mg/kg; in rats, it is 753.8 mg/kg (Spiridonova and Shabalina 1973). The hazards of exposure to the metal carbonyls range from relatively low (for iron pentacarbonyl) to extremely serious (for nickel carbonyl) (Clayton and Clayton 1982, Vol. 2A, pp. 1797-1806); the greater the toxicity of the metal and the more stable and volatile the carbonyl, the more hazardous the compound. Exposure to any of the metal carbonyls causes the same symptoms of nausea, dizziness, headache, substernal pain, coughing and dyspnea (Clayton and Clayton 1982). Evidence concerning any chronic effects of long-term exposure is lacking (ACGIH 1986, p. 145).

OSHA proposes a PEL of 0.1 mg/m³ TWA for cobalt carbonyl to protect against the risk of headache, nausea, and pulmonary effects associated with occupational exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for cobalt carbonyl. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

COBALT HYDROCARBONYL
CAS: 16842-03-8; Chemical Formula: $HCo(CO)_4$
H.S. No. 1099

OSHA has no current limit for cobalt hydrocarbonyl. The ACGIH recommends a TLV-TWA of 0.1 mg/m³ (as cobalt) for this flammable and toxic gas.

Cobalt hydrocarbonyl is approximately half as toxic as nickel carbonyl in terms of acute effects; in animals, it produces clinical signs and symptoms very similar to those produced by nickel carbonyl (ACGIH TLV-TWA of 0.007 mg/m³) and iron pentacarbonyl (ACGIH TLV-TWA of 0.8 mg/m³ (ACGIH 1986, p. 145). These include headache, dizziness, and, after a delay in onset, liver, brain, and lung damage. The 30-minute LC_{50} in rats is 165 mg/kg (Palmes, Nelson, Laskin, and Kuschner 1959). There is no evidence of chronic toxicity or of carcinogenicity.

OSHA proposes a TWA limit of 0.1 mg/m³ to protect exposed employees from the risk of pulmonary, brain, and liver damage, as well as that of acute effects such as headaches and dizziness, which are possible in the absence of an OSHA limit for this substance. The Agency preliminarily concludes that this limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for cobalt hydrocarbonyl. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIAZINON
CAS: 333-41-5; Chemical Formula: $C_{12}H_{21}N_2O_3PS$
H.S. No. 1118

OSHA currently has no limit for diazinon. The ACGIH recommends a TLV-TWA of 0.1 mg/m³, with a skin notation. Pure diazinon is a colorless liquid, but the technical grade is pale yellow to dark brown in color and has a faint odor.

Gaines reports the acute oral LD_{50} for male and female rats to be 108 and 76 mg/kg, respectively (1960). Other reports set the acute oral LD_{50}'s in rats, guinea pigs, and rabbits at 76 to 150, 240 to 320, and 130 mg/kg, respectively (Pesticide Chemicals Official Compendium 1969). Hazleton Laboratories (1965) and Radeleff (1958) have shown much greater susceptibility to diazinon in birds and calves, with the oral LD_{50} being less than 10 mg/kg in some instances. However, susceptibility to repeated doses is relatively consistent among species, with dogs showing signs of poisoning at 9 3 mg/kg per day and rats showing complete inhibition of red blood cell cholinesterase and marked inhibition of brain cholinesterase at 50 mg/kg/day (Bruce, Howard, and Elsea 1955). Monkeys were poisoned at 5 mg/kg/day (Woodard and Cronin 1963). Chronic feeding studies in rats have shown no chronic toxicity at 10, 100, and 1000 ppm. For many mammals, diazinon is less toxic than parathion (ACGIH TLV-TWA of 0.1 mg/m³), although this is not true under some circumstances (ACGIH 1986, p. 172).

In humans, Hayes reports that two patients were poisoned by a dermal diazinon dosage of about 1.1 mg/kg (1963); however, Gassman (1957) reports no ill effects from an accidental ingestion of 30 mg/kg. One man received a dose of 250 mg/kg and recovered after treatment, which included gastric lavage (Bockel 1967). In tests, Geigy (1966) found that a series of doses of 0.05 mg/kg/day for 28 days produced plasma cholinesterase inhibition, and it has been suggested that the no-effect level for cholinesterase inhibition in humans is 0.02 mg/kg/day. Skin absorption of diazinon occurs readily, and overexposures are associated with weakness, headache, blurred vision, salivation, sweating, nausea, vomiting, diarrhea, abdominal cramps, slurred speech, and moist rales in the lungs (ACGIH 1986, p. 172).

The Agency is proposing an 8-hour TWA PEL of 0.1 mg/m³, with a skin notation, for diazinon. The Agency preliminarily concludes that these limits will protect exposed workers from the risk of cholinesterase inhibition, weakness, headache, nausea, vomiting, and the other symptoms and signs of diazinon poisoning resulting either from ingestion or dermal absorption at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for diazinon. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

1,1-DICHLORO-1-NITROETHANE
CAS: 594-72-9; Chemical Formula: $CH_3CCl_2NO_2$
H.S. No. 1121

OSHA currently has a ceiling limit of 10 ppm for 1,1-dichloro-1-nitroethane. The ACGIH recommends a TLV-TWA of 2 ppm for this colorless liquid.

Toxicity data on 1,1-dichloro-1-nitroethane are largely derived from the 1945 studies conducted by Machle and co-workers. These scientists reported that both rabbits and guinea pigs died from inhaling vapors at 100 ppm for 6 hours; at a concentration of 60 ppm, the animals survived a 2-hour exposure.

Four-hour inhalation exposures at 34 ppm and 6-hour daily exposures at 25 ppm for a total of 204 hours also did not kill rabbits or guinea pigs. Skin and mucous membrane irritation was not produced at the 25 ppm exposure level. At survival concentrations, the primary targets of toxicity were the lungs, which showed edema, congestion, hemorrhage, and acute bronchitis. At lethal exposures, these investigators observed acute myocardial degeneration with interstitial edema, cloudy swelling of the liver with cellular degeneration, and tubular degeneration and interstitial edema of the kidney, as well as edema of the tufts of the glomeruli and kidney necrosis. The compound was also found to be a severe skin irritant when two applications were applied on 2 successive days (Machle, Scott, Treon et al. 1945).

OSHA is proposing a PEL of 2 ppm TWA for 1,1-dichloro-1-nitroethane. The Agency preliminarily concludes that this limit will protect workers against the risk of irritation, lung injury, and liver and kidney damage that exists at the current permissible exposure limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 1,1-dichloro-1-nitroethane if the Agency determines that this limit will substantially reduce significant risk.

p-DICHLOROBENZENE
CAS: 106-46-7; Chemical Formula: $C_6H_4Cl_2$
H.S. No. 1125

OSHA currently has an 8-hour 75 ppm TWA limit for p-dichlorobenzene. The ACGIH recommends a limit of 75 ppm TWA and a STEL of 110 ppm for this white crystalline material, which has a camphor-like odor. The ACGIH's limit recognizes that the para isomer is somewhat less toxic than the ortho isomer, for which the ACGIH has established a ceiling limit of 50 ppm.

In animal studies, an injection of 0.005 gram in rats caused slight liver necrosis (Cameron and Thomas 1937). The intraperitoneal injection LD_{50} for rats has been reported as 2562 mg/kg (Zupko and Edwards 1949). The oral LD_{50} in mice is 2950 mg/kg (Domenjoz 1946); for rats, the oral LD_{50} is 2512 mg/kg (Varshavskaya 1970). Rabbits fed a daily dietary exposure of 5 grams developed opacity of the lens in 3 weeks (Berliner 1939); this finding was not confirmed, however, in repeated studies (Pike 1944).

Reports of a human inhalation exposure to unspecified levels of p-dichlorobenzene describe swelling of the feet, ankles, and hands after day-long use of a moth proofing agent consisting of this substance (Claytor 1935). Other reports describe cataracts caused by exposure to unspecified concentrations of the vapor of p-dichlorobenzene (Berliner 1939). Petit and Champaix (1948) report the case of a woman who experienced tingling of the hands, vertigo, and loss of weight from working for 18 months with a mixture of 90 parts p-dichlorobenzene and 10 parts hexachloroethane (airborne concentration not specified).

OSHA is proposing a PEL of 75 ppm TWA and a STEL of 110 ppm for p-dichlorobenzene. The Agency preliminarily concludes that both a TWA and a STEL are necessary to protect exposed workers from the risk of eye damage, vertigo, and neuropathic effects potentially associated with occupational exposure to p-dichlorobenzene. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for p-dichlorobenzene if the Agency determines that this limit will substantially reduce significant risk.

DICHLOROFLUOROMETHANE
CAS: 75-43-4; Chemical Formula: $CHCl_2F$
H.S. No. 1128

OSHA currently has a limit of 1000 ppm TWA for dichlorofluoromethane (FC-21). The ACGIH recommends a TLV-TWA of 10 ppm for this colorless gas. FC-21 is considered more toxic than the related difluorinated methanes. The major health hazards associated with exposure to this substance are liver damage, cardiac sensitization, and narcosis.

Freon-21 has a 4-hour LC_{50} of 49,900 ppm in rats (Tappan and Waritz 1964, as cited in ACGIH 1986, p. 187). Within an hour, exposure to 100,000 ppm killed rats and guinea pigs (Weigand 1971); other tests with guinea pigs and mice demonstrated that concentrations of 50,000 ppm and higher cause unconsciousness or death (Nuckolls 1935, as cited in ACGIH 1986, p. 187; Booth and Bixby 1932). The clinical signs of overexposure include loss of coordination, tremors, narcosis, and prostration, as well as possible lung and liver changes (Tappan and Waritz 1964).

Two-week exposures of rats to 10,000 ppm for 6 hours daily caused hepatic failure or marked liver damage (Trochimowicz, Moore, and Chiu 1977). A series of 90-day exposures of rats and dogs to concentrations of 1000 and 5000 ppm dichlorofluoromethane resulted in bilateral hair loss, cirrhosis, and excessive mortality in rats at both exposure levels; dogs exhibited weight loss at both levels, but mild liver changes were observed only at the 5000-ppm level (Trochimowicz, Lyon, Kelly, and Chiu 1977). Another uncompleted study reported liver pathology in rats repeatedly exposed for 90 days at 500 ppm, and probable liver pathology from similar exposures to 200 ppm; no hepatic effects were observed after exposure to 50 ppm (Allied Chemical Company 1978, as cited in ACGIH 1986, p. 187).

Two of 12 dogs exposed to 10,000 ppm FC-21 plus intravenous epinephrine developed serious arrhythmia (Mullin, as cited in ACGIH 1986, p. 187). Dogs and monkeys (anesthetized) demonstrated tachycardia and hypotension after exposure to FC-21 levels between 50,000 and 100,000 ppm; bronchoconstriction was observed at 25,000 ppm (Aviado and Smith 1975; Belej and Aviado 1975). Anesthetized mice exposed to a concentration of 100,000 ppm FC-21 showed arrhythmia and cardiac sensitization to epinephrine (Aviado and Belej 1974). Pre-implantation loss has been reported in pregnant rats exposed to FC-21 at 10,000 ppm on days 6 to 15 of gestation (Belej and Aviado 1975).

OSHA proposes a TWA limit of 10 ppm for dichlorofluoromethane. The Agency preliminarily concludes that this limit will protect workers against the risks of hepatotoxic effects, cardiac sensitization, and narcosis that have been shown to exist as a consequence of exposure to this substance at levels substantially below the current OSHA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for dichlorofluoromethane if the Agency determines that this limit will substantially reduce significant risk.

DIETHYL KETONE
CAS: 96-22-0; Chemical Formula: $C_2H_5COC_2H_5$
H.S. No. 1135

OSHA currently has no limit for diethyl ketone. The ACGIH recommends a limit of 200 ppm TWA for this colorless liquid, which has an acetone-like odor.

The oral LD_{50} for diethyl ketone in rats is reported to be 2.14 g/kg. Four of six rats died when exposed to diethyl ketone for 4 hours at 8000 ppm (Smyth et al. 1954). In general, the toxicities of the methyl ketones increase with increasing molecular weight; diethyl ketone is somewhat less toxic than is methyl propyl ketone (NIOSH 1978). All of the ketones cause mucous membrane and eye and skin irritation.

OSHA is proposing an 8-hour TWA PEL of 200 ppm for diethyl ketone, the same limit being proposed for methyl

propyl ketone. The Agency preliminarily concludes that this limit will reduce the risk of eye and skin irritation associated with exposure to diethyl ketone in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for diethyl ketone. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIETHYLENE TRIAMINE
CAS: 111–40–0; Chemical Formula: $(NH_2CH_2CH_2)_2NH$
H.S. No. 1138

OSHA currently has no limit for diethylene triamine (DETA). The ACGIH recommends a TLV–TWA of 1 ppm, with a skin notation, for this strongly alkaline, hygroscopic, and somewhat viscous yellow liquid that smells like ammonia.

The acute intraperitoneal LD_{50} values for DETA are reported to be 71 and 74 mg/kg for the mouse and rat, respectively (Hine 1958). In the rat, the reported oral and percutaneous LD_{50} values are the same (1080 mg/kg); the dermal LD_{50} for the rabbit is 1090 mg/kg (Smyth et al. 1949). Exposure to 300 ppm of diethylene triamine vapor for 8 hours failed to kill any of a group of exposed rats (Savitt 1955).

Sutton (1963) has reported that DETA causes severe corneal injury; solutions of 15 to 100 percent caused lasting corneal damage. If improperly controlled, the vapor and liquid cause sensitization of the respiratory tract and skin (American Industrial Hygiene Association 1960). Dernehl demonstrated such sensitization in a study reported in 1951.

OSHA proposes an 8-hour TWA limit of 1 ppm, with a skin notation, for diethylene triamine. The Agency preliminarily concludes that these limits will protect workers against the risk of skin and respiratory tract irritation and sensitization potentially associated with exposure to diethylene triamine in the absence of any OSHA PEL. The skin notation is necessary to reduce the risk of skin sensitization resulting from contact with this substance. The health evidence forms a reasonable basis for proposing a new limit for diethylene triamine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIPROPYL KETONE
CAS: 123–19–3; Chemical Formula: $(CH_3CH_2CH_2)CO$
H.S. No. 1148

OSHA currently has no limit for dipropyl ketone. The ACGIH recommends a TLV of 50 ppm TWA for this colorless liquid with a penetrating odor.

Dipropyl ketone has a moderate oral and inhalation toxicity (Sax 1984). In rats, the oral LD_{50} is 3.73 g/kg. Tests have indicated that rats inhaling 2000 ppm for 4 hours survived, but at 4000 ppm all animals died (Carpenter, Weil, and Smyth 1974). Methyl isobutyl ketone (MIBK) has a similar acute toxicity (OSHA is proposing a 50-ppm 8-hour TWA and a 75-ppm STEL for MIBK) (ACGIH 1986, p. 221).

OSHA is proposing a PEL of 50 ppm TWA for dipropyl ketone. The Agency preliminarily concludes that this limit is necessary to protect workers from the adverse health effects that could occur from the uncontrolled exposures permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for dipropyl ketone. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIQUAT
CAS: 85–00–7; Chemical Formula: $C_{12}H_{12}Br_2N_2$
H.S. 1150

OSHA currently has no limit for diquat. The ACGIH recommends a limit of 0.5 mg/m³ TWA for these yellow crystals.

In most species, the acute oral toxicity of diquat is similar to that of paraquat and ranges from 100 to 400 mg/kg in rats, mice, rabbits, and dogs. Cows experience more severe toxic effects, with an acute oral LD_{50} of 30 mg/kg. The 24-hour percutaneous LD_{50} in rabbits is greater than 400 mg cation/kg; no skin irritation or other ill effects were demonstrated at this level (Clark and Hurst 1970; Rowe and Wright 1965). Rats fed 1000 ppm daily (about 50 mg/kg/day) for 2 years survived; reduced food intake and growth were the only consequences observed. At 500 ppm (about 25 mg/kg/day), the only ill effect observed was a pathologic change in the eye. A dietary level of 10 ppm (about 0.5 mg/kg/day) for 2 years did not induce cataract formation, but cataracts do occur at higher levels, with pathology observed at the 500-ppm level; one in four animals demonstrated complete corneal opacity in one or both lenses after 6 months at the 1000-ppm level. Cataract formation requires prolonged exposure and is not induced by single high-level exposures (ACGIH 1986, p. 222).

Unlike paraquat, diquat does not produce lung damage in human or animal exposures. Acute poisoning may produce nonspecific respiratory distress as well as other nonspecific signs of poisoning. In humans, accidental ingestion has shown less toxic reactions than those associated with paraquat (Orepoulos and McEvoy 1969).

OSHA is proposing a PEL of 0.5 mg/m³ TWA for diquat. The Agency preliminarily concludes that this limit will protect against the risk of ocular problems associated with chronic exposure at the exposure levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for diquat. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DISULFOTON
CAS: 298–04–4: Chemical Formula: $C_8H_{19}O_2PS_3$
H.S. No. 1152

OSHA currently has no exposure limit for disulfoton. The ACGIH recommends a limit of 0.1 mg/m³ TWA for this substance. Pure disulfoton is an oily, colorless liquid; the technical grade is a brown liquid.

The acute toxicity of disulfoton is very high by all laboratory-tested routes of administration. For weanling rats, the intraperitoneal LD_{50} is reported to be 5.4 mg/kg; for adult rats, it is 9.4 mg/kg (Brodeur and Dubois 1963). The acute dermal LD_{50} is 6 mg/kg for adult female rats and 25 mg/kg for adult male rats (Gaines 1969). The acute oral LD_{50}s for male and female rats are reported as 6.8 mg/kg and 2.3 mg/kg, respectively (Brodeur and Dubois 1964). Rats have demonstrated an acquired tolerance for disulfoton (Brodeur and Dubois 1964).

Metabolically, disulfoton is highly fat-soluble, and the compound apparently interferes with mixed-function oxidase activity in the same manner shown to be the case for parathion; with respect to median lethal doses, parathion and disulfoton are similar (Stevens et al. 1973).

OSHA proposes an 8-hour TWA PEL for disulfoton of 0.1 mg/m³. The Agency preliminarily concludes that this limit will prevent the risk of acute toxicity and metabolic injury possible in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for disulfoton. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIVINYL BENZENE
CAS: 108–57–6; Chemical Formula: $C_6H_4(CHCH_2)_2$
H.S. No. 1154

OSHA currently has no limit for divinyl benzene. The ACGIH

recommends a TLV–TWA of 10 ppm. The commercial grade of divinyl benzene is a straw-colored liquid; it contains all three isomers, but the meta isomer predominates.

Divinyl benzene has low acute toxicity. The oral LD_{50} for rats is reported to be 4.1 g/kg, and an acute inhalation study showed no ill effects from a single 7-hour exposure at 351 ppm. However, repeated or prolonged contact with the liquid may cause skin burns (Dow Chemical Company, as cited in ACGIH 1986, p. 228).

Industrial experience indicates that mild irritation of the respiratory system, skin, and eyes can result from inhalation exposures, but there are no data concerning chronic exposures in humans.

OSHA is proposing a PEL of 10 ppm TWA for divinyl benzene. The Agency preliminarily concludes that this limit will prevent the risk of irritation to the respiratory tract, eyes, and skin potentially associated with exposure to divinyl benzene in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for divinyl benzene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ENDOSULFAN
CAS: 115–29–7; Chemical Formula: $C_9H_6Cl_6O_3S$
H.S. No. 1156

OSHA currently has no permissible exposure limit for endosulfan. The ACGIH recommends a TLV–TWA of 0.1 mg/m^3, with a skin notation. Technical endosulfan is a tan, semi-waxy solid mixture; it may have a slight odor similar to that of sulfur dioxide.

The insecticide, endosulfan, is similar in its acute oral toxicity to the related insecticides aldrin and dieldrin, with the exception that it is slightly more toxic than these substances in female laboratory animals. In rats, the oral LD_{50} of endosulfan is 43 mg/kg for males and 18 mg/kg for females (Farm Chemicals Handbook 1974). The dermal LD_{50}s in male and female rats are 130 mg/kg and 74 mg/kg, respectively (Farm Chemicals Handbook 1974). The respiratory LC_{50} for male rats is 50 mg/kg for 4 hours of exposure (Pesticide Chemicals Official Copendium, as cited in ACGIH 1986, p. 230).

In laboratory tests of chronic exposure, rats tolerated oral doses of up to 3.2 mg/kg/day for 3 months without injury (Gaines, as cited in ACGIH 1986, p. 230), and dogs tolerated doses up to 0.75 mg/kg for 1 year (Ely, MacFarlane, Galen, and Hines 1967). A 2-year dietary level of 10 ppm (approximately 0.5 mg/kg/day) in rats was associated with a statistically insignificant decline in female survival rates and caused a reduction in testis weights in males. At 5.0 mg/kg/day, histopathologic findings showed renal tubular damage and some hydropic changes in rat livers (Czech 1958).

Inhalation of endosulfan dust has been associated with slight nausea, confusion, excitement, flushing, and dry mouth (State of California: Department of Industrial Relations, as cited in ACGIH 1986, p. 230). Nine employees who had been working with 50-percent water-wettable endosulfan powder for only a few days had convulsions (Pesticide Chemicals Official Compendium, as cited in ACGIH 1986, p. 230).

OSHA preliminarily concludes that exposure to endosulfan poses a risk of systemic poisoning and renal and testicular damage, and the Agency therefore proposes a PEL of 0.1 mg/m^3 TWA for endosulfan. OSHA believes that this limit will substantially reduce the risk currently associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for endosulfan. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FONOFOS
CAS: 944–22–9; Chemical Formula: $C_{10}H_{15}OPS_2$
H.S. No. 1181

OSHA currently has no limit for fonofos. The ACGIH recommends a limit of 0.1 mg/m^3 TWA, with a skin notation, for this light-yellow liquid.

In male rats, the average acute oral LD_{50} of technical fonofos has been reported to be 13.2 mg/kg (Stauffer Chemical Co., as cited in ACGIH 1986, p. 275). For female rats, an average oral LD_{50} of 3 mg/kg has been reported (NIOSH 1974). The acute dermal LD_{50}s reported for rats and guinea pigs are 147 and 278 mg/kg, respectively (Weir and Hazleton 1981). Weir and Hazleton reported that no localized eye irritation occurred when 0.1 ml of technical fonofos was instilled into rabbit eyes; however, death resulted in these animals within 24 hours after the instillation (1981). Dietary studies of rats lasting 105 weeks have shown 10 ppm (about 0.2 mg/kg) to be a no-effect level. Dogs fed fonofos for 14 weeks showed no-effect dietary levels of 8 ppm; no carcinogenic effects were observed. Rats showed reproductive effects at dietary levels of 10 ppm and 31.6 ppm (about 0.7 mg/kg) (Stauffer Chemical Co., as cited in ACGIH 1986, p. 275).

There are no reports of human poisonings caused by fonofos, although it is known to be a cholinesterase inhibitor (ACGIH 1986, p. 275).

OSHA is proposing a PEL of 0.1 mg/m^3 TWA for fonofos to protect exposed workers from the risk of cholinesterase inhibition that is characteristic of this substance and of other organic phosphate pesticides. A skin notation is also proposed, based on evidence in animals that fonofos can penetrate the skin and cause death. The Agency preliminarily concludes that these limits will reduce the risk to which workers could be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for fonofos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FORMAMIDE
CAS: 75–12–7; Chemical Formula: CH_3NO
H.S. No. 1182

OSHA currently has no limit for formamide. The ACGIH recommends a TLV–TWA of 20 ppm and a TLV–STEL of 30 ppm for this clear, viscous, odorless liquid.

Formamide has a low oral toxicity, with an LD_{50} of approximately 6 g/kg for rats (Thiersh 1962; Zaeva et al. 1969). Dietary administration at 1.5 g/kg for 2 weeks resulted in fatalities in rats; pathologic examination revealed cumulative changes characteristic of gastritis and malnutrition (E.I. du Pont de Nemours and Company, as cited in ACGIH 1986, p. 278). Czajkowska (1981) reports the dermal LD_{50} for skin absorption in rabbits as 6 g/kg; Sturla and Krauss (1977) report the approximate lethal dose in rabbits to be greater than 17 g/kg. Mild and transient irritation, but no allergic skin sensitization, occurred when formamide was applied to the skin of guinea pigs (Sax 1984; E.I. du Pont de Nemours and Company, as cited in ACGIH 1986, p. 278). However, the potential for systemic toxicity through skin absorption has been demonstrated in tests with rats, although effective doses were relatively high (BASF Corporation 1985, as cited in ACGIH 1986, p. 278). Eye irritation tests in rabbits showed only slight, temporary irritation (Carpenter and Smyth 1956). No signs of toxicity in rats were detected in single 6-hour exposures at 3900 ppm formamide dispensed as a mist, or in 6-hour daily exposures for 10 days at approximately 1500 ppm formamide vapor (equivalent

to air saturated with formamide at room temperature); no indications of organ damage were seen in these animals on pathologic examination (E.I. du Pont de Nemours and Company, as cited in ACGIH 1986, p. 278).

Gross fetal malformations were not noted following dermal applications of formamide to skin of pregnant rats; the effects that were observed were weak and were produced at overwhelming concentrations (Stula and Krauss 1977). The no-observed-effect level in a rabbit developmental toxicity study was 22 mg/kg orally (Merkle and Zeller 1980).

There are no reports of industrial poisoning by formamide (E.I. du Pont de Nemours and Company, as cited in ACGIH 1986, p. 278).

OSHA is proposing a PEL of 20 ppm TWA and a 15-minute STEL of 30 ppm for formamide. The Agency preliminarily concludes that this combined limit will protect workers against the risk of eye and skin irritation that exists potentially from workplace exposure at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for formamide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

GERMANIUM TETRAHYDRIDE
CAS: 7782-65-2; Chemical Formula: GeH_4
H.S. No. 1186

OSHA currently has no limit for germanium tetrahydride. The ACGIH recommends a TLV of 0.2 ppm TWA for this colorless gas.

An early study indicated that germanium tetrahydride has a toxicity between that of tin hydride and arsine (Flury and Zernik 1931). In this study, a rabbit survived exposure to 100 ppm for 1 hour. One-hour exposures at 150 and 185 ppm caused fatalities in mice, and a similar exposure involving guinea pigs resulted in sickness at the 150 ppm level and death at 185 ppm (Flury and Zernik 1931). On the other hand, Webster (1956) reported that germanium tetrahydride is less toxic than both tin hydride and arsine. The effect of exposure to germanium tetrahydride is hemolysis. Data concerning chronic or sub-acute toxicities are not available. Based on germanium's acute toxicity, which is approximately half that of stibine, the ACGIH recommends an 8-hour TLV of 0.2 ppm TWA.

OSHA proposes a PEL of 0.2 ppm as an 8-hour TWA for germanium tetrahydride to reduce the risk of hemolytic effects associated with exposure to this substance at the previous uncontrolled level. The Agency preliminarily concludes that implementation of this limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for germanium tetrahydride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

INDENE
CAS: 95-13-6; Chemical Formula: C_9H_8
H.S. No. 1212

OSHA has no current limit for indene. The ACGIH recommends a TLV-TWA of 10 ppm for this colorless liquid. This limit is recommended by analogy to naphthalene, for which a TLV-TWA of 10 ppm is recommended.

Early inhalation studies of indene reported injury to the spleen, liver, and kidneys of rats exposed to indene vapor concentrations of 800 to 900 ppm for six 7-hour periods (Cameron and Doniger 1939). Some animals were found at necropsy to have severe necrosis of the liver with hemorrhage; kidney necrosis was also observed. No other organ damage was found and no deaths occurred as a result of these exposures (Cameron and Doniger 1939). By analogy with the effects of exposure to other monoaromatic hydrocarbons, exposure to indene is likely to irritate the mucous membranes. In laboratory animals, chemical pneumonitis, pulmonary edema, and hemorrhage have resulted from the aspiration of indene liquid into the lung, and repeated skin contact has caused dermatitis as a result of the defatting properties of indene (Gerarde 1960). In dermal studies of rats, one to eight applications of 0.1 ml to the shaved skin were reported to have no effect; three applications of 0.5 ml to guinea pig skin also produced no effect (Cameron and Doniger 1939). The oral toxicity of indene appears to be moderate, with adult rabbits tolerating a single dose of 1 gram without signs of systemic toxicity (Gerarde 1960). Subcutaneous injection of 1 gram, however, caused liver pathology and fatalities; high oral doses (2.5 ml of a 1:1 v/v mixture in olive oil) were uniformly fatal, with characteristic liver, lung, and gastrointestinal changes. Chronic administration of 3 mg/m^3 indene for 105 days caused catalase inhibition and stimulation of blood cholinesterase in rats, but no effects were observed in rats exposed at 0.6 mg/m^3 (Dyshinevich, as cited in ACGIH 1986, p. 321).

OSHA is proposing a PEL of 10 ppm TWA for indene. The Agency preliminarily concludes that this level will reduce the risk of irritation, pulmonary effects, and systemic toxicity that may occur when workers are exposed to indene at the levels permitted by the absence of any OSHA permissible exposure limit. The health evidence forms a reasonable basis for proposing a new limit for indene. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

IODOFORM
CAS: 75-47-8; Chemical Formula: CHI_3
H.S. No. 1214

OSHA has no current limit for iodoform. The ACIGH has established an 8-hour TWA limit of 0.6 ppm for this yellow-green powder or crystalline solid with a pungent odor.

The subcutaneous LD_{50} for rabbits is 50 mg/kg, and the oral LD_{LO} for iodoform in dogs is 1000 mg/kg (Kutob and Plaa 1962). These authors also report that, on a molar basis, iodoform has an acute toxicity in mice similar to that of methyl iodide; this conclusion is based on parameters of lethality, barbiturate sleeping time, and bromsulphalein (BSP) retention time. An NCI bioassay (1978a) of iodoform indicates that the substance is not carcinogenic nor of high systemic toxicity, although histopathological examination of laboratory animals was inadequate.

No human data are available for this compound.

OSHA is proposing an 8-hour TWA limit of 0.6 ppm for iodoform, based on the proposed limit for methyl iodide (2 ppm TWA); these limits are comparable on a molar iodine basis. The health evidence forms a reasonable basis for proposing a new limit for iodoform. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ISOBUTYL ALCOHOL
CAS: 78-83-1; Chemical Formula: $(CH_3)_2CHCH_2OH$
H.S. No. 1219

OSHA currently has a limit of 100 ppm as an 8-hour TWA for isobutyl alcohol. The ACGIH recommends a limit of 50 ppm TWA for this flammable, refractive, colorless liquid.

Limited inhalation studies have reported a somewhat higher acute toxicity for isobutyl alcohol than for n-butyl alcohol (which has an ACGIH ceiling of 50 ppm) (Smyth, Carpenter, and Weil 1951; Smyth, Carpenter, Weil, and Pozzani 1954). A 4-hour LC_{50} of 8000 ppm has been reported in rats for isobutyl alcohol. Ingestion studies in rabbits have reported an acute oral toxicity of 3.75 g/kg for isobutyl alcohol (Smyth, Carpenter, and Weil 1951; Smyth, Carpenter, Weil, and Pozzani

1954). The dermal LO_{50} is 4.2 g/kg (Stokinger 1976). Weese (1928) reported that the narcotic inhalation dose over a total of 136 hours is 6400 ppm in mice. Slight changes in the liver and kidneys were reported, but no fatalities occurred after repeated narcotizing doses (Weese 1928).

The effects of liquid isobutyl alcohol on the human eye appear to be comparable to those of n-butanol; no data are available on ocular exposure to the isobutyl alcohol vapor. Dermal application of isobutyl alcohol has caused slight erythema and hyperemia in humans (Schwartz and Tulipan 1939; Oettel 1936).

OSHA is proposing to reduce the current 8-hour TWA PEL of 100 ppm to 50 ppm for isobutyl alcohol. The Agency preliminarily concludes that a 50-ppm limit will reduce the risk of skin irritation associated with exposures to concentrations below those permitted by the current OSHA PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for isobutyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

ISOOCTYL ALCOHOL
CAS: 26952-21-6; Chemical Formula:
$CH_3(CH_2)_3CH(C_2H_5)CH_2OH$
H.S. No. 1220

OSHA currently has no limit for isooctyl alcohol. The ACGIH recommends a TLV-TWA of 50 ppm, with a skin notation, for this colorless liquid mixture.

The single-dose oral LD_{50}s reported for rats and mice are between 3.2 and 6.4 g/kg; intraperitoneal injection LD_{50}s for these species range from less than 0.4 g/kg to 1.6 g/kg (Hodge 1943; Fassett, as cited in ACGIH 1986, p. 332). The dermal LD_{50} for the guinea pig is greater than 10 ml/kg (Fassett, as cited in ACGIH 1986, p. 332). Moderate skin irritation from exposure to isooctyl alcohol has also been reported. Rats and rabbits have shown skin irritation at exposure levels ranging from 1.7 to 3.34 ml/kg (Smyth et al. 1969). Fassett (as cited in ACGIH 1986, p. 332) also reported no fatalities in rats after an 8-hour inhalation test at 235 ppm.

OSHA is proposing an 8-hour TWA PEL of 50 ppm, with a skin notation, for isooctyl alcohol. The Agency preliminarily concludes that these limits will reduce the risk of skin irritation and dermal absorption potentially associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence, forms a reasonable basis for proposing a new limit for isooctyl alcohol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

n-ISOPROPYLANILINE
CAS: 643-28-7; Chemical Formula:
$C_6H_5NHCH(CH_3)_2$
H.S. No. 1229

OSHA currently has no limit for n-isopropylaniline. The ACGIH recommends a TLV-TWA of 2 ppm, with a skin notation, for this liquid.

The oral LD_{50} for rats exposed to n-isopropylaniline is between 0.25 and 0.5 g/kg. Slight irritation of the skin and eyes has been reported in animals as a result of direct contact with this chemical (Dow Chemical Company, as cited in ACGIH 1986, p. 338). No other data concerning chronic toxicity or human exposure are available (ACGIH 1986, p. 338).

Chemical analysis shows n-isopropylaniline to have toxicologic properties similar to those of its parent compound, aniline. The oral LD_{50}s for the two chemicals are approximately equal. The ACGIH has established the 2-ppm TLV-TWA for n-isopropylaniline on the basis of structural analogy with aniline (which has a 2-ppm TLV-TWA) and n,n-dimethylaniline (which has a 5-ppm TLV-TWA and a 10-ppm STEL); exposure to these substances has been shown to cause hemolytic and central nervous system effects in animals and humans. These substances are also toxic when absorbed through the skin.

OSHA is proposing an 8-hour PEL of 2 ppm for n-isopropylaniline, with a skin notation. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of irritation and, by analogy with aniline, of systemic and hemolytic effects caused by inhalation, ingestion, or dermal absorption. The health evidence forms a reasonable basis for proposing a new limit for n-isopropylaniline. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

KETENE
CAS: 463-51-4; Chemical Formula:
$CH_2=C=O$
H.S. No. 1231

OSHA has a current 8-hour TWA limit of 0.5 ppm for ketene. The ACGIH recommends a TLV-TWA of 0.5 ppm and a TLV-STEL of 1.5 ppm for this colorless gas with a sharp, penetrating odor.

Ketene is highly irritating to the respiratory tract (Mendenhall and Stokinger 1959), and the effects of its action are delayed (Treon, Sigmon, Kitzmiller et al. 1949). Mendenhall and Stokinger (1959) have reported a 10-minute LC_{50} for mice of 17 ppm. Chronic exposure at 1 ppm for 6 months on a schedule of 6 hours daily, 5 days per week, was tolerated by animals of several species (Mendenhall and Stokinger 1960, as cited in ACGIH 1986, p. 341). Similar results have been reported in monkeys exposed repeatedly (55 exposures) for 7 hours (Treon, Sigmon, Kitzmiller et al. 1949). Evidence strongly suggests that the development of emphysema and fibrosis may occur in individuals who have developed a tolerance to the acute effects of ketene exposure (Stokinger, Wagner, and Dobrogarski 1957).

OSHA proposes an 8-hour TWA PEL of 0.5 ppm and a 15-minute STEL of 1.5 ppm for ketene. The Agency preliminarily concludes that workers exposed to this highly irritating and toxic gas are at risk of developing respiratory irritation, pulmonary edema, and other severe pulmonary effects. OSHA believes that these limits will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ketene if the Agency determines that this limit will substantially reduce significant risk.

METHACRYLIC ACID
CAS: 79-41-4; Chemical Formula:
$CH_2=C(CH_3)COOH$
H.S. No. 1244

OSHA currently has no limit for methacrylic acid. The ACGIH recommends a TLV-TWA of 20 ppm for this substance. Methacrylic acid is a liquid with an acrid, disagreeable odor.

The primary toxic hazard associated with exposure to methacrylic acid is irritation, although the degree of irritation from exposure to this substance is significantly less than that from acrylic acid (ACGIH 1986, p. 362).

Direct contact of methacrylic acid with the skin or eye can cause corrosion of the skin or blindness. In rabbits, the skin absorption LD_{50} for methacrylic acid is 0.5 to 1 g/kg (Dow Chemical Company, as cited in ACGIH 1986, p. 362). Rats exposed by inhalation to approximately 1000 ppm methacrylic acid exhibited eye irritation (Dow Chemical Company, as cited in ACGIH 1986, p. 362). Rats exposed to 300 ppm for 6 hours daily for 20 days showed slight congestion of the kidneys (Gage 1970).

Medical reports of acute exposures (at concentrations of up to 113 ppm) in an industrial setting revealed no respiratory symptoms; however, skin responses and a severe corneal burn

were reported (Dow Chemical Company, as cited in ACGIH 1986, p. 362).

OSHA is proposing a PEL of 20 ppm as an 8-hour TWA for this substance. The Agency preliminarily concludes that this limit will protect workers from the risk of severe eye and skin irritation potentially associated with exposure to methacrylic acid at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methacrylic acid. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

4-METHOXYPHENOL
CAS: 150-76-5; Chemical Formula: $CH_3OC_6H_4OH$
H.S. No. 1247

OSHA currently has no limit for 4-methoxyphenol. The ACGIH recommends a TLV-TWA of 5 mg/m³ for this solid substance.

In rats, the oral LD_{50} for 4-methoxyphenol is between 1 and 2 g/kg; the skin absorption LD_{50} is reported as greater than 1 g/kg in rabbits. Results of a 2-month dietary study demonstrated no ill effects at 0.1 ppm (approximately 50 mg/kg/day). Direct contact of 4 methoxyphenol with the skin or eyes causes burns or moderate corneal damage (Hodge et al. 1949; Dow Chemical Co., as cited in ACGIH 1986, p. 367).

To reduce the risk of dermal and ocular effects resulting from exposure to 4-methoxyphenol, a compound similar in chemical structure and toxicity to hydroquinone, OSHA is proposing a permissible exposure limit of 5 mg/m³ TWA. The Agency preliminarily concludes that this limit will protect workers against the risk of dermal and skin effects potentially associated with exposures to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for 4-methoxyphenol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL ACETYLENE-PROPADIENE MIXTURE (MAPP)
CAS: 74-99-7; 463-49-0; Chemical Formula: C_3H_4 isomers
H.S. No. 1250

OSHA currently has a standard of 1000 ppm TWA for MAPP. The ACGIH also recommends an 8-hour TWA limit of 1000 ppm, with a TLV-STEL of 1250 ppm. MAPP contains 58 percent of a mixture of propadiene (a colorless, unstable gas with a strong, unpleasant odor) and methyl acetylene (a colorless gas with a sweet odor); the balance of the mixture consists of paraffinic and olefinic C_3 and C_4 hydrocarbons.

Tests of rabbits, dogs, and guinea pigs exposed to an average concentration of 5000 ppm for 7 hours/day, 5 days/week for 4 months resulted in no adverse health effects except decreased lung weights. No changes at all were observed in animals exposed to 1000 ppm for 4 months (Dow Chemical Co., as cited in ACGIH 1986, p. 368).

On the basis of these data, which show MAPP to be a chemical mixture of low toxicity in experimental animals, the Agency proposes a PEL of 1000 ppm and a STEL of 2250 ppm. The Agency preliminarily concludes that both of these limits are necessary to ensure that workers are protected and that good industrial hygiene practice is maintained. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for MAPP if the Agency determines that this limit will substantially reduce significant risk.

METHYL DEMETON
CAS: 8022-00-2; Chemical Formula: $(CH_3O)_2PSO(CH_2)_2SC_2H_5$
H.S. No. 1256

OSHA currently has no limit for methyl demeton. The ACGIH recommends a TLV-TWA limit of 0.5 mg/m³, with a skin notation. Methyl demeton is an oily, colorless to pale-yellow liquid with an unpleasant odor.

Methyl demeton is reported to have an oral LD_{50} value of 40 to 65 mg/kg for the thiolo isomer and 150 to 250 mg/kg for the thiono isomer. Both isomers form sulfoxide or sulfone, with an oral LD_{50} similar to that of the parent compounds (Dubois and Plazak 1962; Heath and Vandekar 1965; Klimmer and Plaff 1955). In solution or storage, methyl demeton may form alkyl sulfonium compounds of very high intravenous toxicity and an oral LD_{50} of 10 to 20 mg/kg. Dermal toxicity is reported to be moderate, with an LD_{50} of approximately 400 mg/kg (Heath and Vandekar 1965).

In humans, methyl demeton causes changes in intraocular pressure, and acute poisonings produce nausea, headache, dizziness, vomiting, and hyperemia of the nasal mucosa. Chronic exposure causes hyperemia of the respiratory organs and inner ear irritation (Dugel'nyy 1971; Rasuleva 1970).

OSHA is proposing an 8-hour TWA for methyl demeton of 0.5 mg/m³, with a skin notation. The Agency preliminarily concludes that this limit will protect workers from the risk of ocular and nasal irritation and pulmonary effects potentially associated with exposure to this substance at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methyl demeton. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL ETHYL KETONE PEROXIDE
CAS: 1338-23-4; Chemical Formula: $C_8H_{16}O_4$ or $C_8H_{18}O_6$
H.S. No. 1257

OSHA currently has no limit for methyl ethyl ketone peroxide (MEKP). The ACGIH recommends a ceiling limit of 0.2 ppm. MEKP is sold commercially as a colorless liquid mixture of approximately 60 percent MEKP and 40 percent diluent to reduce MEKP's sensitivity to shock.

In mice and rats, the 4-hour LC_{50}s for MEKP have been reported to be 170 ppm and 200 ppm, respectively; by intraperitoneal injection, the LD_{50} in rats is 65 mg/kg, and the oral LD_{50} in this species is 484 mg/kg (Floyd and Stokinger 1958). The same authors report that MEKP is irritating to the eyes and skin. In addition, the effects of MEKP exposure are cumulative; rats died or showed marked evidence of cumulative effects both orally and intraperitoneally after 7 weeks of 3-day/week doses of MEKP that were 20 percent of the LD_{50} level (Floyd and Stokinger 1958). Inhalation of vapors produced petechial and gross hemorrhages of the lungs in rats after 4-hour exposures; liver and kidney damage was also observed by these authors. Acute high-level exposures have caused nasal porphyrin exudate in rats. Although MEKP caused methemoglobin formation in rats, low-level chronic exposures did not cause this effect (Floyd and Stokinger 1958).

OSHA is proposing a ceiling limit of 0.2 ppm for methyl ethyl ketone peroxide. The Agency preliminarily concludes that this limit will protect workers against the risk of eye and skin irritation, kidney and liver damage, and the cumulative effects potentially associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methyl ethyl ketone peroxide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL FORMATE
CAS: 107-31-3; Chemical Formula: $HCOOCH_3$
H.S. No. 1258

OSHA has a current limit of 100 ppm TWA for methyl formate. The ACGIH also recommends an 8-hour time-weighted average of 100 ppm, with a TLV–STEL of 150 ppm. Methyl formate is a flammable, colorless liquid with an agreeable odor.

Methyl formate causes nose and eye irritation, vomiting, incoordination, narcosis, and death in guinea pigs exposed at high concentrations (Schrenk, Yant, Chornyak, and Patty 1936). A 5-percent concentration was fatal in 20 to 30 minutes, a 1.5- to 2.5-percent concentration was dangerous in 30 to 60 minutes, and a 0.5-percent concentration (5000 ppm) was considered the maximum concentration tolerable for a 60-minute period without serious consequences. Lehmann and Flury (1943) observed that inhalation of 1.02 percent methyl formate for 2 to 3 hours caused pulmonary edema and death in cats; a concentration of 1600 ppm resulted in lung inflammation after 1 hour (1943). Guinea pigs died when exposed by inhalation to 2.5 percent methyl formate (Lehmann and Flury 1943).

In studies of methyl formate exposure in humans, van Oettingen reported that exposed workers showed temporary blindness, narcosis, mucous membrane irritation, and dyspnea (1959). Fairhall (1957) has reported that methyl formate was more irritating than either methyl or ethyl acetate (1957).

OSHA is proposing both a 15-minute STEL of 150 ppm and an 8-hour PEL of 100 ppm TWA to prevent the risks of irritation, narcotic effects, and pulmonary damage potentially associated with exposure to concentrations of methyl formate even for short periods (one hour or more). The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl formate if the Agency determines that this limit will substantially reduce significant risk.

METHYL IODIDE
CAS: 74–88–4; Chemical Formula: CH_3I
H.S. No. 1259

OSHA currently has a limit of 5 ppm TWA, with a skin notation, for methyl iodide. The ACGIH recommends a TLV–TWA limit of 2 ppm, with a skin notation, for methyl iodide, and classifies it as a suspected human carcinogen (A2). NIOSH recommends reducing exposure to the lowest feasible limit, and also considers this chemical a carcinogen. Methyl iodide is a colorless, sweet-smelling liquid that turns yellow, red, or brown when exposed to light and moisture.

Methyl iodide has been reported to have an LD_{50} in rats of 150 to 200 mg/kg; liver damage was evident after these lethal exposures (Kutob and Plaa 1960). Fifteen-minute exposures to 3800 ppm were fatal in rats (Chambers et al. 1950, as cited in ACGIH 1986, p. 399), and Bachem (1927, as cited in ACGIH 1986, p. 399) has reported that methyl iodide is 6 times as toxic in mice as methyl bromide. Inhalation studies have shown eye irritation and depressed body-weight in rats as a result of 14-week exposures to 30 and 60 ppm (Black et al. 1984). The same authors observed fatalities in rats within 4 weeks of exposure to 143 ppm; 10 ppm was reported to be a no-effect level.

In industry, fatalities have occurred from methyl iodide poisoning in chemical workers (Garland and Camps 1945; Appel, Galen, O'Brien, and Schoenfeldt 1975). The exposure levels associated with these fatal overexposures are not known, however (ACGIH 1986, p. 399).

In tests of carcinogenicity, methyl iodide produced local sarcomas in rats injected subcutaneously and lung tumors in mice given intraperitoneal injections (Druckrey, Kruse, Preussman et al. 1970; Poirer, Stoner, and Shimkin 1975). These carcinogenic effects occurred at a dosage approximately equivalent to a daily 8-hour exposure to 20 or 25 ppm for an adult human (ACGIH 1986, p. 399).

OSHA proposes an 8-hour TWA limit of 2 ppm, with a skin notation, for methyl iodide. The Agency preliminarily concludes that these limits will protect workers from the risk of irritation, liver and kidney damage, and potential carcinogenicity associated with exposure to methyl iodide in the workplace. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methyl iodide if the Agency determines that this limit will substantially reduce significant risk.

METHYL ISOAMYL KETONE
CAS: 110–12–3; Chemical Formula: $CH_3COCH(C_2H_5)_2$
H.S. 1260

OSHA currently has no limit for methyl isoamyl ketone (MIAK). The ACGIH has established an 8-hour TLV–TWA of 50 ppm. NIOSH recommends a 50-ppm TWA limit for MIAK. Methyl isoamyl ketone is a colorless, clear liquid with a pleasant odor.

The oral LD_{50} value of methyl isoamyl ketone in rats is 1.67 g/kg (Smyth et al. 1962). No data relating exposure levels to specific effects in humans have been reported. However, the ACGIH (1986, p. 400) believes that MIAK is likely to be more irritating and a more potent narcotic than is the case for methyl isobutyl ketone.

The NIOSH criteria document on the ketones states that "because methyl isoamyl ketone contains one more carbon atom than does methyl isobutyl ketone, methyl (isoamyl) ketone might produce irritation and narcosis at concentrations at least as low as those at which methyl isobutyl ketone produces these effects," and NIOSH thus recommends a 50-ppm TWA for MIAK, corresponding to NIOSH's recommendation for methyl isobutyl ketone (NIOSH 1978).

OSHA is proposing an 8-hour TWA limit of 50 ppm for methyl isoamyl ketone. The Agency preliminarily concludes that this limit will protect workers against the risk of narcotic and irritant effects potentially associated with exposure to MIAK at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methyl isoamyl ketone. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL ISOPROPYL KETONE
CAS: 563–80–4; Chemical Formula: $(CH_3)_2CHCOCH_3$
H.S. No. 1262

OSHA currently has no limit for methyl isopropyl ketone (MIPK). The ACGIH recommends a TLV–TWA of 200 ppm. Methyl isopropyl ketone is a colorless, flammable liquid.

Animal studies have shown MIPK to have an acute toxicity somewhat greater than that of diethyl ketone and somewhat lesser than that of di-n-propyl ketone or methyl-n-propyl ketone (ACGIH 1986, p. 405). Rats exposed for 4 hours at a concentration of 5700 ppm died (NIOSH 1977). Other data concerning the inhalation toxicity of MIPK are lacking.

OSHA proposes a limit of 200 ppm TWA for methyl isopropyl ketone. The Agency preliminarily concludes that this limit will protect workers against the risk of irritation associated with exposure to this (and other) ketone(s) in the workplace at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methyl isopropyl ketone. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYL PARATHION
CAS: 298-00-0; Chemical Formula: $C_8H_{10}NO_5PS$
H.S. No. 1265

OSHA currently has no limit for methyl parathion. The ACGIH recommends a TLV-TWA of 0.2 mg/m³, with a skin notation. NIOSH recommends a TWA of 0.2 mg/m³ and a skin notation for methyl parathion. Methyl parathion is a tan to brown liquid with a pungent odor like that of garlic.

Methyl parathion is an acetylcholinesterase inhibitor, and excessive exposure can cause sweating, salivation, diarrhea, bradycardia, bronchoconstriction, muscle fasciculations, and coma. Methyl parathion's acute oral LD_{50} for male rats is almost identical to that of parathion, i.e., 10 to 25 mg/kg; for female rats, the LD_{50} is 24 mg/kg, or approximately one-sixth that of parathion. By the dermal route, methyl parathion is much less toxic than parathion, with an LD_{50} of 67 mg/kg in rats of both sexes (Hayes, as cited in ACGIH 1986, p. 407). Erythrocyte cholinesterase activity was inhibited in dogs fed methyl parathion for 12 weeks at a rate corresponding to approximately 24 mg/day; inhibition of both plasma and erythrocyte cholinesterase activity occurred at doses of 70 mg/day, without accompanying illness (Williams et al. 1959). Dogs fed 6 mg/day methyl parathion for 12 weeks showed no effects from such exposures (Williams et al.). Lifetime feeding studies of rats and mice fed diets containing methyl parathion concentrations of up to 40 ppm and up to 125 ppm, respectively, produced no evidence of cancer (NCI 1979).

Plasma and erythrocyte cholinesterase levels did not differ by more than 20 percent in subjects exposed at 7, 7.5, 8, or 9 mg/man/day, compared with controls (Moeller and Rider 1963). Tiess and associates (1982) have reported a case of protracted methyl parathion poisoning resulting from both percutaneous and inhalation exposure; Dille and Smith (1964) attribute the long-term neuro-psychiatric illness of two pilots to exposure to methyl parathion and other cholinesterase-inhibiting agents. Chronic exposure to small doses of methyl parathion have not caused chromosomal effects (DeCassia Stocco et al. 1982).

OSHA proposes a limit of 0.2 mg/m³ TWA for methyl parathion, with a skin notation. The Agency preliminarily concludes that this limit will protect workers against the risk of acetylcholinesterase inhibition potentially associated with workplace exposures at the levels permitted in the absence of any OSHA limit. The skin notation will protect workers from the risk of percutaneous absorption of this substance. The health evidence forms a reasonable basis for proposing a new limit for methyl parathion. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHYLCYCLOHEXANE
CAS: 108-87-2; Chemical Formula: C_7H_{14}
H.S. 1268

OSHA has a current 8-hour TWA limit of 500 ppm for methylcyclohexane. The ACGIH recommends a limit of 400 ppm TWA for this colorless liquid.

Lehmann and Flury (1943) indicate that the acute toxicity of methylcyclohexane is greater than that of heptane but less than that of octane. Lazarew (1929) found that a 2-hour exposure to a concentration of 7500 to 10,000 ppm caused prostration in mice, and exposure to 10,000 to 12,500 ppm caused death. Treon, Crutchfield, and Kitzmiller (1943) reported that exposure to 1200 ppm had no effect in rabbits, and prolonged exposures to 370 ppm had no effect in monkeys. Methylcyclohexane's histologic effects in animals resemble those of cyclohexane; the liver and kidney are the sites affected (ACGIH 1986, p. 384).

OSHA proposes an 8-hour TWA limit of 400 ppm for methylcyclohexane. The Agency preliminarily concludes that this limit will protect workers against the risk of irritation associated with exposure to methylcyclohexane and other alicyclic hydrocarbons at the levels permitted by the current OSHA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for methylcyclohexane if the Agency determines that this limit will substantially reduce significant risk.

2-METHYLCYCLOPENTADIENYL MANGANESE TRICARBONYL
CAS: 12108-13-3; Chemical Formula: $(CH_3)C_5H_6-Mn(CO)_3$
H.S. No. 1271

OSHA currently has no limit for 2-methylcyclopentadienyl manganese tricarbonyl (C1-2). The ACGIH recommends a TLV-TWA of 0.2 mg/m³, as manganese, with a skin notation. C1-2 is a dark orange liquid with a faintly pleasant odor; it is a complex organic compound containing about 25 percent manganese by weight.

2-Methylcyclopentadienyl Mn tricarbonyl is highly toxic in its concentrated form, causing adverse effects primarily on the central nervous system. It is somewhat irritating to the eyes but skin contact does not produce irritation or sensitization: C1-2 is readily absorbed through the skin (ACGIH 1986, p. 387). Animal studies indicate that C1-2 has a toxicity similar to that of tetraethyl lead and is highly toxic by all routes of exposure (U.S. Navy Smoke Abatement Additive, as cited in ACGIH 1986, p. 387).

The single-dose oral LD_{50} for rats is 23 or 39 mg/kg, depending on sex. The skin LD_{50} for rabbits is 1692±145 mg/kg, and the 1-hour inhalation LC_{50} for rats is about 350 mg/m³ (The Ethyl Corporation, as cited in ACGIH 1986, p. 387). Toxic exposures by all routes produce rapidly appearing symptoms of mild excitement, hyperactivity, tremors, severe clonic spasms, weakness, respiratory distress, and occasional clonic convulsions, followed by terminal coma (U.S. Navy Smoke Abatement Additive, as cited in ACGIH 1986, p. 387).

Acute exposure causes damage to the liver, kidneys, and cerebral cortex, as well as changes in lung tissue (ACGIH 1986, p. 387). Browning (1966) observed chronic bronchitis, peribronchitis, interstitial pneumonia, and lung abscesses in animals that subsequently died from long-term inhalation exposure to C1-2: exposure to C1-2 concentrations of approximately 12 mg/m³ for 100 days produced no deviation in weight gain patterns and no gross or microscopic changes in two dogs (Browning 1966). The liver and kidneys are the principal target organs associated with acute overexposures; the lungs of overexposed animals were hemorrhagic (Browning 1966).

In humans, skin contact should be entirely avoided. A 5- to 15-ml spill on one worker's hand and wrist was reported to have caused "thick tongue," nausea, giddiness, and headache within 3 to 5 minutes (U.S. Navy Smoke Abatement Additive, as cited in ACGIH 1986, p. 387).

OSHA proposes a PEL of 0.2 mg/m³ TWA as manganese, with a skin notation, for 2-methylcyclopentadienyl manganese tricarbonyl. The Agency preliminarily concludes that this limit will protect workers against the risk of CNS effects and systemic damage that exists in the absence of any OSHA limit for this substance. A skin notation is proposed because of C1-2's ability to penetrate the skin rapidly. The health evidence forms a reasonable basis for proposing a new limit for manganese. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MONOCROTOPHOS (AZODRIN)
CAS: 6923-22-4; Chemical Formula: $C_7H_{14}NO_5P$
H.S. No. 1279

OSHA currently has no limit for the systemic insecticide monocrotophos. The ACGIH recommends a TLV-TWA of 0.25 mg/m³ for this reddish-brown solid with a mild ester odor.

Monocrotophos is a highly toxic, direct acting cholinesterase inhibitor that penetrates the intact skin (ACGIH 1986, p. 416). The acute oral LD_{50} values in rats and mice range from 5.7 to 17 mg/kg in a water formulation (Brown et al. 1970; Shellenberger and Newell, as cited in ACGIH 1986, p. 416) and from 10 to 23 mg/kg in an oil formulation (Shellenberger and Newell, as cited in ACGIH 1986, p. 416). These authors also report a percutaneous LD_{50} in the rabbit that ranges from 112 to 709 mg/kg, depending on the vehicle used. A 2-year dietary study of rats ingesting 0, 1, 10, or 100 ppm monocrotophos revealed that both sexes in the 100 ppm group failed to gain as much weight as the controls, but autopsy showed no significant findings; plasma, erythrocyte, and brain cholinesterase decreased at the two highest dose levels but were unaffected at 1 ppm (Johnston 1966, as cited in ACGIH 1986, p. 416; Johnston et al. 1967, as cited in ACGIH 1986, p. 416). Another 2-year feeding study in dogs administered doses of up to 16 ppm monocrotophos revealed no adverse effects at levels of 0.16 and 1.6 ppm, but serious cholinesterase reduction was observed at the 16 ppm level (Johnston 1966, as cited in ACGIH 1986, p. 416; Johnston et al. 1967, as cited in ACGIH 1986, p. 416). Metabolism studies in rats and goats indicate that monocrotophos is excreted rapidly in the rat and does not accumulate in the body (Bull and Lindquist, as cited in ACGIH 1986, p. 416); goats given labeled monocrotophos by mouth showed only traces of the material in their milk (Menzer and Casida; Potter, both as cited in ACGIH 1986, p. 416). Inhalation exposure of rats to an unknown concentration of 75 percent monocrotophos in air for 1 hour was not lethal; a 4-hour exposure to an unknown concentration of the aerosol (0.4 and 0.75 percent) was fatal to 2 out of 6 (0.4 percent aerosol) and 5 out of 8 rats (0.75 percent aerosol). Head-only exposure to the 0.4 percent aerosol resulted in the death of one of eight animals (Wilson, as cited in ACGIH 1986, p. 416).

Intravenous injection of radiolabeled monocrotophos in human volunteers showed maximum excretion at 4 to 8 hours, with 67 ± 5 percent of the material in the urine; absorption of 14 ± 7 percent occurred when the radiolabeled material was applied to the forearm; 33 ± 9 percent of the applied dose was absorbed when it was covered with a vapor-proof film for 72 hours (Maibach 1970). Although gauze patches attached to the clothing and skin of field workers attested to the presence of monocrotophos, no cholinesterase inhibition resulted in post-exposure examinations at 3 hours and at 3 and 7 days (Maibach, as cited in ACGIH 1986, p. 416).

OSHA is proposing a PEL of 0.25 mg/m³ TWA for monocrotophos. The Agency preliminarily concludes that this limit will protect workers against the risk of cholinesterase inhibition potentially associated with exposure in the workplace at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for monocrotophos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MORPHOLINE
CAS: 110-91-8; Chemical Formula: C_4H_9NO
H.S. No. 1281

OSHA has a current limit of 20 ppm, with a skin notation, for morpholine. The ACGIH recommends a 20-ppm TWA limit and a TLV-STEL of 30 ppm, as well as a skin notation. Morpholine is a colorless liquid with an amine-like odor.

Exposure to morpholine produces nasal and bronchial irritation and liver and kidney impairment in animals (Shea 1939); the substance readily penetrates the skin and is highly irritating to the eyes (Jefferson Chemical Company, Inc. 1961, as cited in ACGIH 1986, p. 417). The single oral LD_{50} in rats is 1.05 g/kg (range: 0.95 to 1.16 g/kg), and the single skin LD_{50} for 24-hour contact is 0.5 mg/kg (Smyth, Carpenter, Weil, and Pozzani 1954). A 1-hour exposure to concentrated vapor was not fatal in rats, nor was an 8-hour exposure to 8000 ppm (Smyth, Carpenter, Weil, and Pozzani 1954). Rats were exposed for 8 hours daily to a concentration of 18,000 ppm for a total of 5 days; after the first day, all animals showed severely reddened thoracic walls, and one fatality (from kidney and liver congestion) occurred. A similar fatality occurred on the third day; on day 4, a third rat died, and postmortem examination revealed degeneration of the epithelial lining of the kidney tubules. Three additional deaths occurred after the exposures had ended; autopsy revealed thickened alveoli, emphysema, and liver and kidney effects (Shea 1939).

Reporting on his own reactions to morpholine exposure at a concentration of 12,000 ppm, Shea (1939) complained of nose irritation (after 1 minute) and coughing (after 90 seconds); in addition, when he transferred morpholine by pipette, he experienced sore throat and mucosal irritation. All symptoms disappeared after the experiment stopped (Shea 1939). Skin contact poses a moderately high degree of hazard, which diminishes as the product is diluted with water to less than 25 percent (Jefferson Chemical Company, Inc. 1961, as cited in ACGIH 1986, p. 417). Respiratory irritation but no chronic effects have been reported as a result of industrial exposure (Patty 1963). In comparison with ammonia, morpholine has a greater potential for systemic toxicity (ACGIH 1986, p. 417).

OSHA proposes an 8-hour TWA limit for morpholine of 20 ppm TWA and a 15-minute STEL of 30 ppm, with a skin notation. The Agency preliminarily concludes that this limit will protect workers against the risk of eye and respiratory tract irritation potentially associated with exposures in the absence of a short-term limit. OSHA is retaining the skin notation for morpholine because of its ability to be absorbed through the skin. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for morpholine if the Agency determines that this limit will substantially reduce significant risk.

NITRIC ACID
CAS: 7697-37-2; Chemical Formula: HNO_3
H.S. No. 1286

OSHA currently has an 8-hour limit of 2 ppm TWA for nitric acid. The ACGIH recommends the same TWA limit and a 15-minute STEL of 4 ppm, and NIOSH recommends a TWA limit of 2 ppm. Nitric acid is a fuming colorless or yellowish liquid.

Rats receiving a single exposure to nitric acid mist at a concentration of 63 mg/m³ exhibited no apparent adverse effects (Diggle and Gage 1954).

Chronic exposure to airborne nitric acid vapor or mist at unspecified levels was reported to cause chronic bronchitis, pneumonitis (Fairhall 1957), and tooth erosion (Lynch and Bell 1947).

Nitric acid's irritant potential is considered similar to that of other strong acids; it typically exists in conjuction with nitrogen dioxide, which is regarded as being more hazardous (ACGIH 1986, p. 428).

OSHA is proposing a PEL of 2 ppm TWA and a STEL of 4 ppm for nitric acid. The Agency preliminarily

concludes that this combined limit will protect workers against the risk of irritation, chronic pulmonary disease, and dental corrosion that potentially exists at exposures at the levels permitted by the TWA alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for nitric acid if the Agency determines that this limit will substantially reduce significant risk.

p-NITROANILINE
CAS: 100-01-6; Chemical Formula: $NO_2C_6H_4NH_2$
H.S. No. 1287

OSHA currently has a skin notation and a limit of 1 ppm TWA (6 mg/m³) for p-nitroaniline (PNA). The ACGIH recommends a limit of TLV-TWA 3 mg/m³, with a skin notation. para-Nitroaniline usually exists in the form of yellow needles.

p-Nitroaniline is readily absorbed through the skin and is a strong methemoglobin-forming agent, and prolonged exposure can cause liver damage (ACGIH 1986, p. 430). Anderson (1946) reported several cases of PNA-poisoning among shipboard workers assigned to clean up a p-nitroaniline spill; one man with a history of liver disease became jaundiced and died, and the other exposed workers became cyanotic and complained of headache, sleepiness, weakness, and respiratory distress (Anderson 1946). It has also been reported that children who ingested p-nitroaniline that was contained in wax crayons subsequently became ill (Rieders and Brieger 1953).

Several investigators (Anderson 1946; Gupta 1953; Fairhall 1957; Linch 1974) have concluded that the nitroanilines are more hazardous than aniline, and, on this basis, the ACGIH has recommended a TWA limit for PNA that is lower than the limit for aniline (ACGIH 1986, p. 430).

OSHA is proposing a PEL of 3 mg/m³ TWA for p-nitroaniline, with a skin notation. The Agency preliminarily concludes that this limit will protect workers against the risk of methemoglobinemia and liver damage potentially associated with exposure to PNA at levels above 3 mg/m³. The Agency is retaining the skin notation because this substance is readily absorbed through the skin. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for p-nitroaniline if the Agency determines that this limit will substantially reduce significant risk.

NITROTOLUENE
CAS: 88-72-2; 99-08-1; 99-99-0; Chemical Formula: $CH_3C_6H_4NO_2$
H.S. No. 1292

OSHA currently has an 8-hour limit of 5 ppm, with a skin notation, for nitrotoluene. The ACGIH recommends a TLV-TWA of 2 ppm, also with a skin notation. The ortho- and meta-isomers of nitrotoluene are yellow liquids; the para-isomer is also yellow, but exists in crystalline form.

Nitrotoluene is one of the aromatic nitrogen compounds that may cause methemoglobin formation. Linch (1974) has studied the nitrotoluene isomers and reported that they have relatively low emiagenic potential; he considered nitrotoluene comparable to aniline in its toxic effects (Linch 1974). Cases of poisoning as a result of exposure to nitrotoluene are rare (von Oettingen 1941).

OSHA proposes an 8-hour TWA limit of 2 ppm, with a skin notation, for nitrotoluene. The Agency preliminarily concludes that this limit will protect workers against the risk of methemoglobinemia potentially associated with exposure to this substance; the skin notation is retained because of nitrotoluene's capacity to penetrate the skin. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for nitrotoluene if the Agency determines that this limit will substantially reduce significant risk.

NONANE
CAS: 111-84-2; Chemical Formula: $CH_3(CH_2)_7CH_3$
H.S. No. 1293

OSHA currently has no limit for nonane. The ACGIH recommends a TLV-TWA of 200 ppm for this colorless liquid.

The toxicity of nonane is approximatelv equal to that of VM&P naphtha. Naphtha has a 4-hour inhalation LC_{50} for rats of 3400 ppm, while nonane has an LC_{50} of 3200 ppm (Carpenter et al. 1975, 1978). These investigators found a no-effect level of 590 ppm nonane for rats exposed 6 hours/day, 5 days/week for a 65-day period; under the same exposure conditions, a no-effect level of 560 ppm was reported for rats exposed to VM&P naphtha (Carpenter et al. 1975, 1978). Earlier studies of octane and heptane have resulted in much higher LC_{50} values for mice, i.e., 13,500 ppm and 16,000 ppm, respectively, for 30- to 60-minute exposures (Flury and Zernik 1931). Swann and associates (1974) have reported similarly high values for octane and hexane in mice; mice died from respiratory arrest after 3 to 5 minutes of exposure to 16,000 ppm of octane or to 48,000 ppm of hexane (Swann et al. 1974).

OSHA proposes an 8-hour TWA limit of 200 ppm for nonane. The Agency preliminarily concludes that this limit will protect workers against the risk of narcotic effects potentially associated with exposure to nonane at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for nonane. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

OXALIC ACID
CAS: 144-62-7; Chemical Formula: $H_2C_2O_4$
H.S. No. 1299

OSHA currently has a limit of 1 mg/m³ for oxalic acid. The ACGIH has a TLV-TWA of 1 mg/m³ and recommends a TLV-STEL of 2 mg/m³. Anhydrous oxalic acid is usually in the form of a white powder; the dihydrate form is a colorless, odorless, crystalline substance.

Oxalic acid is known to produce severe burns of the eyes, mucous membranes, and skin (The Merck Index 1983, p. 991). There have been human fatalities from ingesting as little as 5 grams of oxalic acid. It appears that these deaths were caused by oxalic acid's ability to disturb the calcium-potassium balance in critical tissues (Klauder, Shelanski, and Gabriel 1955). Solutions of 5- to 10 percent oxalic acid have also been reported to irritate the skin on prolonged exposure.

Because of oxalic acid's severe acute toxicity, OSHA is proposing an 8-hour TWA limit of 1 mg/m³ PEL and a STEL of 2 mg/m³. The Agency preliminarily concludes that both of these limits are required to protect exposed workers from the risk of severe eye and skin burns and respiratory tract irritation that could result from elevated short-term exposures at the present TWA limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for oxalic acid if the Agency determines that this limit will substantially reduce significant risk.

PERCHLORYL FLUORIDE
CAS: 7616-94-6; Chemical Formula: ClO_3F
H.S. No. 1309

OSHA's current 8-hour TWA limit for perchloryl fluoride is 3 ppm. The ACGIH has a TLV-TWA of 3 ppm and a STEL of 6 ppm for this colorless gas with a sweet odor.

The 4-hour LD_{50}s in rats and mice were 385 and 630 ppm, respectively.

Dogs exposed for 4 hours to 220- to 450-ppm concentrations of the vapor, followed by exposure to 620 ppm for 2.5 hours, became hyperpneic and cyanotic and showed increased methemoglobin. Dogs succumbing from these exposures had pigment deposition in the liver, spleen, and bone marrow; alveolar hemorrhage and collapse; and emphysema.

Exposure to 185 ppm for 6 hours/day, 5 days/week for 7 weeks killed 18 of 20 rats, 20 of 30 mice, and all exposed guinea pigs (Greene, Colburn, Donati, and Weeks 1960). These animals had difficulty breathing, became cyanotic, and developed alveolar edema and methemoglobinemia; at autopsy, they showed fluorosis; patchy lungs; enlarged spleens; and hemosiderosis of the kidneys, spleen, and liver. When animals were exposed on a similar regimen but to a concentration of 104 ppm for 6 weeks, all guinea pigs but only 1 of 20 rats died (Greene, Colbourn, Donati, and Weeks 1960). After a 6-month exposure to 24 ppm, bone fluoride levels increased 4-fold in guinea pigs, 3-fold in rats, and about 50 percent in dogs. Animals exposed at 24 ppm showed no signs of irritation (Greene, Colbourn, Donati, and Weeks 1960).

OSHA is proposing an 8-hour TWA of 3 ppm and a STEL of 6 ppm for perchloryl fluoride. The Agency preliminarily concludes that this combined limit will protect workers from the risk of fluorosis and hematologic effects potentially associated with exposures to perchloryl fluoride at the levels permitted in the absence of a short term limit. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for perchloryl fluoride if the Agency determines that this limit will substantially reduce significant risk.

MEVINPHOS (PHOSDRIN)
CAS: 7786-34-7; Chemical Formula:
H.S. No. 1320

OSHA currently has an 8-hour TWA limit of 0.1 mg/m³, with a skin notation, for mevinphos (phosdrin). The ACGIH recommends a TLV-TWA of 0.01 ppm (0.1 mg/m³) and a TLV-STEL of 0.03 ppm (0.3 mg/m³), also with a skin notation. Phosdrin is a colorless liquid. The commercial product is a mixture of cis- and trans-isomers that have a yellow color.

The acute oral LD_{50} of phosdrin is 4 to 8 mg/kg for male mice and 6 to 8 mg/kg for female rats (Shell Chemical Corporation 1956, as cited in ACGIH 1986, p. 412). Phosdrin is a cholinesterase inhibitor and has been reported to cause slight plasma cholinesterase depression but no decrease in brain cholinesterase activity in rats fed 2 to 5 ppm. The compound may be absorbed dermally and by inhalation or ingestion; the action of the compound is direct and immediate (Cleveland and Treon 1961). The dermal LD_{50} in rats has been reported to be 4.5 mg/kg (Gaines 1969). Chronic feeding of rats demonstrated a minimal lethal dose of between 100 and 200 ppm. Cholinesterase activity decreased continually when sublethal doses were administered until a maximum reduction in RBC cholinesterase activity of 25 percent was achieved on the 27th day of the administration of 1.5 to 20 mg doses (Huelse and Federspil 1975).

In industry, the primary hazards associated with exposure to phosdrin are absorption of phosdrin through the skin, lung, and mucous membranes, which causes liver damage (Natoff 1970). Phosdrin intoxication is reported to occur in humans, with accompanying symptoms of headache, visual distortion, weakness, cramps, diarrhea, pain, and respiratory distress. Severe exposure may cause convulsions; in one reported case, some symptoms (anxiety, depression, vertigo, and nystagmus) persisted for as long as 4 months (Zavon, as cited in ACGIH 1986, p. 412).

OSHA is proposing a PEL of 0.01 ppm TWA and a STEL of 0.03 ppm for phosdrin, with a skin notation. The Agency preliminarily concludes that these limits will protect workers against the risk of cholinesterase inhibition and hepatic injury that results from absorption of phosdrin through the skin and mucous membranes and from exposure by the inhalation and oral routes. OSHA believes that these limits will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phosdrin if the Agency determines that this limit will substantially reduce significant risk.

PHOSPHORUS OXYCHLORIDE
CAS: 10025-87-3; Chemical Formula: $POCl_3$
H.S. No. 1323

OSHA has no current limit for phosphorus oxychloride. The ACGIH recommends a TLV-TWA of 0.1 ppm and a TLV-STEL of 0.5 ppm. This clear, colorless, fuming liquid has a pungent odor.

The primary hazards associated with inhalation of phosphorus oxychloride vapor are irritation of the eyes and respiratory tract, as well as narcotic effects, gastric irritation, pulmonary edema, and nephritis (The International Technical Information Institute 1978).

Weeks and associates (1964) reported 4-hour LC_{50} values for phosphorus oxychloride of 48 ppm and 52 ppm for guinea pigs and rats, respectively. They also observed that ammonia vapor mediates the irritant effects of exposure to phosphorus oxychloride without significantly altering this LC_{50} value (Weeks et al. 1964).

Both chronic and acute occupational intoxication have been reported to occur among workers exposed to phosphorus oxychloride (Sassi 1954).

OSHA is proposing a PEL of 0.1 ppm TWA and a 15-minute STEL of 0.5 ppm for phosphorus oxychloride. The Agency preliminarily concludes that these limits will reduce the risk of narcotic effects and systemic poisoning potentially associated with acute and chronic exposure at the uncontrolled levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for phosphorus oxychloride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PHOSPHORUS PENTASULFIDE
CAS: 1314-80-3; Chemical Formula: P_2S_5
H.S. No. 1324

OSHA currently has a limit of 1 mg/m³ as an 8-hour TWA for phosphorus pentasulfide. The ACGIH also recommends a limit of 1 mg/m³ TWA and a 15-minute STEL of 3 mg/m³. These limits are the same as those proposed for phosphoric acid, which the ACGIH believes to be approximately as toxic as phosphorus pentasulfide. Phosphorus pentasulfide is a greenish-yellow crystalline mass with an odor like that of rotten eggs.

The primary hazard associated with exposure to phosphorus pentasulfide is respiratory irritation (Smyth 1956). In the presence of moisture, phosphorus pentasulfide is rapidly hydrolyzed to phosphoric acid and hydrogen sulfide. No toxicity data are available concerning phosphorus pentasulfide per se.

OSHA is proposing a PEL of 1 mg/m³ as an 8-hour TWA, with a 15-minute STEL of 3 mg/m³, for phosphorus pentasulfide. The Agency preliminarily concludes that both of these limits are necessary to reduce the risk of respiratory irritation associated with exposure to this substance at the higher concentrations permitted at the current PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phosphorus pentasulfide if the

Agency determines that this limit will substantially reduce significant risk.

PHTHALIC ANHYDRIDE
CAS: 85-44-9; Chemical Formula:
$C_6H_4(CO)_2O$
H.S. No. 1326

OSHA currently has an 8-hour TWA limit of 2 ppm for phthalic anhydride. The ACGIH recommends a limit of 1 ppm TWA. Phthalic anhydride exists in the form of white crystalline needles with a mild odor.

The primary exposure hazards associated with phthalic anhydride are severe skin, eye, and respiratory irritation. The substance can also produce skin and, perhaps, pulmonary sensitization (Patty 1963). Baader (1955) has reported irritant effects in animals exposed to 30 mg/m³ (approximately 5 ppm) phthalic anhydride in air.

In studies of workers exposed to phthalic anhydride, symptoms of respiratory tract injury as well as bronchitis, eye irritation, and nasal bleeding have been reported. Precise exposure concentrations were not detectable by the analytic method being used, which had a limit of detection of 25 mg/m³ (i.e., of 4 ppm or lower) (Baader 1955; Menschick 1955). Other industrial acid anhydrides (e.g., tetrachlorphthalic anhydride and maleic anhydride) are considered more irritating than phthalic anhydride (ACGIH 1986, p. 489).

OSHA is proposing an 8-hour TWA limit of 1 ppm for phthalic anhydride, compared with the limit of 0.25 ppm being proposed for maleic anhydride. The Agency preliminarily concludes that a 1 ppm limit will reduce the risk of respiratory irritation and the potential risk of skin and pulmonary sensitization that exists for workers exposed at higher levels permitted by the current PEL. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phthalic anhydride if the Agency determines that this limit will substantially reduce significant risk.

PROPARGYL ALCOHOL
CAS: 107-19-7; Chemical Formula:
$HC{\equiv}CCH_2OH$
H.S. No. 1335

OSHA has no current limit for propargyl alcohol. The ACGIH has established an 8-hour TWA of 1 ppm, with a skin notation, for this light to straw-colored liquid, which smells like geraniums.

In rats, guinea pigs, and mice, the oral LD_{50}s are 70, 60, and 50 mg/kg, respectively; the inhalation LC_{50} in both the rat and mouse is reported to be about 850 ppm (NIOSH 1977).

Propargyl alcohol is a primary skin irritant, but it is not a skin sensitizer (Antara Chemicals 1952, as cited in ACGIH 1986, p. 496). The toxicity of propargyl alcohol is estimated to be equal to that of allyl alcohol (oral LD_{50} in rats of 64 mg/kg) (NIOSH 1977). The ACGIH limit is based on the structural and toxicological similarity of propargyl alcohol to allyl alcohol (ACGIH 1986, p. 496).

OSHA is proposing an 8-hour TWA for propargyl alcohol of 1 ppm, with a skin notation. The Agency preliminarily concludes that these limits will protect workers against the risk of skin and mucous membrane irritation potentially associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for propargyl alcohol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PROPIONIC ACID
CAS: 79-09-4; Chemical Formula:
CH_3CH_2COOH
H.S. No. 1336

OSHA currently has no limit for propionic acid. The ACGIH recommends a TLV-TWA of 10 ppm and a TLV-STEL of 15 ppm. Propionic acid is a colorless, oily liquid with a pungent odor.

The primary health effects associated with exposure to propionic acid are skin burns and irritation of the eyes and respiratory system. Smyth and co-workers (1962) reported that the oral LD_{50} for rats is 4.3 g/kg; NIOSH (1977) stated that the intravenous LD_{50} for mice is 625 mg/kg and the skin absorption LD_{50} for rabbits is 500 mg/kg. Inhalation of the saturated vapor for 8 hours caused no rat fatalities (ACGIH 1986, p. 498).

Acute industrial exposures have been reported to cause mild to moderate skin burns, eye irritation, and, in a single incident, asthmatic cough. No irritation was observed as a consequence of exposures in humans averaging below 0.25 ppm with excursions to 2.1 ppm in an 8 hour-period (Dow Chemical Company, as cited in ACGIH 1986, p. 498).

OSHA proposes limits of 10 ppm TWA and 15 ppm as a 15-minute STEL for propionic acid. The Agency preliminarily concludes that both of these limits are required to protect workers against the risk of eye and respiratory tract irritation that exists at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for propionic acid. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

n-PROPYL ACETATE
CAS: 109-60-4; Chemical Formula:
$CH_3COOCH_2CH_2CH_3$
H.S. No. 1338

OSHA currently has an 8-hour TWA limit of 200 ppm for n-propyl acetate. The ACGIH also recommends a 200 ppm TWA limit and a TLV-STEL of 250 ppm. n-Propyl acetate is a pleasant-smelling liquid.

The primary health effects associated with exposure to n-propyl acetate are narcosis and eye and respiratory irritation. The limiting 5-hour narcotic concentrations for cats and mice have been reported as 9000 ppm and 6000 ppm, respectively (Flury and Wirth 1933). n-Propyl acetate's narcotic action is 1.3 times that of ethyl acetate; salivation and irritation of cats' eyes occurred at 2600 ppm (Flury and Wirth 1933). A 4-hour exposure at 8000 ppm killed four of six rats (Smyth 1964, as cited in ACGIH 1986, p. 500).

OSHA is proposing a PEL of 200 ppm TWA and a STEL of 250 ppm for n-propyl acetate. The Agency preliminarily concludes that both of these limits are required to prevent the risk of narcosis and eye and respiratory tract irritation that exists for workers exposed to levels above the level permitted by the 8-hour TWA limit alone. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for n-propyl acetate if the Agency determines that this limit will substantially reduce significant risk.

PROPYL ALCOHOL
CAS: 71-23-8; Chemical Formula:
$CH_3CH_2CH_2OH$
H.S. No. 1339

OSHA currently has a limit of 200 ppm TWA for n-propyl alcohol. The ACGIH recommends the same TWA limit, a 250-ppm 15-minute STEL, and a skin notation. Propyl alcohol is a colorless liquid with an alcohol-like odor.

The primary health effect associated with exposure to propyl alcohol is mild narcosis. Propyl alcohol's toxicity is somewhat greater than that of isopropyl alcohol (Gleason, Gosselin, and Hodge 1963).

The inhalation LD_{50} for propyl alcohol in rats is reported as 1.9 g/kg (Smyth, Carpenter, Weil, and Pozzani 1954). Starrek reported deep narcosis in mice inhaling the vapor at a concentration of 4100 ppm for 240 minutes and of 24,500

ppm for 60 minutes; ataxia appeared in 90 to 120 minutes at 3250 ppm (Starrek in Patty 1963 pp. 1434–1438). These effects are almost twice as intense as those reported for exposure to the vapor of isopropyl alcohol. The dermal LD_{50} in rabbits is 5040 mg/kg (Sax 1984).

Nelson, Ege, Ross, and associates (1943) reported mild eye, nose, and throat irritation in humans exposed at 400 ppm to the vapor of isopropyl alcohol, but no data exist on human sensory response to propyl alcohol vapor. The ACGIH (1986, p. 500) reports that many industrial hygienists consider the vapor of propyl alcohol to be more irritating to the throat than the vapor of the isomer.

OSHA is proposing an 8-hour TWA PEL of 200 ppm and a STEL of 250 ppm for propyl alcohol, with a skin notation. The Agency preliminarily concludes that these limits will protect workers against the risk of narcosis and irritation that exists at levels above the PEL. OSHA also proposes to add a skin notation because propyl alcohol can be absorbed through the skin. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for propyl alcohol if the Agency determines that this limit will substantially reduce significant risk.

PROPYLENE OXIDE
CAS: 75–56–9; Chemical Formula: CH_3CHOCH_2
H.S. No. 1344

OSHA currently has an 8-hour TWA limit of 100 ppm for propylene oxide. The ACGIH recommends a limit of 20 ppm TLV–TWA. Propylene oxide is a colorless, highly flammable, volatile, and ethereal liquid.

The health hazards associated with exposure to this substance are primary skin, eye, and respiratory irritation, as well as central nervous system depression. The oral LD_{50} values reported for rats and guinea pigs are 930 mg/kg and 690 mg/kg, respectively. In mice, the inhalation LC_{50} has been reported to be at 1740 ppm for 4 hours. Dogs and guinea pigs exposed for 4 hours at 2000 and 4000 ppm, respectively, died (NIOSH 1977). Although some species tolerate daily exposures to 200 ppm, all species tested tolerated 100 ppm without ill effects (Rowe, Hollingsworth, Oyen et al. 1956). Jacobson and associates (1956) considered the toxic effects of propylene oxide to be one-half to one third as intense as those of ethylene oxide (Jacobson, Hackley, and Feinsilver 1956).

Corneal burns and skin necrosis, as well as respiratory and pulmonary irritation, have been reported in humans as a result of direct contact with the liquid or vapor (Patty 1963); central nervous system effects include ataxia, incoordination, and general depression.

OSHA proposes an 8-hour TWA limit of 20 ppm for propylene oxide to protect workers against the risk of primary irritation and CNS depression potentially associated with exposure to higher levels. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for propylene oxide if the Agency determines that this limit will substantially reduce significant risk.

SILICON TETRAHYDRIDE
CAS: 7803–62–5; Chemical Formula: SiH_4
H.S. No. 1361

OSHA currently has no limit for silicon tetrahydride. The ACGIH limit of 5 ppm as an 8-hour TWA was established in 1983. Silicon tetrahydride, which is a colorless gas, is used in the manufacture of semiconductors.

Studies of rats exposed to silicon tetrahydride at levels of 126 ppm for 1 hour (Matheson Gas Products 1971, as cited in ACGIH 1986, p. 528) and at 1400 ppm for 6 hours (Union Carbide Corporation 1980, as cited in ACGIH 1986, p. 528) have failed to identify any systemic effects associated with exposure to this chemical. Sax (1984) lists the effects of acute exposure to silicon tetrahydride as moderate irritation to the eyes, skin, and mucous membranes.

OSHA is proposing a limit of 5 ppm TWA for silicon tetrahydride. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of eye, skin, and upper respiratory tract irritation potentially associated with exposure to this substance at the unregulated levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for silicon tetrahydride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

SULFURYL FLUORIDE
CAS: 2699–79–8; Chemical Formula: SO_2F_2
H.S. No. 1379

The current OSHA limit for sulfuryl fluoride is 5 ppm as an 8-hour TWA. The ACGIH recommends 5 ppm as a TWA, with the addition of a STEL of 10 ppm. Sulfuryl fluoride is a colorless gas with a sulfide odor. When selecting this limit, the ACGIH took into consideration the fact that, compared with hydrogen fluoride (TLV–TWA ceiling of 3 ppm), only a small portion of the inhaled gas is retained and converted to inorganic fluorides.

In extensive animal studies conducted by the Dow Chemical Company (1962 and 1970, as cited in ACGIH 1986, p. 546), sulfuryl fluoride was determined to exhibit one-half to one-third the acute inhalation toxicity of methyl bromide. Acute exposures of animals resulted in tremors that later developed into severe convulsions. Pulmonary edema was seen in laboratory animals following a single severe exposure. Repeated exposures of rats, guinea pigs, and mice to 20 ppm sulfuryl fluoride for 7 hours per day produced both kidney and lung injuries after 6 months. After 12 months of exposure, slight effects were seen that reversed after exposure was terminated. Some evidence of fluorosis was observed in the incisors of mice, but not in the teeth of the rats or guinea pigs (Dow Chemical Company 1962, 1970, as cited in ACGIH 1986, p. 546).

A report by Taxay (1966) that examined an incident of workplace exposure to sulfuryl fluoride noted that abdominal pain, nausea, vomiting, and itching were the major symptoms. On the day following exposure, the serum of the affected worker tested positive for fluoride.

OSHA is proposing an 8-hour TWA limit of 5 ppm and a STEL of 10 ppm for sulfuryl fluoride. The Agency preliminarily concludes that these limits will protect workers against the risks of kidney and lung injury and of fluorosis potentially associated with chronic exposure to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for sulfuryl fluoride if the Agency determines that this limit will substantially reduce significant risk.

THIONYL CHLORIDE
CAS: 7719–09–7; Chemical Formula: Cl_2OS
H.S. No. 1393

OSHA's current Z tables have no limits for thionyl chloride. The ACGIH has established a ceiling limit of 1 ppm for this substance. Thionyl chloride is a colorless to pale yellow liquid with a suffocating odor.

Thionyl chloride vapors are skin, eye, and mucous membrane irritants, probably as a result of the formation of sulfur dioxide and hydrogen chloride (ACGIH 1986, p. 572). An inhalation exposure of 17.5 ppm proved lethal to cats within 20 minutes (Sax 1979).

The ACGIH's exposure limit for thionyl chloride is based on the exposure limits for the decomposition products (hydrogen chloride and sulfur

dioxide) of thionyl chloride when mixed with water. The reaction of one mole of thionyl chloride with water produces two moles of hydrogen chloride and one of sulfur dioxide, so that 1 ppm of thionyl chloride can be shown to produce a total irritant gas concentration of 3 ppm. The exposure limit for hydrogen chloride is 5 ppm as a ceiling limit; for sulfur dioxide, the limit is a TWA of 2 ppm. Thus, "the * * * ceiling limit of 1 ppm for thionyl chloride should prevent the irritant effects of its reaction products" (ACGIH 1986, p. 572).

The Agency is proposing a ceiling limit of 1 ppm for thionyl chloride. OSHA preliminarily concludes that this limit will protect workers from the risk of irritation of the eyes, skin, and mucous membranes potentially associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for thionyl chloride. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TRIBUTYL PHOSPHATE
CAS: 126–73–8; Chemical Formula: $(C_4H_9)_3PO_4$
H.S. No. 1402

The current OSHA standard for tributyl phosphate is 5 mg/m³ as an 8-hour TWA. The ACGIH has established a 2.5-mg/m³ TWA. Tributyl phosphate is a clear, colorless, odorless liquid.

Tributyl phosphate's toxicity affects the skin and mucous membranes, the lungs and the central nervous system, and this substance is also a cholinesterase inhibitor.

A paper by Smyth and Carpenter (1944) reported that contact with liquid tributyl phosphate caused severe eye injury and skin irritation when tested in rabbits. Chambers and Casida (1967) found that mice injected with 1 g/kg tributyl phosphate intraperitoneally became paralyzed. A study by Vandekar (1957) in which mice were given tributyl phosphate by gavage revealed that a dose of 80 mg/kg resulted in a 1-hour period of anesthesia, and a dose of 100 mg/kg resulted in 8 to 10 minutes of anesthesia, followed by respiratory failure and death. Administered intraperitoneally to rats, tributyl phosphate inhibited cholinesterase activity and stimulated plasma beta-glucuronidase activity (Suzuki, Kikuchi, Kato et al. 1977). This substance did not exhibit mutagenic activity in bacterial or fruit fly assays (Hanna and Dyer 1975). Nausea and headache were reported by workers exposed to levels of 15 mg/m³ of tributyl phosphate (Mastromatteo, as cited in ACGIH 1986, p. 591).

OSHA is proposing to reduce the 8-hour PEL from 5 mg/m³ to 2.5 mg/m³. OSHA preliminarily concludes that this limit will protect workers against the risk of paralysis, anesthetic effects, and skin or eye irritation potentially associated with exposure to tributyl phosphate. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for tributyl phosphate if the Agency determines that this limit will substantially reduce significant risk.

TRICHLOROACETIC ACID
CAS: 76–03–9; Chemical Formula: CCl_3COOH
H.S. No. 1404

OSHA currently has no exposure limits for trichloroacetic acid. The ACGIH recommends an 8-hour TWA of 1 ppm to protect against the corrosive effects of trichloroacetic acid. Trichloroacetic acid is a relatively strong acid that forms deliquescent crystals.

The Dow Chemical Company (1977, as cited by the ACGIH 1986, p. 592) reported that the oral LD_{50} of trichloroacetic acid for rats is 3.33 g/kg. Studies on mice conducted by NIOSH (1984) established that the oral LD_{50} for this species is 4.97 g/kg, and that a 500-mg/kg dose was fatal when administered intraperitoneally.

Medical reports show mild to moderate skin and eye burns in workers exposed to unspecified levels of trichloroacetic acid; although corrosive, trichloroacetic acid is not readily absorbed by the skin (ACGIH 1986, p. 592).

OSHA is proposing an 8-hour TWA limit for trichloroacetic acid of 1 ppm. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of skin and eye irritation associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for trichloroacetic acid. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TRIMETHYLAMINE
CAS: 75–50–3; Chemical Formula: $(CH_3)_3N$
H.S. No. 1411

OSHA presently has no exposure limit for trimethylamine. The ACGIH recommends a 10-ppm limit as an 8-hour TWA and 15 ppm as a 15-minute STEL. Trimethylamine has a pungent, fishy odor and is a gas at room temperature.

Little toxicological data are available for trimethylamine. One study reports that the intravenous LD_{50} for this substance is 90 mg/kg in mice (Dechezlepretre and Cheymol 1967). The ACGIH established the TLV for trimethylamine on the basis of its chemical similarity to dimethylamine, for which the current TLV–TWA is 10 ppm. Dimethylamine is a central nervous system depressant and cause methemoglobinemia.

OSHA is proposing an 8-hour TWA limit of 10 ppm and a STEL of 15 ppm (15 minutes) for trimethylamine. Based on analogy to dimethylamine, the Agency preliminarily concludes that these limits will protect workers exposed at previously unregulated levels from the risk of eye, mucous membrane, and upper respiratory tract irritation associated with this substance. The health evidence forms a reasonable basis for proposing a new limit for dimethylamine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

n-VALERALDEHYDE
CAS: 110–62–3; Chemical Formula: $CH_3(CH_2)_3CHO$
H.S. No. 1420

OSHA currently has no limit for n-valeraldehyde. The ACGIH limit is 50 ppm as an 8-hour TWA. n-Valeraldehyde is a colorless liquid.

n-Valeraldehyde's toxic effects include both skin and eye irritation. Animal studies showed n-valeraldehyde to be severely irritating when applied to guinea pig skin and to rabbits' eyes (Fassett, as cited in ACGIH 1986, p. 619). The dermal LD_{50} for guinea pigs exceeds 20 ml/kg (Fassett, as cited in ACGIH 1986, p. 619).

A series of studies of the relative acute inhalation toxicity of 13 aliphatic saturated and unsaturated aldehydes in mice, guinea pigs, and rabbits showed that valeraldehyde was relatively nontoxic systemically (Salem and Cullumbine 1960).

OSHA is proposing a 50-ppm 8-hour TWA limit for this previously unregulated chemical. The Agency preliminarily concludes that this limit will protect workers from the risk of valeraldehyde's potential to cause severe eye and skin irritation. The health evidence forms a reasonable basis for proposing a new limit for n-valeraldehyde. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

m-XYLENE ALPHA, ALPHA'-DIAMINE

CAS: 1477-55-0; Chemical Formula: $C_6H_4(CH_2NH_2)_2$
H.S. No. 1432

OSHA presently has no exposure limit for this substance. The ACGIH has established a limit of 0.1 mg/m³ as a ceiling limit that should not be exceeded during any part of the working day, and has added a skin notation to indicate that substantial percutaneous absorption can occur through the eyes, mucous membranes, and skin. m-Xylene alpha, alpha'-diamine (MXDA) is a colorless liquid.

Animal studies have demonstrated that MXDA is strongly irritating to the skin (Haskell Laboratory 1973, private communication; Sherwin-Williams Company 1978). Research at Du Pont (1973) showed that pure MXDA was corrosive when applied to the skin of guinea pigs, and a 50-percent MXDA solution caused severe irritation in these animals. In a separate study (Sherwin-Williams Company 1978), a 10-percent mixture of MXDA caused severe skin irritation and erythema in guinea pigs. Sherwin-Williams (1978) also reported that rats exposed to levels of MXDA ranging from 1.74 to 6.04 mg/liter even for 1 hour sustained liver, kidney, and lung damage, as determined at necropsy. One study showed mild sensitization when MXDA was applied to guinea pig skin, but this effect was not observed in a second study (Sherwin-Williams Company 1978).

OSHA preliminarily concludes that a ceiling limit of 0.1 mg/m³ is necessary to protect against the risk of skin irritation, percutaneous absorption of MXDA, and potential systemic effects. The health evidence forms a reasonable basis for proposing a new limit for MXDA. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

XYLIDINE
CAS: 1300-73-8; Chemical Formula: $(CH_3)_2C_6H_3NH_2$
H.S. No. 1433

OSHA's current Z tables list an exposure limit of 5 ppm as an 8-hour TWA for xylidine, with a skin notation. In 1982, the ACGIH reduced its TLV to 2 ppm as an 8-hour TWA and retained the skin notation. Xylidine is a pale-yellow to brown liquid. Commercial xylene is a mixture of isomers.

Several studies indicate that the current OSHA PEL for xylidine is insufficient to protect workers against hepatotoxic and other adverse effects. A paper by Von Oettingen et al. (1974) reported liver damage in dogs, rats, cats, and mice repeatedly exposed to 45 ppm xylidine for 7 hours per day for a period of 20 to 40 weeks; these exposures also caused death in dogs, cats, and mice. Treon, Sigmon, Wright, et al. (1950) noted cardiac, liver, and kidney damage in animals fatally exposed at the following doses: Cats, 17 ppm; guinea pigs, 50 ppm; and rabbits, 60 ppm; cyanosis was also observed in these animals.

OSHA is proposing to reduce the existing 8-hour TWA to 2 ppm and to retain the skin notation. The Agency preliminarily concludes that these limits will protect workers from the risk of cardiac, kidney, and liver damage potentially associated with exposure to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for xylidine if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

Exposure to the 72 substances included in this category place workers at risk of material health impairment or functional incapacity. The adverse health consequences of exposure to these chemicals include neuropathies, skin and respiratory tract irritation, kidney and liver damage, and gastrointestinal disorders. The available health evidence for this large group of substances forms a reasonable basis for proposing to reduce existing limits or to add new limits where none formerly existed. At the time of the final rule, OSHA will establish new or revise existing limits, if the Agency determines that these limits will substantially reduce significant risk.

13. Substances for Which Proposed Limits Are Based on Avoidance of Biochemical/Metabolic Effects

Introduction

One basis for establishing exposure limits is the ability of many toxic substances to interfere with the normal metabolism or biochemistry of the body. A total of 26 substances for which OSHA is proposing limits fall into this group. Table C13-1 shows these substances, their current OSHA PELs, ACGIH TLVs, and NIOSH RELs, and their CAS and HS numbers. For four of these substances, OSHA is proposing only to lower the 8-hour TWA; for two other substances, the Agency is proposing to retain the 8-hour limit and to add a STEL. In one instance, OSHA is proposing a reduced TWA and the addition of a ceiling. In one case (terphenyls), OSHA proposes a reduction in the ceiling level, and for 17 substances, new limits are being proposed. In the case of p-nitrochlorobenzene, OSHA proposes to retain OSHA's current limit of 1 mg/m³ as an 8-hour TWA. NIOSH has a REL for only two of these substances, carbon monoxide and carbon dioxide.

Description of the Health Effects

The compounds shown in Table C13-1 are further divided into the following sub-classes, based on their mechanism of action:

- Substances that are cholinesterase inhibitors;
- Substances that interfere with the oxygen carrying capacity of blood;
- Substances with Antabuse-like effects.

The disruption of metabolic processes by toxic substances, if severe enough, results in potentially dangerous effects on the neurological, cardiovascular, and respiratory systems. The adverse health consequences caused by exposure to chemicals having cholinesterase inhibition effects range from wheezing, nausea, vomiting, and confusion to respiratory failure, coma, and death. If exposure has localized rather than systemic effects, the signs and symptoms of cholinesterase inhibition can include sweating, blurred vision, and constriction of the bronchial tubes. Substances that interfere with the ability of the blood to carry oxygen cause a broad range of symptoms, including fainting, loss of consciousness, rapid heartbeat, headache, nausea, coma, and death. Carbon monoxide (CO) is the best known substance in this category of chemicals, and exposure to CO is common throughout industry.

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Table C13-1. Substances for Which Limits Are Based on Avoidance of Metabolic Effects

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***	Biochemical/ Metabolic Effect
1025 Aniline and homologs	62-53-3	5 ppm TWA, Skin	2 ppm TWA, Skin	-	Methemoglobinamia
1058 Calcium cyanamide	156-62-7		0.5 mg/m^3 TWA		Antabuse-like effect
1068 Carbofuran	1563-66-2		0.1 mg/m^3 TWA		Cholinesterase inhibition
1069 Carbon dioxide	124-38-9	5000 ppm TWA	5,000 ppm TWA 30,000 ppm STEL	10,000 ppm TWA 30,000 ppm Ceiling (10 min)	Hyperventilation
1071 Carbon monoxide†	630-08-0	50 ppm TWA	50 ppm TWA 400 ppm STEL	35 ppm TWA 200 ppm Ceiling	Carboxyhemoglobinemia
1091 Chlorpyrifos	2921-88-2		0.2 mg/m^3 TWA 0.6 mg/m^3 STEL, Skin		Cholinesterase inhibition
1103 Crufomate	299-86-5		5 mg/m^3 TWA 20 mg/m^3 STEL		Cholinesterase inhibition

Table C13-1. Substances for Which Limits Are Based on Avoidance of Metabolic Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***	Biochemical/ Metabolic Effect
1104 Cyanamide	420-04-2		2 mg/m^3 TWA	-	Antabuse-like effect
1131 Dicrotophos	141-66-2	-	0.25 mg/m^3 TWA, Skin	-	Cholinesterase inhibition
1143 Dimethylaniline	121-69-7	5 ppm TWA, Skin	5 ppm, TWA, Skin 10 ppm STEL		Methemoglobinemia
1146 Dioxathion	78-34-2		0.2 mg/m^3 TWA, Skin	-	Cholinesterase inhibition
1151 Disulfiram (Antabuse)	97-77-8		2 mg/m^3 TWA		Antabuse effects
1160 Ethion	563-12-2		0.4 mg/m^3 TWA, Skin		Cholinesterase inhibition
1173 Fenamiphos	22224-92-6		0.1 mg/m^3 TWA, Skin	-	Cholinesterase inhibition
1174 Fensulfothion	115-90-2		0.1 mg/m^3 TWA		Cholinesterase inhibition

Table C13-1. Substances for Which Limits Are Based on Avoidance of Metabolic Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***	Biochemical/ Metabolic Effect
1175 Fenthion	55-38-9		0.2 mg/m^3 TWA, Skin	-	Cholinesterase inhibition
1245 Methomyl	16752-77-5		2.5 mg/m^3 TWA		Cholinesterase inhibition
1280 Monomethylaniline	100-61-8	2 ppm TWA, Skin	0.5 ppm TWA, Skin	-	Methemoglobinemia
1288 p-Nitrochloro-benzene[++]	100-00-5	1 mg/m^3 TWA, Skin	3 mg/m^3 TWA, Skin		Methemoglobin-emia
1319 Phorate	298-02-2		0.05 mg/m^3 TWA, 0.2 mg/m^3 STEL, Skin	-	Cholinesterase inhibition
1337 Propoxur	114-26-1		0.5 mg/m^3 TWA		Cholinesterase inhibition
1349 Ronnel	299-84-3	15 mg/m^3 TWA	10 mg/m^3 TWA		Cholinesterase inhibition
1380 Sulprofos	35400-43-2		1 mg/m^3 TWA		Cholinesterase inhibition

Table C13-1. Substances for Which Limits Are Based on Avoidance of Metabolic Effects (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***	Biochemical/ Metabolic Effect
1384 Terphenyls	26140-60-3	1 ppm Ceiling	0.5 ppm Ceiling		Mitochondrial changes
1401 m-Toluidine	108-44-1	-	2 ppm TWA, Skin		Methemoglobinemia
1413 2,4,6-Trinitrotoluene	118-96-7	1.5 mg/m^3 TWA, Skin	0.5 mg/m^3 TWA, Skin	-	Methemoglobinemia

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed PEL is the NIOSH REL.

++ OSHA limit is retained.

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The Antabuse-like effects associated with exposure to three chemicals—disulfiram, cyanamide, and calcium cyanamide—include facial flushing, nausea, and a racing heartbeat. However, these effects are manifested only if the exposed individual has ingested alcohol. The three chemicals in this sub-group cause this effect by inhibiting aldehyde dehydrogenase activity, which is involved in the biotransformation of alcohol.

For chemicals that cause systemic toxicity in animals and/or humans, the grossly observable signs and symptoms of intoxication are usually secondary to the interaction of the chemical with a molecular target. In other words, the chemical interacts with (binds with or modifies) an endogenous molecular constituent (protein, nucleic acid, lipid, etc.) in the target tissue(s). The result of the interaction is ordinarily a modification or elimination of the normal function of the specific molecular constituent which, if sufficiently severe, may lead to secondary effects within the affected cells and/or tissues. It is possible for a number of molecules to be affected by the toxic chemical without there being any overt manifestation of toxicity. In other words, there is an apparent no-effect level governing the overt manifestation of toxicity, although there are usually metabolic effects at levels below those that cause overt effects.

For chemicals for which the molecular target is known and for which methods are available to detect the altered molecular target, it is possible to use the measure of altered biochemical function as a sensitive indicator of exposure to the chemicals at levels below those that cause grossly observable signs and symptoms of poisoning. For some other classes of chemicals, studies in animals and/or humans have shed light on the biochemical basis of their toxicity. For some of these classes of chemicals, it is possible to base limits of human exposure on biochemical, metabolic, or pharmacologic indicators of their interaction with molecular targets rather than on grossly visible signs and symptoms of adverse systemic effects.

Cholinesterase inhibition. A number of organophosphate and carbamate insecticides produce acute toxicity in humans through inhibition of acetylcholinesterase at cholinergic synapses in the central and peripheral nervous systems. This inhibition causes an accumulation of acetylcholine at the effector sites and elicits signs and symptoms consistent with excessive cholinergic activity. These include bronchoconstriction; increased bronchial secretions, salivation, and lacrimation; nausea; vomiting; cramps; constriction of the pupils; muscular weakness; and cardiac irregularities. If sufficiently severe, acetyl-cholinesterase inhibition **may** cause coma, irreversible CNS damage, and death.

The mechanisms by which carbamates and organophosphates inhibit acetylcholinesterase differ. In general, carbamates form a non-covalently bound complex with the enzyme, while most organophosphates bind covalently with the enzyme. The net result, inactivation of the enzyme, is similar for both groups. In either case, the inhibition is usually reversible. The carbamate-cholinesterase complex dissociates to regenerate the active enzyme, while cholinesterase inactivated by organophosphates is replaced by the *de novo* synthesis of active enzyme. Therefore, unless the inhibition is sufficiently severe to cause brain damage or death, the manifestations of acute toxicity are reversible, and poisoned individuals recover without sequelae. A significant proportion of endogenous cholinesterase activity may be inhibited before the overt manifestations of intoxication appear. The fraction of total cholinesterase activity that can be inhibited without there being signs and symptoms of toxicity varies from individual to individual and also appears to depend on the intensity and duration of exposure. The lack of warning signs at low levels of exposure increases the need to set exposure limits at levels that will protect those individuals who do not readily manifest the symptoms and signs of toxicity from experiencing the subclinical effects of exposure.

Compounds that interfere with the oxygen-carrying capacity of the blood. A number of compounds produce their immediate toxicity in humans by altering the ability of hemoglobin in the red blood cells to bind, transport, and release oxygen. Perhaps the best studied of these is carbon monoxide. Carbon monoxide binds to hemoglobin with a greater affinity than does oxygen. It also alters the dissociation characteristics for the oxygen-hemoglobin complex. The overall effect is to reduce the oxygen-carrying capacity of the blood. Also included in this overall category of compounds is a group of aromatic amines and nitro compounds that react with hemoglobin in the blood to reduce it to methemoglobin. Methemoglobin will not bind with oxygen and therefore is not an effective carrier of oxygen.

Because these compounds reduce the ability of the blood to transport oxygen, the overt signs and symptoms of acute toxicity are those of tissue anoxia, i.e., neurobehavioral disturbances, dizziness, cardiac irregularities, cyanosis, unconsciousness, and death. The severity of the symptoms are a function of the degree to which the oxygen-carrying capacity of the blood has been depleted and of the state of the exposed individual's health. In the case of carbon monoxide, individuals may experience only very subtle neurobehavioral effects when 10 percent of the hemoglobin is bound to carbon monoxide, and healthy individuals may tolerate carboxyhemoglobin concentrations of 50 percent for short periods of time without experiencing lasting adverse effects.

In the cases of both carbon monoxide and the methemoglobin-forming compounds, the primary effect (i.e., formation of carboxyhemoglobin or methemoglobin) is reversible. In the absence of additional carbon monoxide exposure, carboxyhemoglobin dissociates to carbon monoxide and fully functional hemoglobin. Methemoglobin can be reoxidized to hemoglobin by endogenous mechanisms, but the major recovery mechanism is via the synthesis of new hemoglobin.

Substances that cause Antabuse-like effects. The ingestion of alcoholic beverages following exposure to disulfiram, cyanamide, or calcium cyanamide results in a characteristic syndrome consisting of flushing of the face, nausea, vomiting, hypotension, and increased heart rate. If exposure is particularly severe, the reaction may trigger convulsions, cardiac arrhythmias, or heart attacks and has in some cases caused death. In the vast majority of less severe cases, the reaction is fully reversible, although the symptoms are temporarily completely disabling. Disulfiram (Antabuse) is used therapeutically in the treatment of chronic alcoholism; as such, employees who are currently being treated with disulfiram for alcoholism are at particularly high risk if they are also occupationally exposed to these substances that cause Antabuse-like effects. These compounds do not cause any signs or symptoms of toxicity in the absence of alcohol ingestion unless exposure levels are far above those that trigger the alcohol response.

Dose-Response Relationships and Biochemical/Metabolic Effects

Cholinesterase inhibition. Typically, the cholinesterase inhibition potential of a compound is assessed by measuring plasma cholinesterase activity in the treated organism. Data from experiments in animals and limited data

from human clinical trials indicate that the percentage of basal plasma cholinesterase activity decreases with increasing dose and that the dose-response curve is S-shaped. Because there is inter-individual variation in this relationship, the dose-response curve for a population exposed to a cholinesterase inhibitor would be expected to be much shallower in slope and to have longer tails than the dose-response curve for any single individual.

The relationship between the dose-response curve for plasma cholinesterase inhibition and the dose-response curves for more direct indicators of clinical intoxication, such as acetylcholinesterase activity in the CNS or the actual appearance of signs of intoxication, is not known. Evidence suggests that there is considerable inter-individual variability in these relationships. Some individuals may be free of the symptoms and signs of intoxication when their plasma cholinesterase levels have been inhibited by as much as 90 percent, while others may experience symptoms after only a small decrease in plasma cholinesterase activity. Because of this variability, any exposure limit should be set with this individual variability in mind.

Substances that interfere with oxygen transport. Both carboxyhemoglobin and methemoglobin formation exhibit a classical sigmoidal dose-response relationship in relation to exposure to carbon monoxide or methemoglob-informing compounds. The loss in the oxygen-carrying capacity of the blood is a function of the intensity and duration of exposure. As stated above, the majority of healthy individuals can tolerate some reduction in the oxygen-carrying capacity of their blood without experiencing symptoms of overt toxicity. However, there is great inter-individual variability in the degree of decreased oxygen-carrying capacity that can be tolerated without apparent ill effect. Individuals with pre-existing anemia or with high carboxyhemoglobin levels as a result of other environmental exposures may already be at or above the level at which they will display the signs or experience the symptoms of tissue anoxia. For these individuals, even a small incremental decrease in the oxygen-carrying capacity of the blood can have serious consequences.

Substances causing Antabuse-like effects. The dose-response characteristics of disulfiram, cyanamide, and calcium cyanamide follow the usual S-shaped curve. The effect of exposure to cyanamide is approximately one-half that of exposure to disulfiram (ACGIH 1986). The proposed limits for the substances in this group have been set at levels below those associated with the Antabuse effect in workers ingesting alcohol either during or after work.

The following paragraphs describe the Agency's preliminary findings with respect to the substances that cause metabolic disturbances. The discussions below illustrate the serious nature of the risk associated with exposure to these substances.

PHORATE
CAS: 298-02-2; Chemical Formula: $C_7H_{17}O_2PS_3$
H.S. No. 1319

Phorate is an organophosphorus cholinesterase inhibitor that is used as an insecticide. The ACGIH has recommended exposure limits of 0.05 mg/m³ 8-hour TWA and 0.2 mg/m³ STEL for phorate, with a skin notation.

Phorate has been shown to be a highly toxic compound in animals. Rats exposed to daily doses of phorate showed effects at levels above 0.15 mg/kg/day but no effects at levels below this level. The no-effect level in dogs is between 0.01 and 0.05 mg/kg/day Gaines 1969).

The proposed limit of 0.05 mg/m³ as an 8-hour TWA, supplemented by a STEL of 0.2 mg/m³ and a skin notation, is based on calculations that the no-effect level in humans would lie in the range between 0.21 and 0.7 mg/day, and that use of an appropriate safety factor would suggest an 8-hour limit of 0.05 mg/m³ with a STEL of 0.2 mg/m³ to ensure against excursions greatly in excess of the TWA limit.

OSHA preliminarily finds that these limits will protect workers exposed to phorate against cholinesterase inhibition and its associated effects, which include respiratory symptoms, nausea, confusion, and vomiting. The Agency believes that, in the absence of any OSHA limit, phorate-exposed employees are at risk of experiencing such effects and that establishing a PEL will substantially reduce these risks. The health evidence forms a reasonable basis for proposing a new limit for phorate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CARBON MONOXIDE
CAS: 630-08-0; Chemical Formula: CO
H.S. No. 1071

OSHA's current limit for carbon monoxide is 50 ppm TWA. The ACGIH recommends a TLV-TWA of 50 ppm with a TLV-STEL of 400 ppm. NIOSH (1972) recommends an 8-hour TWA limit of 35 ppm with a 200-ppm ceiling.

Carbon monoxide readily combines with hemoglobin to form carboxyhemoglobin (COHb). Excessive accumulations of COHb cause hypoxic stress in healthy individuals as a result of reduced oxygen-carrying capacity of the blood. In patients with cardiovascular disease, such stress can further impair cardiovascular function. The ACGIH (1986) cites a number of studies showing that exposure to 50 ppm TWA carbon monoxide generally results in COHb levels of 8 to 10 percent, and that such levels are not associated with signs or symptoms of health impairment in healthy individuals. However, ACGIH comments that a TLV of 25 ppm, which results in COHb levels of 4 percent or less, may be necessary for workers with disease that places them at higher risk of serious cardiovascular injury. The NIOSH recommendation of 35 ppm TWA is also based on protecting workers with chronic heart disease; NIOSH believed that such workers should not be allowed to approach a COHb level of 5 percent.

The basis for the recommendation of a 400-ppm TLV-STEL by the ACGIH is not entirely clear, but may be based on a study by Schulte (1964), who stated that exposure to 100 ppm carbon monoxide for 4 hours is excessive. NIOSH recommended a 200-ppm short-term limit to supplement the TWA limit since it appears that transient exposures up to 200 ppm do not significantly alter a worker's equilibrium COHb level.

Exposure to the TLV-TWA of 50 ppm generally results in COHb levels of 8 to 15 percent. These levels are not associated with toxic effects in healthy individuals. NIOSH recommends an 8-hour TWA limit of 35 ppm and a ceiling limit of 200 ppm, based on the need to protect workers with chronic heart disease. OSHA proposes that these NIOSH limits be adopted as the PEL to ensure that COHb levels are less than 5 percent and thus protect workers who may be at greater risk because of cardiovascular or pulmonary impairment. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for carbon monoxide if the Agency determines that this limit will substantially reduce significant risk. OSHA's preliminary feasibility analysis is based on limited data at this level, and the Agency therefore requests additional feasibility information from the public.

CRUFOMATE
CAS: 299-86-5; Chemical Formula: $C_{12}H_{19}ClNO_3P$
H.S. No. 1103

This pesticide actively inhibits both plasma and erythrocyte cholinesterase. Neither OSHA nor NIOSH presently has a limit for crufomate; the ACGIH has set a TWA-TLV of 5 mg/m³ and a STEL of 20 mg/m³ for this substance.

A study in humans showed that ingestion of 200 mg of crufomate daily for 7 days caused no apparent cholinesterase inhibition in the subjects of this controlled study. Rats and dogs receiving higher doses (5 mg/kg/day) for two years did show this effect (McCollister et al. 1968).

Because cholinesterase inhibition is a very sensitive indicator of exposure, OSHA preliminarily concludes that the proposed level of 5 mg/m³ will provide a margin of safety below the ingestion NOEL for humans, which corresponds approximately to an 8-hour inhalation of 20 mg/m³. The substantial risk of experiencing such effects will be significantly reduced from the uncontrolled levels possible in the absence of an OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for crufomate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CARBON DIOXIDE
CAS: 124-38-9; Chemical Formula: CO_2
H.S. No. 1069

OSHA's current limit for carbon dioxide is 5000 ppm TWA. ACGIH also recommends a 5000-ppm TLV-TWA with a 30,000-ppm TLV-STEL. NIOSH recommends a 10-hour TWA limit of 10,000 ppm with a 10-minute 30,000 ppm ceiling limit.

Both ACGIH (1986) and NIOSH (1976f) cite studies indicating that continuous exposure to between 1.5 and 3 percent carbon dioxide (15,000 to 30,000 ppm) results in few, if any, adverse effects. However, electrolyte imbalances and other mild metabolic changes have been associated with prolonged exposure to 10,000 to 20,000 ppm (Schulte 1964; Gray et al. 1950). Increases in the rate of respiration have been observed among resting subjects exposed to 39,500 ppm for periods shorter than a day and among exercising subjects exposed to airborne concentrations below 30,000 for the same period (Sinclair et al. 1969).

OSHA is proposing to add a 30,000-ppm STEL to the existing PEL of 5000 ppm TWA to protect employees from experiencing elevated short term exposures; the Agency preliminarily concludes that this limit will substantially reduce the risk associated with such short-term exposures to CO_2. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for carbon dioxide if the Agency determines that this limit will substantially reduce significant risk.

ANILINE (AND HOMOLOGUES)
CAS: 62-53-3; Chemical Formula: $C_6H_5NH_2$
H.S. No. 1025

The current OSHA 8-hour TWA permissible exposure limit for aniline is 5 ppm, with a skin notation. The ACGIH-recommended 8-hour TLV is a 2-ppm TWA, with a skin notation. Aniline, when first distilled, is an oily, colorless liquid that darkens on exposure to air.

Occupational aniline poisoning was a relatively common occurrence in earlier years (ACGIH 1986, p. 30). The early limits for aniline were set to guard against acute toxicity manifested as cyanosis (Henderson and Haggard 1943). Cirrhosis and chronic CNS effects were also reported (Holstein 1955; von Oettingen 1941). Skin absorption occurs when aniline vapor contacts the skin (Dutkiewicz 1962), and skin contact should therefore be avoided.

Early studies suggested that less than full-shift exposures of 7 to 53 ppm of aniline vapor caused mild symptoms, while 1-hour inhalation exposures to concentrations in the range of 100 to 160 ppm caused severe effects (Henderson and Haggard 1943). Later studies in several species of animals found no effects, other than a slight increase in methemoglobin in the blood of rats, after the animals had been exposed to aniline concentrations of 5 ppm for 6 months (Oberst, Hackley, and Comstock 1956). An early NCI aniline hydrochloride cancer bioassay in Fischer-344 rats and B6C3F1 mice demonstrated carcinogenic effects, primarily in the spleen of rats, but multiple organ sites were also involved in rats fed 0.6 percent or 0.3 percent aniline hydrochloride for 103 weeks (NCI 1978).

OSHA has preliminarily concluded that the current limit of 5 ppm is not protective, since systemic effects have been observed in humans exposed to levels as low as 7 ppm and in animals at levels as low as 5 ppm. Accordingly, OSHA proposes an 8-hour TWA of 2 ppm for aniline and retains the skin notation to protect against percutaneous absorption. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for aniline if the Agency determines that this limit will substantially reduce significant risk. The Agency intends to analyze the evidence of aniline carcinogenicity further.

CALCIUM CYANAMIDE
CAS: 156-62-7; Chemical Formula: $CCaN_2$
H.S. No. 1058

OSHA currently has no limit for calcium cyanamide. The ACGIH recommends a TLV-TWA of 0.5 mg/m³ for this crystalline gray material.

The acute toxicity of calcium cyanamide is low, although evidence of its toxic effects is sparse. The oral LD_{50} reported for rabbits is 1400 mg/kg, and that for rats is 1000 mg/kg (Guide to Chemicals Used in Crop Production, London, Ontario, 1973).

Skin and eye irritation have been reported in rats and rabbits, with a significant irritative effect occurring when 100 mg is placed directly into the eyes of rabbits (Martin 1975). Severe skin irritation developed in rabbits when a paste of this substance was applied to the shaved abdominal skin for 24 hours (Martin 1975). Two of five animals died when the dose was 10 g/kg, but all survived a dose of 5 g/kg.

Most industrial toxicities involve primary skin irritation or sensitizing dermatitis. This skin irritation develops in the form of an erythematous rash over the body surfaces exposed to the substance or those areas irritated by clothing or perspiration. Some individuals develop a macular rash on exposure, and this may progress to the weeping stage. In addition, exposed workers may develop temporary vasomotor disturbances of the upper body, with susceptibility increasing with alcohol intake (Fassett 1963). Calcium cyanamide is used medically for its Antabuse-like effect, and the maintenance dose in adults is between 50 and 100 mg/day (Hald, Jacobson, and Varson 1952).

OSHA proposes a TWA of 0.5 mg/m³ for calcium cyanamide. The Agency preliminarily concludes that this level will substantially reduce the risks of eye and skin irritation, sensitizing dermatitis, and the occurrence of Antabuse-like effects possible at previously unregulated levels of exposure. The health evidence forms a reasonable basis for proposing a new limit for calcium cyanamide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CARBOFURAN
CAS: 1563-66-2; Chemical Formula: $C_{12}H_{15}NO_3$
H.S. No. 1068

OSHA does not currently regulate carbofuran. The ACGIH recommends a TLV-TWA of 0.1 mg/m³ for this white crystalline solid.

The inhalation toxicity of carbofuran is low, with Tobin reporting the LC_{50} of

50-percent wettable powder to be 108 mg/m³ for male and 133 mg/m³ for female rats; a respiratory LC_{50} of 53 mg/m³ for guinea pigs exposed to 75-percent wettable powder is also reported (Tobin 1970). Rhesus monkeys did not display cholinesterase depression at levels equivalent to 0.56 mg/m³ of 75-percent wettable powder (Tobin 1970). Chronic feeding studies in the rat have shown no effect at 25 ppm; in the dog, the no-effect level was 20 ppm (Gaines, unpublished data). Inhibition of plasma, erythrocyte, and brain cholinesterase levels were evident at levels of 50 ppm in the diet (Tobin 1970). Six-hour exposures at levels of 0.86 mg/m³ caused significant cholinesterase inhibition in animals (Tobin 1970).

Workers exposed at concentrations approaching 0.1 mg/m³ have not shown any adverse effects (Tobin, personal communication to ACGIH TLV Committee, as cited in ACGIH 1986, p. 100).

OSHA is proposing a permissible exposure limit of 0.1 mg/m³ TWA for this substance to protect exposed employees from the risk of metabolic effects potentially associated with exposure to this previously unregulated substance. The health evidence forms a reasonable basis for proposing a new limit for carbofuran. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CHLORPYRIFOS
CAS: 2921-88-2; Chemical Formula: $C_9H_{11}Cl_3NO_3PS$
H.S. 1091

OSHA has no current limit for chlorpyrifos. The ACGIH recommends a TLV-TWA of 0.2 mg/m³ and a 0.6-mg/m³ STEL, with a skin notation, for this white crystalline solid.

Chlorpyrifos has an acute oral LD_{50} of 135 mg/kg for female rats and 163 for male rats (The Merck Index 1983, pp. 309-310). Other sources have reported the acute oral LD_{50} as 82 mg/kg in rats and the acute dermal LD_{50} as about 2000 mg/kg for rabbits (Gray 1965; Gaines 1969).

Chlorpyrifos is absorbed through the skin. It is an active inhibitor of plasma cholinesterase but has only moderate capacity to reduce red blood cell cholinesterase or to cause cholinergic symptoms and systemic injury (ACGIH 1986, p. 138). Particle inhalation has been shown to cause mild depression in plasma cholinesterase in dogs exposed for 4 hours at the upper end of a 140- to 280-mg/m³ range (Spencer 1968).

Dogs and rats fed 3.0 mg/kg of chlorpyrifos daily for 2 years showed no adverse effects (FAO/WHO 1972). Male and female rats showed no teratogenic or reproductive effects when fed 1.0 mg/kg per day (Dow Chemical Company 1972).

Five out of seven human exposures to 0.5 percent chlorpyrifos resulted in a measurable decrease (50 percent) in plasma and red cell cholinesterase (Eliason, Cranmer, von Windeguth et al. 1969). However, another study showed no ill effects on cholinesterase metabolism when human volunteers were exposed to an ultra-low-volume spray (0.8 um/m³ for 3 to 8 minutes) (Ludwig, Kilian, Dishburger, and Edwards 1970). Human cholinesterase levels appear to be less affected by dermal exposure than do those of rabbits (ACGIH 1986, p. 138). In human volunteers, four repeated dermal doses of 10 mg/kg, applied for 12 hours each, caused no depression in cholinesterase levels, but a similar dose of 25 mg/kg did depress plasma cholinesterase. Human subjects ingesting 0.03 mg/kg for 3 weeks showed no cholinesterase effects, but subjects ingesting 0.1 mg/kg demonstrated plasma cholinesterase depression (Dow Chemical Company 1973).

Workers applying chlorpyrifos as a spray were exposed to 0.5 percent chlorpyrifos emulsion and exhibited a marked decrease in plasma and red cell cholinesterase levels (Eliason, Cranmer, von Windeguth et al. 1969). In five of seven exposed sprayers, this reduction was greater than 50 percent.

OSHA proposes a PEL of 0.2 mg/m³ TWA and a 0.6 mg/m³ STEL for chlorpyrifos to protect exposed workers against the risk of organic injury and cholinesterase inhibition caused by this currently unregulated substance. A skin notation is also proposed to protect workers from the significant risk of systemic effects caused by percutaneous absorption. The health evidence forms a reasonable basis for proposing a new limit for chlorpyrifos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

CYANAMIDE
CAS: 420-04-2; Chemical Formula: $H_2NC{=}N$
H.S. No. 1104

OSHA currently has no limit for cyanamide. The ACGIH recommends a TLV-TWA of 2 mg/m³. Undiluted cyanamide is a deliquescent crystalline solid.

The average oral LD_{50} for cyanamide in rats is 125 (85 to 180) mg/kg, and cyanamide has been observed to be very irritating and caustic to the skin (American Cyanamide Company n.d.). As a 25-percent solution, which is commonly used, 10 mL/kg applied to the skin of rabbits caused no fatalities or signs of systemic toxicity. Irritation occurred in the form of primary skin irritation and, following instillation into the eye, slight irritation of the conjunctival sac (American Cyanamide Company n.d.).

When cyanamide is ingested or inhaled by a person who has also consumed an alcoholic beverage, the person experiences vasodilation of the face and neck, tachycardia, tachypnea, nausea, vomiting, and hypotension. This syndrome is referred to as the Antabuse effect. Studies of cyanamide's Antabuse-like effects indicate that the effect is about one-half that of tetraethylthiuram disulfide (Antabuse) and one-sixth that of tetramethyl thiuram disulfide (Hald, Jacobsen, and Larsen et al. n.d.).

OSHA proposes a limit of 2 mg/m³ TWA for cyanamide. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of irritation and of an adverse reaction in individuals who have ingested alcohol. The health evidence forms a reasonable basis for proposing a new limit for cyanamide. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DICROTOPHOS (BIDRIN)
CAS: 141-66-2; Chemical Formula: $C_8H_{16}NO_5P$
H.S. No. 1131

OSHA currently has no limit for dicrotophos; the ACGIH recommends a TLV of 0.25 mg/m³ TWA, with a skin notation, for this brown liquid with a mild ester odor.

Dicrotophos is a cholinesterase inhibitor (ACGIH 1986, p. 193). The acute oral LD_{50} in rats is reported as 22 mg/kg, and the percutaneous LD_{50} in rabbits is 224 mg/kg (Stanford Research Institute 1962, as cited in ACGIH 1986, p. 193). Another study reports the oral LD_{50} in rats as 16 to 21 mg/kg and the dermal LD_{50} in the same species as 42 mg/kg (Gaines 1969). Two-year feeding studies in rats given 0, 1, 10, or 100 ppm dicrotophos showed no detectable effects at the 1-ppm concentration. At the higher concentrations, decreased body weights (as compared to controls) and cholesterinase inhibition were observed (Woodward Research Corporation 1967, as cited in ACGIH 1986, p. 193). Dietary studies in dogs showed both plasma and erythrocyte cholinesterase inhibition at a 16-ppm concentration, but no significant ill effects at concentrations of 0, 0.16, or 1.6

ppm (Woodward Research Corporation 1967, as cited in ACGIH 1986, p. 193). Studies of vapor inhalation in male rats have shown that transient illness occurred after a 1-hour exposure to 910 mg/m³ technical dicrotophos, and 2620 mg/m³ or 2120 mg/m³ of 38-percent dicrotophos (Kettering Laboratories 1965, as cited in ACGIH 1986). Dicrotophos does not cause demyelinization in chickens (Tunstall Laboratory 1965; Kettering Laboratory 1963, as cited in ACGIH 1986, p. 193), and it is metabolized in a fashion similar to mono-microtophos (Menzer and Casida 1965). The ACGIH (1986, p. 193) reports that dicrotophos penetrates the skin.

The ACGIH recommendation is based on the data described above and, in part, by analogy to other cholinesterase-inhibiting substances. OSHA is proposing an 8-hour TWA permissible exposure limit of 0.25 mg/m³, with a skin notation, for dicrotophos. The Agency preliminarily concludes that this limit will protect exposed workers from the metabolic effects, such as cholinesterase inhibition, potentially associated with inhalation, ingestion, and dermal exposure to this substance. The health evidence forms a reasonable basis for proposing a new limit for dicrotophos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DIMETHYLANILINE
CAS: 121–69–7; Chemical Formula: $C_6H_5N(CH_3)_2$
H.S. No. 1143

OSHA's current permissible exposure limit for dimethylaniline is 5 ppm as an 8-hour TWA, with a skin notation. The ACGIH recommends an 8-hour TWA limit of 5 ppm, with a 15-minute STEL of 10 ppm and a skin notation. Dimethylaniline is a yellow-to-brown oily liquid.

One of the major toxic effects of dimethylaniline exposure is methemoglobinemia, although authorities disagree concerning the level at which humans can tolerate exposure to this substance (ACGIH 1986, p. 207).

Hamblin (1962) reported that dimethylaniline is quantitatively less toxic than aniline. Dogs administered a single oral dose of 50 mg/kg exhibited methemoglobinemia, and absorption through the skin can increase the overall exposure (Hamblin 1962). Mayer (1930) reported that dimethylaniline's necrotic potential was markedly lower than that of aniline, which has a TLV–TWA of 2 ppm. However, von Oettingen (1941) stated that dimethylaniline has a greater depressant effect on the nervous system than does aniline.

The literature on industrial experience with dimethylaniline is limited. Hamilton (1919) reported collapse, prolonged unconsciousness, visual disturbance, and intense abdominal pain following severe exposure of two workers.

The Agency is proposing an 8-hour TWA PEL of 5 ppm and a short-term limit of 10 ppm, with a skin notation, for dimethylaniline. OSHA believes that the STEL is necessary to afford protection from CNS depression following acute exposures. OSHA preliminarily concludes that these limits, taken together, will provide exposed workers with protection from the risks of skin absorption, methemoglobinemia, and neuropathic effects associated with exposure to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for dimethylaniline if the Agency determines that this limit will substantially reduce significant risk.

DIOXATHION (DELNAV)
CAS: 78–34–2; Chemical Formula: $C_{12}H_{26}O_6P_2S_4$
H.S. No. 1146

OSHA currently has no permissible exposure limit for dioxathion. The ACGIH recommends a limit of 0.2 mg/m³ as an 8-hour TWA, with a skin notation. Dioxathion is a nonvolatile, very stable, dark amber liquid.

The pesticide, dioxathion, contains both the cis- and trans-isomers of 2,3-p-dioxanedithiol; the cis-isomer is approximately four times as acutely toxic as the trans-isomer ACGIH 1986, p. 219). The oral LD_{50} values reported for rats range from 23 to 118 mg/kg (with most values in the 23- to 64-mg/kg portion of the range); in dogs, oral LD_{50}s range from 10 to 40 mg/kg. The LC_{50} in rats is 1398 mg/m;³ in mice, it is 340 mg/m³ (Hercules, Inc. 1973, as cited in ACGIH 1986, p. 219). The percutaneous LD_{50}s in rats and rabbits are reported to be 63 and 85 mg/kg, respectively (NIOSH 1983). Instillation of 0.1 ml dioxathion into the rabbit eye produces mild, transient conjunctivitis but no corneal damage (ACGIH 1986, p. 219).

In subacute oral toxicity studies, the no-effect dose level in rats was reported to be 0.22 mg/kg/day; in dogs, a no-effect level of between 0.075 and 0.25 mg/kg/day was indicated (Frawley, Weir, Tusing et al. 1963). Dioxathion was reported not to produce myelin degeneration in chickens (Frawley, Weir, Tusing et al. 1963). The no-effect level in multigenerational studies of reproductive effects in rats was reported to be 10 ppm (Kennedy, Frawley, and Colandra 1973).

Human volunteers who ingested 0.075 mg/kg/day had no symptoms related to plasma or blood cholinesterase activity, while those ingesting 0.15 mg/kg/day exhibited a slight decrease in plasma cholinesterase activity (Frawley, Weir, and Tusing et al. 1963). The World Health Organization has estimated an acceptable daily intake for man of 0.0015 mg dioxathion/kg (WHO, as cited in ACGIH 1986, p. 219). Other organophosphorous compounds have been demonstrated to produce levels of cholinesterase inhibition analogous to those produced by dioxathion (ACGIH 1986, p. 219).

OSHA is proposing an 8-hour TWA PEL of 0.2 mg/m³ for dioxathion; the Agency also proposes a skin notation for dioxathion. OSHA preliminarily concludes that these limits will protect exposed workers against the risk of metabolic effects associated with inhalation and oral exposure and with dermal penetration of this substance, which is currently not regulated by OSHA. The health evidence forms a reasonable basis for proposing a new limit for dioxathion. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

DISULFIRAM
CAS: 97–77–8; Chemical Formula: $C_{10}H_{20}N_2S_4$
H.S. No. 1151

OSHA currently has no limit for disulfiram. The ACGIH recommends a limit of 2 mg/m³ TWA for this crystalline solid.

Disulfiram has a very low order of acute oral toxicity in laboratory animals (ACGIH 1986, p. 225). The LD_{50} for rats is reported as 8.6 g/kg (The Merck Index 1983, pp. 491–492), and the oral LD_{50} for rabbits is reported to be 2.05 g/kg (Brieger 1947). The compound is highly toxic when injected intraperitoneally, with an LD_{50} of 75 mg/kg for mice (National Technical Information Service, as cited in ACGIH 1986, p. 225). The effects of high-dose ingestion include degenerative changes in the liver and kidneys. Very high doses can cause leukopenia and marked hypoplasia or aplasia of the bone marrow; in the most seriously afflicted animals, the blood urea nitrogen sometimes increased and the thymol turbidity test was positive (Brieger 1947).

Adverse health effects occur in humans consuming alcohol and simultaneously exposed to disulfiram. This represents a significant concern since disulfiram, under the trade name

Antabuse, is used as a medication in the treatment of chronic alcoholism. For individuals who drink alcohol and are exposed to disulfiram, the symptoms of exposure are facial vasodilation, tachycardia, tachypnea, nausea, vomiting, pallor, and hypotension. High doses of disulfiram can induce convulsions, cardiac arrhythmias, and myocardial infarction, and the compound has also been associated with polyneuropathy, peripheral neuritis, and skin eruption (Compendium of Pharmaceuticals and Specialties 1968). In industry, there have been reports of minimal skin irritation (Mastromatteo, as cited in ACIGH 1986, p. 225) and of optic neuritis (Norton and Walsh 1972).

OSHA is proposing a PEL of 2 mg/m³ TWA for disulfiram. The Agency preliminarily concludes that this limit will protect workers against the risk of Antabuse-like effects associated with exposure to airborne concentrations of disulfuram in combination with alcohol consumption. The health evidence forms a reasonable basis for proposing a new limit for disulfiram. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

ETHION (NIALATE)
CAS: 563–12–2; Chemical Formula:
$C_9H_{22}O_4P_2S_2$
H.S. No. 1160

OSHA currently has no permissible exposure limit for ethion. The ACGIH recommends a limit of 0.4 mg/m³ TWA, with a skin notation. Pure ethion is an odorless and colorless liquid. The technical material has a very disagreeable odor.

Ethion, is an insecticide that is used in a variety of forms, including 25-percent wettable powder, 2-, 3-, and 4-percent dust, 5-percent granules, and in several oil solutions and combinations with other chemicals. As a result, the acute toxicity values reported vary considerably.

NIOSH (1974) reports an oral LD_{50} in rats of 13 mg/kg. Other reported values for oral LD_{50}s in rats include 65 mg/kg, 96 mg/kg, and 208 mg/kg (Clinical Handbook on Economic Poisons; Farm Chemicals Handbook A74; Pesticide Chemicals Official Compendium; all as cited in ACGIH 1986, p. 236). Studies with 95 percent technical ethion report oral LD_{50}s of 87.4±0.16 mg/kg for albino rats and 24.4 mg/kg for female rats (Niagara Chemical Division, FMC Corp., as cited in ACGIH 1986, p. 236). Inhalation studies report LC_{50} values of 710 mg/m³ for female rats exposed to 25-percent wettable powder dust for 1 hour, and 7200 mg/m³ for male rats similarly exposed. Dermal exposure studies employing technical Nialate report a median acute dermal lethal dose of 915 mg/kg, demonstrating ethion's ability to penetrate skin; instillation of 0.05 ml ethion in the rabbit eye is immediately irritating but does not cause corneal scarring (Niagara Chemical Division, FMC Corp., as cited in ACGIH 1986, p. 236). Dietary studies of rats fed 600, 1000, or 1500 ppm showed complete cholinesterase inhibition; 300 ppm in the diet produced marked cholinesterase inhibition (Pesticide Chemicals Official Compendium, as cited in ACGIH 1986, p. 236).

Ethion poisonings have been reported in workers harvesting grapes and peaches (State of California: Department of Industrial Relations, as cited in ACGIH 1986. p. 236).

OSHA is proposing a PEL of 0.4 mg/m³ TWA for ethion. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of organophosphate poisoning and cholinesterase inhibition posed to workers in the absence of any OSHA limit. The Agency notes this substance's potential for dermal absorption in laboratory animals and is proposing a skin notation to protect against the risk of systemic toxicity possible in the absence of a skin notation. The health evidence forms a reasonable basis for proposing a new limit for ethion. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FENAMIPHOS
CAS: 22224–92–6; Chemical Formula:
$C_{13}H_{22}NO_3PS$
H.S. No. 1173

OSHA currently has no limit for fenamiphos. The ACGIH recommends a TLV–TWA of 0.1 mg/m³ for this substance, with a skin notation. Fenamiphos is a tan-colored and waxy solid.

Fenamiphos is a cholinesterase inhibitor that produces both central and peripheral cholinergic reactions (WHO 1975). The acute oral LD_{50} values reported for fenamiphos are 2 to 19 mg/kg in rats, 22 mg/kg in mice, 56 to 100 mg/kg in guinea pigs, 10 to 17 mg/kg in rabbits, and approximately 10 mg/kg in cats and dogs. Acute dermal LD_{50} values are 72 to 154 mg/kg in rats and 178 to 225 mg/kg in rabbits. One- and 4-hour exposures of rats to fenamiphos aerosols resulted in LC_{50} values of 110 to 175 and 91 mg/m³ to 100 mg/m³ of air, respectively. Rabbits exhibited no dermal or eye irritation (WHO 1975; Loeser and Kimmerle 1971).

Rats exposed to fenamiphos aerosol at concentrations of 0.03, 0.25, or 3.5 mg/m³ of air for 3 weeks exhibited no symptoms. At 3.5 mg/m³, rats showed significant depression of plasma cholinesterase; 0.25 mg/m³ was the highest no-effect concentration observed (Kimmerle, as cited in ACGIH 1986, p. 265). Two-year feeding studies of dogs (0.5, 1.0, and 10 ppm) and rats (3, 10, and 30 ppm) revealed no treatment-related toxic or oncogenic effects or tissue changes at a dietary level of 10 ppm; no-observable-effect levels were 3 ppm for the rat and 1 ppm for the dog (WHO 1975). Studies of rabbits and rats showed no embryotoxic or teratogenic effects, and results of a 3-generation study in rats showed that fenamiphos had no effect on reproduction (WHO 1975). Studies of mice have also shown no mutagenic effects, and a study of chickens demonstrated no delayed neurotoxic effects (WHO 1975; Kimmerle, as cited in ACGIH 1986, p. 265). Fenamiphos is metabolized rapidly and excreted primarily in the urine, as demonstrated in absorption tests of the skin and digestive and respiratory tracts of rats and cows (Waggoner and Khasawinah 1974).

There are no reports of human poisonings caused by exposure to fenamiphos, and no quantitative data are available relating adverse health effects to measurable airborne concentrations of fenamiphos.

OSHA proposes a PEL for this substance of 0.1 mg/m³ TWA to protect against the risk of anti-cholinesterase effects. A skin notation is also proposed based on the evidence of percutaneous absorption of fenamiphos in experimental animals. The Agency preliminarily concludes that these limits will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for fenamiphos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FENSULFOTHION (DASANIT)
CAS: 115–90–2; Chemical Formula:
$C_{11}H_{17}O_4PS_2$
H.S. No. 1174

OSHA currently has no limit for fensulfothion. The ACGIH recommends a TLV–TWA of 0.1 mg/m³ Fensulfothion is a brown liquid at room temperature.

Fensulfothion has an acute oral LD_{50} of 4 mg/kg in male rats, and 1.8 mg/kg in female rats. Aerosol inhalation studies in rats have shown LC_{50}s of 113 mg/m³ for a 1-hour exposure and 29.5 mg/m³

for a 4-hour exposure (Luser and Kimmerle 1971). This insecticide has been shown to have effects similar to those of the other thiophosphates, which cause cholinesterase inhibition. Dermal toxicity is relatively high, with LD_{50} values ranging between 14 and 30 mg/kg for male rats and between 3.5 and 3.0 mg/kg for females (NIOSH 1974). Tests of mice and rabbits have shown no embryotoxic, reproductive or mutagenic effects. The no-effect dietary level in subchronic feeding studies is reported to be 1 ppm in rats and 2 ppm in dogs. The no-effect level for cholinesterase inhibition is reported as 1 ppm in the diet for both dogs and cats (ACGIH 1986, p. 266).

In humans, dermal studies have shown irritation without cholinesterase effects from 2-hour twice-daily applications of a 5-percent granular formulation to the forearms of three subjects. Systemic absorption through the lungs has been demonstrated after inhalation of fensulfothion aerosols (ACGIH 1986, p. 266).

OSHA is proposing a PEL of 0.1 mg/m^3 TWA for this previously unregulated substance to reduce the risks of metabolic effects and skin irritation. The Agency preliminarily concludes that this limit will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for fensulfothion. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

FENTHION

CAS: 55–38–9; Chemical Formula: $C_{10}H_{15}O_3PS$

H.S. No. 1175

OSHA currently has no limit for fenthion. The ACGIH recommends a TLV–TWA of 0.2 mg/m^3, with a skin notation. Fenthion is a yellow-to-tan, oily liquid that smells slightly like garlic.

The primary health effect associated with exposure to fenthion is plasma cholinesterase inhibition. The oral LD_{50} values for the rat and rabbit are 215 mg/kg and 150 mg/kg, respectively, and the dermal LD_{50} in rats is 330 mg/kg (*Farm Chemicals Handbook* 1976; NIOSH 1977). Rats given single intramuscular injections of 5, 25, or 50 mg/kg of fenthion exhibited enduring changes in the electroretinogram (ERG) and cholinesterase activity; pseudocholinesterase activity in the plasma dropped to 50 percent of normal on the fourth day after injection. The retinal effects of fenthion persisted for as long as 50 days (Imai 1975). Groups of Donryn rats fed 300 ppm fenthion daily showed symptoms of organophosphate intoxication, including nervousness, general spasms, diarrhea, salivation, and ophthalmologic effects (Kawai, Tojo, Miyazawa et al. 1976). The no-effect inhalation level for rats has been reported to be 1 ppm for exposures of 6 hours/day, 5 days/week for 3 weeks (Thyssen 1979, as cited in ACGIH 1986, p. 267); the 4-hour inhalation LC_{50} in the rat is between 800 and 1200 mg/m^3 Thyssen 1978, as cited in ACGIH 1986, p. 267).

No mutagenic, carcinogenic, or reproductive effects have been reported (WHO 1976; Food and Agriculture Organization 1979; Shirasu, Moriya, Kato et al. 1976; Hanna and Dyer 1975; Oesch 1977; Simmon, Mitchell, and Jergenson 1977; Herbold 1980). Single and repeated applications of the compound have shown no delayed neurotoxic effects in chickens (WHO 1972). Two-year feeding studies of rhesus monkeys have shown plasma cholinesterase inhibition only at the highest oral dose given, i.e., 0.2 mg/kg daily (Rosenblum 1980).

Griffin, Rosenblum, and Coulston (1979) reported cholinesterase depression in humans at oral doses of 0.07 mg/kg daily for 4 weeks, but no effect was observed at 0.02 mg/kg. The lowest lethal dose for humans is 50 mg/kg (*Farm Chemicals Handbook* 1976; NIOSH 1977).

OSHA is proposing an 8-hour TWA limit of 0.2 mg/m^3, with a skin notation, for fenthion. The Agency preliminarily concludes that these limits will protect workers against the risk of cholinergic effects associated with exposures to this substance at the levels permitted by the absence of any OSHA limit. A skin notation is proposed because of evidence that fenthion is readily absorbed through the skin. The health evidence forms a reasonable basis for proposing a new limit for fenthion. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

METHOMYL

CAS: 16752–77–5; Chemical Formula: $C_5H_{10}N_2O_2S$

H.S. No. 1245

OSHA currently has no limit for methomyl. The ACGIH recommends a TLV–TWA of 2.5 mg/m^3 for this white crystalline solid with a slightly sulfurous odor.

Methomyl is a cholinesterase-inhibiting insecticide. The oral LD_{50} in rats is reported to be between 25 and 40 mg/kg (Dashiell and Kennedy 1984). Studies of dermal effects have reported no appreciable irritation or sensitization effects in guinea pigs. Instillation of a 10-percent solution of methomyl in propylene glycol or of the dry material into rabbit eyes caused mild conjunctivitis without corneal injury. However, marked pupillary constriction, a health effect produced commonly by cholinesterase inhibitors, occurred (E.I. du Pont de Nemours and Co., Inc., as cited in ACGIH 1986, p. 363). The LC_{50} of unformulated methomyl as mist is 0.3 mg/L at 4-hour exposures; the lethal concentration in rats exposed to a 90-percent water-soluble formulation with a particle size of less than 10 microns was approximately 0.45 mg/L.

Inhalation studies have reported no fatalities resulting from 4-hour exposures to the saturated vapor. There is no clinical evidence of cumulative toxicity resulting from 10 doses of 5.1 mg/kg/day over a 14-day period (Harvey, Jelnek, and Sherman 1973). Methomyl is rapidly metabolized and excreted in the urine, and cholinesterase inhibition is thus quickly reversed. In dogs, a dose of 20 mg/kg (one-half the lethal dose) produced symptoms of intoxication and cholinesterase inhibition that disappeared within 2 to 4 hours after cessation of exposure (E.I. du Pont de Nemours and Co., Inc. as cited in ACGIH 1986, p. 363). No depression of cholinesterase activity could be detected in rats fed at levels of 0, 200, 400, or 800 ppm methomyl for 79 days. In dogs, 90-day and 2-year feeding studies have shown no effect at 0, 50, 100, or 400 ppm; however, animals fed at 1000 ppm did demonstrate toxicity. Similar studies of rats have shown kidney, liver, and spleen damage at higher feeding levels, but the no-effect level for both rats and dogs has been reported to be 100 ppm (Kaplan and Sherman 1977).

OSHA is proposing a PEL of 2.5 mg/m^3 TWA for methomyl. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of cholinesterase inhibition to which they could otherwise be exposed in the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for methomyl. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

MONOMETHYLANILINE

CAS: 100–61–8; Chemical Formula: $C_6H_5NH(CH_3)$

H.S. No. 1280

OSHA's existing PEL for monomethylaniline (N-methyl aniline) is 2 ppm, measured as an 8-hour TWA, and this limit is accompanied by a skin notation, indicating that this chemical may penetrate the skin to a degree such that the total amount absorbed by the body via all routes of exposure may be

significantly increased. The ACGIH has a limit of 0.5 ppm TWA for monomethylaniline, with a skin notation. Monomethylaniline is a colorless liquid which turns reddish-brown after standing.

Treon, Deichmann, Sigmon, and associates (1949) found that monomethylaniline applied to the skin of laboratory animals resulted in systemic poisoning, and that the oral LD_{50} in rabbits was 280 mg/kg. A later study by Treon and his associates (1950) showed that guinea pigs, rabbits, and rats died from 130 or fewer 7-hour exposures to 7.6 ppm monomethyl aniline. In the same study, a monkey survived the same number and length of exposures at 2.4 ppm, and a dog survived 50 exposures at 86 ppm. Exposed animals later developed blood changes, including methemoglobinemia and Heinz bodies.

OSHA is proposing a 0.5-ppm TWA limit, with a skin notation, for this substance. The Agency preliminarily concludes that these two limits, taken together will protect exposed workers from the risk of metabolic and blood effects, such as methemoglobinemia, potentially associated with exposure to monomethylaniline. The skin notation will protect workers from the risk of systemic poisoning posed by skin absorption of this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for monomethylaniline if the Agency determines that this limit will substantially reduce significant risk.

p-NITROCHLOROBENZENE
CAS: 100–00–5; Chemical Formula: $NO_2C_6H_6H_4Cl$
H.S. No. 1288

OSHA currently has an 8-hour TWA limit of 1 mg/m³, with a skin notation, for p-nitrochlorobenzene (PNCB). The ACGIH recommends a TLV–TWA of 3 mg/m³ with a skin notation. para-Nitrochlorobenzene exists as yellow crystals and has a sweet odor.

The primary hazards associated with exposure to PNCB include systemic toxicity to the liver, spleen, bone marrow, and kidneys, as well as methemoglobinemia and DNA damage. The Monsanto Company (1977) reported an oral LD_{50} in rats of 530 mg/kg and a dermal LD_{50} in rabbits of greater than 3040 mg/kg; PNCB was absorbed through rabbit skin to produce methemoglobinemia (Kubota 1960), although application to the skin or eyes did not produce irritation (Monsanto Company 1977). Rusakov and associates (1973) described sensitization in guinea pigs after dermal application of PNCB.

A 4-hour inhalation exposure of rats (heads only) showed that the lethal concentration was approximately 16.1 mg/L (Du Pont Company 198l, as cited in ACGIH 1986, p. 432). Head-only exposures at 0.05, 0.29, or 0.64 mg/L PNCB for 6 hours/day, 5 days/week for 2 weeks resulted in spleen weight increases and blood effects in all groups. In addition, there were dose-related effects in blood methemoglobin levels, i.e., decreased hemoglobin, hematocrit, and red blood cell count values. Microscopic changes in the spleen, bone marrow, and kidneys were seen in the two higher-dose groups, and pathological degeneration of the seminiferous tubules and abnormal epididymal sperm contents were also observed in these groups (Du Pont Company 1984, as cited in ACGIH 1986, p. 432).

The Monsanto Company (1981, as cited in ACGIH 1986, p. 432) reported that a 90-day gavage administration of PNCB at daily doses of 0.3, 10, or 30 mg/kg to male and female rats produced hemolytic effects and spleen changes at all levels, kidney and liver effects at mid- to high-level doses, and hyperplasia of bone marrow and testicular atrophy at the highest dose (30 mg/kg/day). In 1985, Monsanto reported the results of another gavage study in rats. After 2 years of PNCB feeding at 0.1, 0.7, or 5.0 mg/kg/day, animals in the mid- and high-dose groups exhibited hemolytic effects; in addition, mid- and high-dose groups showed microscopic spleen, kidney, and liver changes and, at the highest dose, bone marrow hyperplasia and testicular atrophy were seen (Monsanto Company 1985, as cited in ACGIH 1986, p. 432).

Rats fed PNCB at doses of 0, 0.1, 0.7, or 5 mg/kg/day for up to 2 years showed methemoglobinemia at the two highest levels, and animals in the 5 mg/kg/day group had indications of anemia and pigment accumulation in spleen cells. No treatment-related increase in tumors was observed (Monsanto Company 1985, as cited in ACIGH 1986, p. 432). In a dietary cancer bioassay, rats and mice were given PNCB at unspecified levels for 2 years (Weisberger, et al. 1978). Only mice were affected, with mice of both sexes showing an increase in vascular tumors at the highest dose and male mice showing an increase in liver tumors at the lowest dose (Weisberger et al. 1978).

Maternal toxicity was seen in rats given PNCB by gavage at doses of 15 and 45 mg/kg/day on days 9 through 16 of gestation; at the 45-mg/kg level, fetotoxicity and teratogenicity were also observed (Nair et al. 1985). At 15 mg/kg, maternal toxicity but no fetotoxicity or teratogenic effects occurred; at the lowest dose, the only effect was a small increase in maternal spleen weight. A two-generation reproductive study resulted in a reduced mating index in rats given 0.7 or 5.0 mg/kg/day (Monsanto Company) 1984, as cited in ACGIH 1986, p. 432). Positive responses were observed in a mutation assay of L5178Y TK mouse lymphoma cells (both in the presence and absence of metabolic activation) and in a microbial assay of *Salmonella* strain TA 1535 (in the absence of metabolic activation); however, no evidence of mutagenicity was noted in assays of three other *Salmonella* strains or in assays of Chinese hamster ovary cells, rat hepatocyte primary culture/DNA repair, or rat bone marrow cell clastogenesis (Monsanto Company 1980–1984, as cited in ACGIH 1986, p. 432). PNCB produced DNA damage in the liver, kidney, and brain cells of rats after a single intraperitoneal dose of 30 to 1000 mg/kg (Cesarone et al. 1983) and in cultured hepatocytes at 1.5 hours after a 3-hour treatment (Cesarone et al. 1984).

p-Nitrochlorobenzene may be absorbed through the lungs and skin in humans to produce methemoglobin. Reports of industrial exposures indicate that overexposure causes cyanosis, weakness, and headache (Saita and Moreo 1958; Renshaw 1926). In a study of workmen exposed to average concentrations of PNCB at 55, 125, and 143 ppm and to a PNCB-nitrophenol mixture at 23 ppm, the authors concluded that the mixed exposure did not produce chronic intoxication, but did cause increased methemoglobin, the appearance of Heinz bodies, headache, vertigo, and occasional eczema; these effects could not be attributed definitely either to skin absorption or to the level of PNCB in the mixture (Pacseri et al. 1958). No data are reported for the p-nitrochlorobenzene exposures only (Pacseri et al. 1958).

OSHA is proposing to retain its current 8-hour TWA limit of 1 mg/m³ for p-nitrochlorobenzene, with a skin notation. The Agency preliminarily concludes that these limits are necessary to protect workers from the risk of methemoglobinemia and changes in the spleen, liver, and kidney possible at higher exposure levels. OSHA is retaining the skin notation because dermal absorption of PNCB has been shown to cause systemic effects in animals.

PROPOXUR
CAS: 114–26–1; Chemical Formula: $C_{11}H_{15}NO_3$
H.S. No. 1337

OSHA has no current limit for propoxur. The ACGIH has established an 8-hour TLV–TWA of 0.5 mg/m³ for this white, odorless, crystalline compound.

The oral LD_{50}s in male and female rats are 83 and 86 mg/kg, respectively; for both sexes, the dermal LD_{50} is greater than 2400 mg/kg (Gaines 1969).

Dietary studies in rats at levels of 7.5 mg/kg/day for 28 days or at 800 ppm for 3 months produced no adverse effects (Association of American Pesticide Control Officials, Inc., 1966, as cited in ACGIH 1986, p. 499).

Rats were exposed to propoxur concentrations of 5, 7, 18.7, or 31.7 mg/m³ 6 hours/day, 5 days/week for 12 weeks; animals in the high-dose group showed depressed red blood cell and brain cholinesterase levels, and plasma cholinesterase was depressed by as much as 20 to 30 percent (Association of America Pesticide Officials, as cited in ACGIH 1986, p. 499).

In humans, a few cases of mild propoxur poisoning have been reported among sprayers of this insecticide and among residents of propoxur-treated homes (Vandekar, Hedayat, Plestina, and Ahmady 1968). In a study of human volunteers, a single oral dose of 1.5 mg/kg propoxur caused gastrointestinal symptoms that disappeared two hours after ingestion and a depression in red blood cell cholinesterase; oral doses of 0.75 to 1.0 mg/kg produced no symptoms but did depress erythrocyte cholinesterase (Vandekar, Plestina, and Wihelm 1971).

OSHA is proposing an 8-hour TWA of 0.5 mg/m³ for propoxur. The Agency preliminarily concludes that this limit will protect workers against the risk of cholinesterase inhibition potentially associated with exposure to this substance at the levels permitted by the absence of any OSHA limit. The health evidence forms a reasonable basis for proposing a new limit for propoxur. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

RONNEL
CAS: 299–84–3; Chemical Formula: $(CH_3O)_2PSOC_6H_2Cl_3$
H.S. No. 1349

OSHA currently has a limit of 15 mg/m³ TWA for ronnel. The ACGIH recommends a TLV–TWA of 10 mg/m³ for this white, noncombustible powder.

Ronnel is an indirect cholinesterase inhibitor that affects the blood plasma rather than the red cell acetyl cholinesterase (Plapp and Casida 1958). The acute oral LD_{50} for rats is reported as 1250 and 2630 mg/kg for males and females, respectively. The oral LD_{50} in dogs is greater than 500 mg/kg (McCollister, Oyen, and Rowe 1959). Two-year dietary studies of rats fed up to 50 mg/kg/day showed no effect on growth rate, food consumption, survival or hematopoesis (McCollister, Oyen, and Rowe 1959). In a study by Gladenko and Stuk (1972), albino rats developed clinical symptoms of motor irritation, tremor, increased auditory and tactile sensitivity, lacrimation, and salivation within 2 weeks at exposure levels between 164 and 328 mg/kg; some animals died during the latter part of the study. At exposures below 16.4 mg/kg, no ill effects were observed (Gladenko and Stuk 1972). A 2-year feeding study in dogs exposed at 10 mg/kg showed no ill effects except cholinesterase depletion (Worden, Noel, and Mawdsley-Thomas 1972).

Patch tests of 50 human subjects showed that ronnel has no skin-sensitizing potential (McCollister, Oyen, and Rowe 1959).

OSHA proposes an 8-hour TWA limit of 10 mg/m³ for ronnel. The Agency preliminarily concludes that this limit will protect workers against the risk of cholinergic effects potentially associated with exposure to this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for ronnel if the Agency determines that this limit will substantially reduce significant risk.

SULPROFOS
CAS: 35400–43–2; Chemical Formula: $C_{12}H_{19}O_2PS_3$
H.S. No. 1380

OSHA's Z tables currently have no limit for sulprofos. The ACGIH recommends an exposure limit of 1 Mg/m³ as an 8-hour TWA. Sulprofos, also known as the insecticide Bolstar^R, is a tan liquid.

Kimmerle (1982, as cited in ACGIH 1986, p. 547) conducted an extensive animal study on the effects of sulprofos. He reported that the acute toxicity of sulprofos is species-dependent; rats have an oral LD_{50} of 100 to 300 mg/kg and mice have an oral LD_{50} of 1600 to 1800 mg/kg. The acute dermal toxicity of this substance is low, with an LD_{50} greater than 1000 ml/kg in rats and 800 to 1000 mg/kg in rabbits. In rabbits, sulprofos did not irritate the skin or eyes, and it had no dermal sensitization effects In guinea pigs. Inhalation studies showed no fatalities in rats exposed to aerosol concentrations of up to 4130 mg/m³ of sulprofos over a period of 4 hours. In a 3-week inhalation study in which rats were exposed to aerosol concentrations of 6, 14, or 74 mg/m³, the two highest concentrations produced cholinergic symptoms; no observable effects were seen at the lowest concentration. Two-year feeding studies by Kimmerle (as cited in ACGIH 1986, p. 547) in dogs, rats, and mice showed that sulprofos concentrations of 150 ppm, 250 ppm, or 400 ppm were tolerated by all species, with no sulprofos-related tissue changes, signs of toxicity, or oncogenic effects. The overall NOELs were 10 ppm in dogs, 6 ppm in rats, and 2.5 ppm in mice. Kimmerle's ingestion studies in rats and rabbits at levels of 3, 10, or 30 mg/kg/day of sulprofos showed no embryotoxic or teratogenic effects in these animals, and a three-generation diet study in rats also produced no adverse reproductive effects. Mutagenic studies reported by the same author in mice were negative. Separate subacute inhalation studies also showed no effects on blood cholinesterase levels in rats exposed to 6 mg/m³ Zielhuis and Van der Kreek 1979).

There are no reported cases of poisoning in humans (ACGIH 1986, p. 547).

OSHA is proposing an 8-hour TWA limit of 1 mg/m³ for sulprofos. The Agency preliminarily concludes that this limit will protect workers from the risk of cholinesterase inhibition, the most sensitive indicator of exposure to this currently unregulated substance. The health evidence forms a reasonable basis for proposing a new limit for sulprofos. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

TERPHENYLS
CAS: 26140–60–3; Chemical Formula: $C_{18}H_{14}$
H.S. No. 1384

The current OSHA limit for the terphenyls is 1.0 ppm as a ceiling limit. The ACGIH recommends a 0.5-ppm ceiling limit for these substances. Terphenyls are colorless or light-yellow solids and are used as coolants in nuclear reactors. Commercial preparations contain mixtures of ortho, meta, and para terphenyls.

The terphenyls are primary irritants that cause eye, skin, and respiratory irritation.

Haley, Detrick, Kosmeau et al. (1959) reported that mixtures of terphenyls caused conjunctival irritation when instilled into the eyes of rabbits and damaged guinea pig skin following intracutaneous injection. Cornish, Bahor, and Ryan (1962) determined LD_{50} values of 1900, 2400, and greater than 10,000 mg/kg for the ortho, meta-, and para-terphenyls, respectively. These authors

also conducted 30-day feeding studies of rats involving doses of 250 or 500 mg/kg/day of the individual terphenyl isomers. Rats fed ortho-terphenyl showed elevated liver and kidney weight ratios; rats fed meta-terphenyl displayed elevated kidney weight ratios only; and rats fed para-terphenyl showed no elevation in liver or kidney weight ratios. Two studies by Petkau and Hoogstraaten (1965) and Young, Petkau, and Hoogstraaten (1969) have shown that the terphenyls have nephrotoxic effects and cause hepatic damage in rats fed 33 mg/kg/day. Adamson, Bowden, and Wyatt (1969) published a study in which rats exposed to terphenyl aerosols for 7 hours per day at a concentration of 50 mg/m^3 for a period of 8 days developed morphological changes in their pulmonary cell mitochondria: the number of vacuolated mitochondria was directly related to duration of exposure.

Weeks and Lentle (1970, 1971) conducted a clinical survey of 47 workers with ongoing exposure to terphenyl coolant in a nuclear facility. The study represented 122 man-years of occupational exposure, with duration of exposure ranging from 6 months to 7 years. The airborne concentrations of terphenyl varied, measuring 0.094 mg/m^3 in general working areas and up to 0.89 mg/m^3 in areas with organic piping equipment. The terphenyl coolant was determined to be a primary irritant, even in those workers wearing protective clothing, because skin moistness increased sensitivity to the terphenyls (Weeks and Lentle 1970, 1971). Testa and Masi (1964) reported that at concentrations above 10 mg/m^3 (approximately 1 ppm), workers reported both eye and respiratory irritation.

OSHA is proposing a ceiling of 0.5 ppm for the terphenyls. The Agency preliminarily concludes that this limit will protect exposed workers against the risk of primary irritation of the eyes, skin, and upper respiratory tract and of mitochondrial changes potentially associated with exposure to very low levels of the terphenyls. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for terphenyls if the Agency determines that this limit will substantially reduce significant risk.

m-TOLUIDINE
CAS: 108–44–1; Chemical Formula: C_7H_9N
H.S. No. 1401

m-Toluidine currently has no OSHA permissible exposure limit. The ACGIH recommends a 2-ppm 8-hour TWA, with a skin notation. m-Toluidine is a light yellow liquid.

When m-toluidine was tested on the eyes and skin of rabbits, moderate to strong irritation effects resulted (NIOSH 1979). A mean maximal methemoglobinemia of 60.2 percent was reported to occur following the intravenous administration of 27 mg m-toluidine per kilogram body weight in cats (McLean, Starner, and Thomas 1969). Rodent carcinogenicity studies cited by the ACGIH (1986, p. 589) were either inconclusive or negative.

The effects in humans of exposure to m-toluidine, either absorbed through the skin or via inhalation, are hematuria and methemoglobinemia. Exposure to 40 ppm for 60 minutes causes severe poisoning (Goldblatt 1955). There are no epidemiological studies of workers exposed only to m-toluidine (ACGIH 1986, p. 589).

OSHA is proposing a 2-ppm 8-hour TWA and a skin notation for this previously unregulated chemical. The Agency preliminarily concludes that this limit will protect workers from the risk of metabolic effects, such as hematuria and methemoglobinemia, associated with exposure to m-toluidine at levels currently permitted in the absence of any OSHA PEL. The health evidence forms a reasonable basis for proposing a new limit for m-toluidine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

2,4,6-TRINITROTOLUENE
CAS: 118–96–7; Chemical Formula: $C_7H_5N_3O_6$
H.S. No. 1413

OSHA's current PEL for 2,4,6-trinitrotoluene (TNT) is 1.5 mg/m^3 as an 8-hour TWA with a skin notation. The ACGIH has set a standard of 0.5 TLV–TWA with a skin notation for this chemical. TNT occurs as yellow needle-like crystals and is used as an explosive.

The ACGIH's limit was selected on the basis of health surveys conducted among occupationally exposed workers. Fairhall (1957) describes dermatitis, cyanosis, gastritis, acute yellow atrophy of the liver, and aplastic anemia as possible effects of exposure to TNT. According to Sollman (1957), blood destruction, leucocytosis or leucopenia, and varying degrees of central nervous system change (probably resulting from anoxia, peripheral neuritis and muscular pains, cardiac muscular and menstrual irregularities, and urinary and renal irritation) can also occur as a consequence of TNT exposure. TNT has irritant properties, and may cause sneezing, sore throat, or skin irritation (von Oettingen 1941).

A study by Goodwin (1972) revealed 36 cases of liver damage in a munitions plant where workers were exposed to a mean air level of 2.38 mg/m^3 TNT over a period of 20 years. Another study (Morton et al. 1976) found elevated levels of liver enzymes in 43 TNT shell-packers and loaders who worked where TNT exposures ranged from 0.3 to 0.8 mg/m^3 over a period of 5 months. In 1975, Djerassi and Vitany published a paper describing hemolytic episodes in three TNT workers with glucose-6-phosphate dehydrogenase deficiency; although these workers were from Iraq, where G–6–PDase deficiency has a high (25 percent) frequency of occurrence, the study is also of concern for other workers having a high frequency of G–6–PDase deficiency.

OSHA is proposing an 8-hour TWA of 0.5 mg/m^3 with a skin notation for 2,4,6-trinitrotoluene. The Agency preliminarily concludes that this limit is necessary to protect workers against the risk of liver damage and hemolytic effects potentially associated with exposure to TNT. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for 2,4,6-trinitrotoluene if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

For the class of toxic substances having biochemical/metabolic effects, OSHA preliminarily concludes that occupational exposure presents significant risks. The effects associated with exposure to these substances (which inhibit cholinesterase activity, interfere with the blood's ability to carry oxygen, and produce Antabuse-like symptoms and signs) range from nausea, bronchoconstriction, cardiac irregularities, neurobehavioral effects, and unconsciousness, to coma and death, depending on the severity of the exposure. Because many of these substances are relatively new on the industrial scene, OSHA has no limits for them. This situation means that occupational exposures can potentially be uncontrolled, which increases the urgency that limits be adopted. The Agency thus preliminarily finds that establishing or revising limits for this group of toxicants will reduce occupational risks. The health evidence discussed in this section provides a reasonable basis for proposing revised or new limits for these substances. At the time of the final rule, OSHA will revise or add new limits for this group of metabolic toxins if the Agency

determines that these limits will substantially reduce significant risk.

14. Substances for Which Proposed Limits Are Based on Avoidance of Sensitization Effects

Introduction

OSHA is proposing limits for eight substances based on their sensitization potential. Table C14–1 lists the current OSHA PELs, ACGIH Limits, and NIOSH RELs for each chemical in this group, along with their CAS and HS numbers. In four cases, current OSHA regulations set no limit on exposure. For two substances, OSHA is proposing to reduce its current TWA–PEL. In one other instance, OSHA is proposing to replace its current ceiling limit with an 8-hour TWA–PEL and a 15-minute STEL. For the remaining substance, the addition of a STEL with no change in the current TWA–PEL is proposed. NIOSH has recommended exposure limits for three substances that cause sensitization; OSHA is proposing the REL value for one of these chemicals, isophorone diisocyanate.

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Table C14-1. Substances for Which Limits Are Based on Avoidance of Sensitization

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1066 Captafol (Difolatan)	2425-06-1		0.1 mg/m^3 TWA, Skin	
1100 Cobalt, metal, fume, dust	7440-48-4	0.1 mg/m^3 TWA	0.05 mg/m^3 TWA	-
1222 Isophorone diisocyanate	4098-71-9		0.01 ppm TWA, Skin	0.005 ppm TWA 0.02 ppm Ceiling (10 minutes)
1313 Phenothiazine	92-84-2		5 mg/m^3 TWA, Skin	-
1315 Phenyl glycidyl ether	122-60-1	10 ppm TWA	1 ppm TWA	1 ppm Ceiling (15 min)
1329 Picric acid	88-89-1	0.1 mg/m^3 TWA, Skin	0.1 mg/m^3 TWA 0.3 mg/m^3 STEL, Skin	
1373 Subtilisins (Proteolytic enzymes)	9014-01-1		0.06 ug/m^3 Ceiling**	

Table C14-1. Substances for Which Limits Are Based on Avoidance of Sensitization (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
†398 Toluene-2,4-diisocyanate	584-84-9	0.02 ppm Ceiling	0.005 ppm TWA 0.02 ppm STEL	0.005 ppm TWA 0.02 ppm Ceiling (20 min)

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

† Proposed PEL is the NIOSH REL.

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Description of the Health Effects

A sensitization reaction, also known as an allergic reaction, is defined as an adverse response to a chemical following a previous exposure to that chemical or to a structurally similar one (Klaasen 1986). The subject who suffers an allergic reaction is said to have become sensitized to that chemical. Sensitization is the result of an immune reaction to the chemical; although the initial exposure does not generate an immediate response, the immune system "remembers" the chemical and reacts strongly at the next encounter. A related phenomenon is cross-sensitization. Cross-sensitization occurs when exposure to one chemical elicits a sensitization reaction not only on subsequent exposure to the same chemical but also on exposure to a different chemical, usually one with a similar structure.

The toxic manifestations of a sensitization reaction vary both in their location and severity. In humans, common target organs are the skin and the eyes; typical allergic conditions in these organ systems are allergic contact dermatitis and conjunctivitis, respectively. The respiratory system can also be sensitized; the resulting pathologies include bronchitis and asthma (Dean et al. 1986). These allergic reactions are mediated by the two immunoglobulins IqD or IqE. Involvement of IqD results in delayed contact dermatitis. In contrast, IqE-mediated reactions cause very severe effects, such as acute asthmatic attack, urticaria, and anaphylactic shock, which can be fatal. The unpredictability and potential seriousness of sensitization reactions demand that exposures be carefully controlled.

Sensitivity to a chemical frequently persists throughout the lifetime of an individual; occasionally it may gradually disappear over time. Usually symptoms are not observed after exposure to the sensitizing agent is discontinued. Although treatment for some allergies is possible, avoidance is considered the best way, and sometimes the only way, to regain good health.

An additional cause for concern about exposure to sensitizing chemicals is recent evidence that residual respiratory symptoms may continue even after exposure is discontinued. For example, in the case of toluene-2,4-diisocyanate (TDI), Weill et al. (1981) and Innocenti et al. (1981) found that sensitized workers may exhibit decreased pulmonary function or chronic bronchitis for as long as 3½ years after cessation of exposure.

Dose-Response Relationships and Sensitization Effects

Like other toxic effects, allergic reactions are dose-related; that is, in response to increasing doses of the chemical, increasing numbers of subjects may be sensitized, and the subsequent reactions may be more severe. The time course of sensitization for any one individual is unpredictable. Some individuals are sensitized after only one exposure; others remain resistant to sensitization after a lifetime of exposure. Different people are generally sensitive to different chemicals, although some chemicals are more universally reactive than others, such as the active agent in poison ivy. Various parameters influence the likelihood of sensitization by a particular chemical, such as "the nature of the chemical, concentration, type of exposure, genetic susceptibility and nongenetic idiosyncrasies" (Emmett 1986). Sensitization reactions observed in occupational settings are often the result of dermal or inhalation exposure.

For most of the substances in this group, the proposed limits are based on health surveys and reports of occupationally exposed populations. These studies indicate that exposures below a certain no-effect level generally do not result in individuals becoming sensitized. Where human data were absent or sparse, OSHA has relied on animal evidence to set the proposed limit. However, since chemically induced immunological sensitization occurs among laboratory animals by the same mechanism as in humans (that is, immune reactions in animals can be mediated by either IqB or IqE immunoglobulins), sensitization reactions in animals are generally good predictors of immune reactions in humans.

The discussions below describe OSHA's preliminary findings for the substances in this group. These discussions illustrate the nature of the risk confronting exposed employees, and the extent to which the risk of developing immune sensitization will be reduced among workers by the promulgation of the proposed limits.

CAPTAFOL (DIFOLATAN)
CAS: 2425-06-1; Chemical Formula: $C_{10}H_9Cl_4NO_2S$
H.S. No. 1066

OSHA has no current permissible exposure limit for captafol. The ACGIH recommends a TLV-TWA of 0.1 mg/m³, with a skin notation. Captafol is a white, crystalline substance with a slight but characteristic odor.

A 2-year study conducted by the World Health Organization (Reinhardt and Brittelli 1981) reported growth depression in rats at captafol dietary levels of 1500 and 5000 ppm, and histopathologic examination revealed changes in the livers and kidneys of the animals exposed at these levels. No tumors were observed. In male rats, an increase in liver-to-body-weight ratio was observed at levels of 250 ppm and higher after 12 months of captafol feeding (Reinhardt and Brittelli 1981).

In humans, skin irritation has been reported in both American and Japanese studies of farmers applying captafol as a fungicide. Arimatsu (1970) reports that farmers using captafol have experienced acute contact dermatitis manifesting as erythematous dermatitis and phototoxic eruptions. Khan reports that workers cleaning up in an area where captafol was handled experienced skin and respiratory sensitization (written communication, 1975, as cited in ACGIH 1986, p. 97).

OSHA is proposing a permissible exposure limit for captafol of 0.1 mg/m³ TWA, with a skin notation, to protect exposed workers against the risk of contact dermatitis and respiratory and skin sensitization associated with exposure to this substance at the levels permitted in the absence of any OSHA limit. The Agency preliminarily concludes that the 8-hour TWA, combined with a skin notation, will substantially reduce this risk. The health evidence forms a reasonable basis for proposing a new limit for captafol. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

COBALT (METAL, DUST AND FUME)
CAS: 7440-48-4; Chemical Formula: Co
H.S. No. 1100

OSHA has a current 8-hour TWA limit of 0.1 mg/m³ for cobalt metal dust and fume. The ACGIH recommends a TLV-TWA of 0.05 mg/m³ for cobalt, which is a gray, hard, magnetic, and somewhat malleable metal.

Animal studies indicate that high intratracheal doses (10, 25, or 50 mg) of cobalt metal dust can cause obliterative bronchiolitis adenomatosis in guinea pigs (Schepers 1955). Additional studies in animals have shown that exposure to cobalt dust or fumes causes hypersensitivity reactions. Increases in serum A-globulin and neuraminic acid occurred in dogs and rabbits exposed by inhalation to cobalt metal, metal fume, or carbide blend; injections of $CoCl_2$ produced similar reactions (Stokinger and Wagner 1958). Recent studies conducted on miniswine have shown that inhalation of 0.1 mg/m³ cobalt

metal dust (50 percent alpha and 50 percent beta variety, with a size range of from 0.4μ to 3.6μ) has caused early (onset in 3 months) pulmonary disease. Wheezing, which indicates hypersensitivity, occurred during the fourth week of exposure to 0.1 or 1.0 mg/m³ for 6 hours/day, 5 days/week, for 3 months following a 1-week sensitizing dose (Kerfoot, Frederick, and Domeier 1975).

Pulmonary disease has been reported frequently in workers exposed to cobalt in the manufacture of cemented tungsten carbide (Miller, Davis, Goldman, and Wyatt 1953; Lundgren and Ohman 1954; Lundgren and Swensson 1953). The adverse effect of exposure is generally chronic interstitial pneumonitis. Fatalities have been reported occasionally from exposures to cobalt of 1 to 2 mg/m³ or less (Fairhall, Castberg, Carrozzo, and Brinton 1947; Fairhall, Keenan, and Brinton 1959). An increase in serum A–2 globulin fraction was reported in the case of a welder exposed to fumes containing cobalt; the welder had a history of exertional dyspnea and an abnormal chest X-ray (Seigesmund et al. 1974). Schwartz, Tulipan, and Birmingham (1957) reported that allergic dermatitis has been caused by contact with cobalt and its compounds.

In studies undertaken by the Michigan Department of Health, it was demonstrated that, in the period between 1946 and 1964, improved control measures had successfully reduced cobalt metal dust and fume levels from 14.42 mg/m³ to a level below 0.1 mg/m³. No new cases of systemic toxicity or dermatitis have since been associated with cobalt exposure. The Pennsylvania Department of Health demonstrated that concentrations could be controlled easily to 0.07 mg/m³; without control, concentrations were about 0.5 mg/m³ (ACGIH 1986, p. 144).

OSHA is proposing an 8-hour TWA limit of 0.05 mg/m³ for cobalt metal fume and dust. The Agency preliminarily concludes that this limit will provide workers exposed to cobalt metal dust and fume with protection against the risk of serious pulmonary injury demonstrated to occur at levels above 0.1 mg/m³. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for cobalt if the Agency determines that this limit will substantially reduce significant risk.

ISOPHORONE DIISOCYANATE
CAS: 4098–71–9; Chemical Formula: $C_{12}H_{18}N_2O_2$
H.S. No. 1222

There is no current OSHA limit for isophorone diisocyanate (IPDI). The ACGIH has recommended a TLV–TWA of 0.01 ppm, with a skin notation. NIOSH (1978) recommended a 10-hour TWA of 0.005 ppm for all isocyanates, with a 10-minute ceiling limit of 0.02 ppm.

To date, there is little direct information on health effects associated with exposure to this chemical. However, diisocyanates, in general, cause irritation of the respiratory tract, decreases in pulmonary function, and sensitization. The ACGIH (1986) cited two reports in which workers exposed to isophorone diisocyanate suffered asthma or dyspnea (Clark and Aldons 1981; Tyrer 1979). Neither of these reports contained quantitative exposure data. The ACGIH recommended that the TLV–TWA for 2,4-toluene diisocyanate (TDI) apply to isophorone diisocyanate until more information becomes available; however, the ACGIH did not include its 0.02-ppm TLV–STEL for TDI in this recommendation. NIOSH (1978) came to the same conclusion, reasoning that other diisocyanates would react similarly to TDI on a molar basis; therefore, NIOSH recommended that the limits established for TDI (0.005 ppm TWA and 0.02 ppm as a 10-minute ceiling) apply to all diisocyanates. In supporting the need for a ceiling limit for diisocyanates, NIOSH (1978) cites a report in which 12 workers in an automobile plant developed severe respiratory symptoms after exposure to 0.03 to 0.07 ppm TDI for one week. The ceiling limit recommended by NIOSH is designed to prevent the irritation effects of exposure to the diisocyanates in nonsensitized workers.

OSHA is proposing a 0.005-ppm TWA, a 0.02-ppm ceiling (10-minute), and a skin notation for IPDI. The Agency believes that these limits will protect exposed nonsensitized workers against IPDI's sensitizing effects and minimize asthmatic reactions among sensitized workers. OSHA's preliminary feasibility analysis is based on limited data at this level; the Agency requests additional feasibility information from the public. The health evidence forms a reasonable basis for proposing a new limit for isophorone diisocyanate. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PHENOTHIAZINE
CAS: 92–84–2; Chemical Formula: $S(C_6H_4)_2NH$
H.S. No. 1313

Currently, neither OSHA nor NIOSH has an occupational exposure limit for phenothiazine. The ACGIH has established an 8-hour TWA–PEL for this substance of 5 mg/m³, with a skin notation.

The Agency's recommendation is based primarily on a study by Mawhinney and Rakow (1968) that showed that exposure to 15 to 48 mg/m³ of phenothiazine was associated with skin sensitization in workers but not with more acute systemic effects. Symptoms of sensitization included burning and an itching sensation of the skin. The skin effects were identifiable as an allergic reaction because the employees developed a tolerance to phenothiazine exposure after a few weeks (Mawhinney and Rakow 1968). Accompanying the sensitization reaction were pinkish-red-colored hair and brown fingernails.

OSHA is proposing an 8-hour TWA limit of 5 mg/m³, which represents a threefold margin of safety over the low end of the exposure range that causes sensitization reactions in workers. Because uncontrolled occupational exposures to phenothiazine pose a risk of developing sensitization reactions, OSHA preliminarily concludes that adopting an exposure limit of 5 mg/m³ will markedly reduce the risk of sensitization for workers. The health evidence forms a reasonable basis for proposing a new limit for phenothiazine. At the time of the final rule, OSHA will promulgate a new limit if the Agency determines that this limit will substantially reduce significant risk.

PHENYL GLYCIDYL ETHER
CAS: 122–60–1; Chemical Formula: $C_6H_5OCH_2CHOCH_2$
H.S. No. 1315

OSHA currently has an 8-hour TWA limit of 10 ppm for phenyl glycidyl ether. The ACGIH recommends a TLV–TWA of 1 ppm for this substance, and NIOSH recommends a 15-minute ceiling limit of 1 ppm. Phenyl glycidyl ether is a colorless liquid.

Exposure to phenyl glycidyl ether causes systemic effects and irritation. Studies in 1956 by Hine, Kodama, Wellington, and colleagues showed pulmonary inflammation and liver changes in some of the rats exposed for 7 hours daily for 50 days to 100 ppm; respiratory distress and minimal eye irritation were also observed in the exposed animals. Intragastric LD_{50} values of 1.40 g/kg for mice and 3.85 g/kg for rats were reported. Animals displayed central nervous system (CNS) depression, and death was caused by respiratory paralysis; in the survivors, these CNS effects were transient. The percutaneous LD_{50} reported for rabbits was 2.99 g/kg. Other studies have

reported a single-dose oral LD_{50} of 4.26 g/kg, although exposure for 8 hours to the near-saturated vapor was not lethal (Smyth, Carpenter, Weil, and Pozzani 1954). Terrill and Lee (1977) reported kidney, liver, spleen, thymus, and testicular changes in rats exposed to phenyl glycidyl ether at 29 ppm for 4 hours daily, 5 days/week for 2 weeks. At concentrations of 12 or 5 ppm, these authors observed no effects other than hair loss after exposures of 6 hours/day, 5 days/week for 9 weeks; however, after 18 weeks, 10 percent of male and 25 percent of female rats exhibited alopecia. These health effects were attributed by the authors to direct irritation of the skin rather than to systemic absorption (Terrill and Lee 1977).

Reports of workers using or handling this substance have described moderate skin irritation on prolonged or repeated contact, as well as several cases of skin sensitization (ACGIH 1986, p. 476).

NIOSH (1978) notes that the glycidyl ethers are biologically reactive compounds because of the presence of the epoxide group; these compounds have also been shown to have cytotoxic effects and to be mutagenic in short-term bioassays. Terrill and Lee (1977) exposed rats repeatedly to 1 ppm PGE and observed no effects, although skin damage was observed at 5 ppm. Inconclusive evidence of testicular degeneration was reported in some of the rats exposed to levels as low as 1.75 ppm (Haskell Laboratory Reports, as cited in NIOSH 1978, p. 114). At 10 ppm, 5 day/week exposures for 10 weeks caused respiratory tract irritation and early signs of liver necrosis in rats (Hine, Kodama, Wellington, Dunlap, and Anderson 1956).

OSHA is proposing to reduce the 8-hour TWA for phenyl glycidyl ether to 1 ppm. The Agency preliminarily concludes that this limit will protect exposed workers from the risk of skin and respiratory tract irritation, skin sensitization, testicular damage, and liver necrosis potentially associated with exposure to the current limit of 10 ppm. OSHA believes that the revised limit will substantially reduce these risks. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for phenyl glycidyl ether if the Agency determines that this limit will substantially reduce significant risk.

PICRIC ACID
CAS: 88–89–1; Chemical Formula: $HOC_6H_2(NO_2)_3$
H.S. No. 1329

OSHA currently has a limit of 0.1 mg/m³ TWA, with a skin notation, for picric acid. The ACGIH also recommends an 8-hour TWA of 0.1 mg/m³, as well as a 15 minute short-term limit of 0.3 mg/m³ and a skin notation. Picric acid occurs as colorless to pale yellow, odorless, and intensely bitter crystals.

Picric acid and its salts are toxic by ingestion, skin contact, or inhalation, and the substances also have skin-sensitization potential (Schwartz 1944). Available reports concerning human exposures describe edema, papules, vesicles, and desquamations of the face, mouth, and nose (Sunderman, Weidman, and Batson 1945). Systemic poisoning following absorption has been reported to produce headache, vertigo, vomiting, nausea, diarrhea, and skin and conjunctival discoloration, as well as discoloration of urine and albuminuria; high-dose exposures caused destruction of erythrocytes and produced gastroenteritis, hemorrhagic nephritis, and acute hepatitis (Sunderman, Weidman, and Batson 1945). Occupational exposure to ammonium picrate dust at concentrations of 0.0088 to 0.1947 mg/m³ caused dermatitis only in those workers who were least exposed; the ACGIH believes that this suggests that desensitization or adaptation occurs with repeated exposure (ACGIH 1986, p. 490).

OSHA proposes an 8-hour TWA of 0.1 mg/m³, a 15-minute STEL of 0.3 mg/m³, and a skin notation for picric acid. The Agency has preliminarily concluded that these limits will protect exposed workers from the risk of systemic poisoning resulting from skin absorption and of sensitization caused by contact with this substance. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for picric acid if the Agency determines that this limit will substantially reduce significant risk.

SUBTILISINS
CAS: 1395–21–7; 9014–01–1; Chemical Formula: None
H.S. No. 1373

Currently, neither OSHA nor NIOSH has an occupational exposure limit for subtilisins. The ACGIH has established a ceiling limit of 0.06 μg/m³. Subtilisins are proteolytic bacterial enzymes used primarily in laundry detergents. They are considered a threat to occupational health because they cause bronchoconstriction and respiratory allergies in addition to irritation of the skin and respiratory tract (ACGIH 1986; Pepys et al. 1969).

A report by the California Department of Public Health (1969) showed that several workers were hospitalized after exposure to subtilisins in a detergent formulation plant where the "safe limit" was set at 0.12 μg/m³. Whether this limit was exceeded or the workers failed to wear the protective gear they were given is unclear.

OSHA is proposing a ceiling limit of 0.06 μg/m³ for the subtilisins; the incident described above suggests that OSHA's proposal to set a ceiling limit of 0.06 μg/m³ for exposure to subtilisins is appropriate and will reduce the risk of skin irritation, respiratory allergies, and sensitization in the exposed worker population. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for subtilisins if the Agency determines that this limit will substantially reduce significant risk.

TOLUENE-2,4-DIISOCYANATE
CAS: 584–84–9; Chemical Formula: $CH_3C_6H_3(NCO)_2$
H.S. No. 1398

The current OSHA limit for toluene-2,4-diisocyanate (TDI) is 0.02 ppm as a ceiling limit. The ACGIH and NIOSH both recommend a TWA of 0.005 ppm and a STEL of 0.02 ppm.

TDI is one of the most frequently encountered sensitizers in the workplace, and is also a known cross-sensitizer. The proposed limit is based on human data showing that workers can develop sensitization reactions at exposure levels below the 0.02-ppm ceiling. Elkins et al. (1965) reviewed the incidence of TDI intoxication in 14 plants in Massachusetts between 1957 and 1962. In eleven instances of TDI intoxication, the average concentration of TDI was 0.015 ppm, and in nine cases the average concentration was below 0.01 ppm. In all plants where the average levels were above 0.01 ppm, TDI had caused respiratory problems. TDI-related respiratory problems were not observed when the average concentration of TDI was maintained below 0.007 ppm.

Williamson conducted two TDI studies (1964, 1965) that revealed a 5-percent sensitization rate in 99 workers exposed for 18 months to levels of TDI averaging below 0.02 ppm. The author believed that accidental spills accounted for the high sensitization rate. Williamson also found that six sensitized workers out of 18 exposed to concentrations of TDI below 0.02 ppm for 14 months showed marked decreases in lung function.

A NOEL (no-observed-effect level) for TDI has been documented. In 1975, Roper and Cromer failed to observe any

symptoms of respiratory illness or changes in pulmonary function in nine employees working in a plant where breathing zone samples showed TDI concentrations of 0.001 to 0.002 ppm.

Wegman et al. (1974, 1977, 1982) observed a dose-response relationship among TDI-exposed employees in the long-term decline of lung function, as documented in test results. Only for those workers exposed to less than 0.002 ppm TDI were the results of lung function tests normal. In keeping with these findings, OSHA is proposing a TWA of 0.005-ppm and a STEL of 0.02-ppm.

OSHA preliminarily concludes that the evidence clearly demonstrates that workers are at risk of pulmonary sensitization reactions at the current PEL, as evidenced by declines in pulmonary function observed among workers exposed below this level. OSHA also believes that establishing a 0.005-ppm TWA with a 0.02-ppm STEL will reduce this risk; TDI-related respiratory effects have not generally been observed among workers exposed below 0.01 ppm. The health evidence forms a reasonable basis for proposing a revision to this level. At the time of the final rule, OSHA will establish a new limit for toluene-2,4-diisocyanate if the Agency determines that this limit will substantially reduce significant risk.

Preliminary Conclusions

For the eight sensitizing agents included in this category of substances, OSHA preliminarily concludes that there are occupational risks associated with exposure. The effects caused by such exposures include skin sensitization, substantial decrements in lung function, bronchoconstriction, and severe skin irritation. Reducing or establishing exposure limits for these toxic substances will substantially reduce these workplace risks.

The health evidence for these sensitizers forms a reasonable basis for proposing revisions to or additions of exposure limits for these substances. At the time of the final rule, OSHA will establish new limits or revise existing limits if the Agency determines that these limits will substantially reduce significant risk.

15. Substances for Which Proposed Limits Are Based on Avoidance of Cancer

The ACGIH has established new TLVs or lowered previous TLVs for 17 substances based on evidence that occupational exposure may be associated with an increased cancer risk. Table C15–1 lists the current OSHA permissible exposure levels (PELs), the ACGIH TLVs, the NIOSH RELs, and the CAS and HS numbers for these substances. OSHA is proposing to revise existing TWA and/or STEL limits for six substances; retain a PEL for three substances currently listed on Table Z–2; adopt NIOSH ceiling limits for two substances; and add limits for six substances not currently listed on OSHA's Z-tables.

The following discussion addresses some general aspects of carcinogenicity, together with the methodology used by OSHA in previous rulemakings to assess carcinogenic hazards. Two representative substances are reviewed in terms of their effects, dose-response considerations, and quantitative risk assessments to evaluate the decrease in risk of developing cancer that is expected after revising or establishing PELs for these substances. In this section, quantitative risk models that are widely accepted by the scientific community are used as a means of estimating cancer risks. The multistage model, which is the model primarily used by OSHA, is preferred over other models because it is based on a more plausible biological mechanism of cancer than the other models.

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TABLE C15 1. Substances for Which Limits Are Based on Avoidance of Cancer

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1008 Acrylamide	79-06-1	0.3 mg/m^3 TWA, Skin	0.03 mg/m^3 TWA, Skin	0.3 mg/m^3 TWA
1020 Amitrole (3-Amino-1,2,4-triazole)	61-82-5	-	0.2 mg/m^3 TWA	-
1028 Asphalt fumes	8052-42-4	--	5 mg/m^3 TWA	5 mg/m^3 Ceiling (15 min)
1033 Beryllium & compounds++	7440-41-7	0.002 mg/m^3 TWA 0.005 mg/m^3 STEL 0.025 mg/m^3 Ceiling (30 min)	0.002 mg/m^3 TWA	0.5 ug/m^3 (No time specified)
1073 Carbon tetrachloride+	56-23-5	10 ppm TWA 25 ppm STEL 200 ppm Ceiling (5 min/4 hr)	5 ppm TWA, Skin	2 ppm Ceiling (60 min)
1086 Chloroform+	67-66-3	50 ppm Ceiling	10 ppm TWA	2 ppm Ceiling (60 min)

TABLE C15-1. Substances for Which Limits Are Based on Avoidance of Cancer (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1092 Chromic acid & chromates++	7440-47-3	0.1 mg/m^3 Ceiling	0.05 mg/m^3 TWA	25 ug/m^3 TWA 50 ug/m^3 Ceiling (15 min)
1094 Chromyl chloride	14977-61-8	-	0.025 ppm TWA	--
1142 Dimethyl sulfate	77-78-1	1 ppm TWA, Skin	0.1 ppm TWA, Skin	--
1283 Nickel (soluble compounds)	7440-02-0	1 mg/m^3 TWA	0.1 mg/m^3 TWA	15 ug/m^3 TWA
1291 2-Nitropropane	79-46-9	25 ppm TWA	10 ppm TWA	Lowest feasible level
1372 Styrene	100-42-5	100 ppm TWA 200 ppm STEL 600 ppm Ceiling (5 min/3 hr)	50 ppm TWA 100 ppm STEL	50 ppm TWA 100 ppm STEL (15 min)
1399 o-Toluidine	95-53-4	5 ppm TWA Skin	2 ppm TWA Skin	--
1400 p-Toluidine	106-49-0	-	2 ppm TWA Skin	-

TABLE C15-1. Substances for Which Limits Are Based on Avoidance of Cancer (continued)

H.S. Number/ Chemical Name	CAS No.	Current PEL*	ACGIH TLV**	NIOSH REL***
1425 Vinyl bromide	593-60-2	--	5 ppm TWA	--
1426 Vinyl cyclohexene dioxide	106-87-6	--	10 ppm TWA, Skin	--
1436 Zinc chromates (CrVI)++	13530-65-9	0.1 mg/m^3 Ceiling	0.05 mg/m^3 TWA	0.001 mg/m^3 TWA

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ Proposed PEL is the NIOSH REL.

++ Existing limit is retained.

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Description of the Health Effects

Cancer is a life-threatening and particularly insidious disease that is brought about by the invasion of organ systems by abnormal tissue growth. The abnormal tissue is comprised of cells that have been altered in such a way as to cause unrestricted cell growth. As this unrestricted growth progresses, the abnormal tissue begins to interfere with the vital functions of normal organ systems. In the absence of medical intervention, most forms of cancer are ultimately lethal. In some instances (e.g., colon cancer, breast cancer), life can be prolonged through chemotherapy, radiation treatment, surgery, or some combination of these; however, the quality of life of the victims of cancer is usually severely affected. In other instances, such as lung cancer, there is little hope of survival, even when aggressive treatment strategies are employed.

An increased risk of developing cancer has been associated with occupational or environmental exposure to a number of chemical substances. The development of chemically induced cancer in humans and animals is a complex and multi-step process that is not completely understood. It is currently believed that the mechanism by which cancer develops requires at least two stages: initiation and promotion. Initiation occurs when chemicals interact either directly or indirectly with DNA to cause a heritable mutation. Alterations in DNA structure may cause an incorrect reading of the DNA sequence during replication and result in more altered cells, which may eventually be expressed as a tumor. There is a correlation between substances that are mutagenic in *in-vitro* test systems and their ability to cause cancer. Although genotoxic assays are not capable of predicting carcinogenic potential with certainty, such assays are useful for the preliminary identification of substances that may have the potential to cause cancer.

The second stage in the carcinogenic process is promotion. Promotion is considered to be the likely mechanism of action when there is no evidence that a substance interacts with genetic material, e.g., when *in-vitro* mutagenicity assays are negative. Peroxisome proliferation, immunosuppression, and hormonal alterations are examples of promotional events; these events facilitate the unrestricted multiplication of initiated cells, leading to the development of cancer. When a substance or its metabolite possesses both initiation and promotion capabilities, it is considered to be a complete carcinogen, i.e., exposure to the substance alone is sufficient to cause cancer. Examples of such substances that OSHA has recently regulated include asbestos, benzene, ethylene oxide, and formaldehyde.

In all of OSHA's past rulemakings for carcinogens, the Agency has used a weight-of-evidence approach to assess the carcinogenic potential of chemical substances. This approach involves examining all available human epidemiologic studies, clinical and case studies, animal studies, mutagenicity studies, and metabolic studies, combined with a quantitative assessment of cancer risk, to make determinations regarding the potential that occupational exposure to a substance increases the risk of cancer. OSHA relies most heavily on epidemiologic studies of worker populations and well-conducted animal bioassays to make these determinations. OSHA's overall approach to promulgating regulations for carcinogens has been upheld in a number of Court decisions.

The following discussion summarizes how epidemiologic and animal studies are used to assess cancer risk.

Epidemiology studies. Epidemiological studies that include detailed exposure data provide the best evidence for describing a causal relationship between exposure to a substance and the onset of cancer in humans. Epidemiologic evidence has been relied on heavily in OSHA's decisions to promulgate standards for the carcinogens benzene, asbestos, and arsenic. At a minimum, positive epidemiologic studies provide qualitative proof of a causal relationship between exposure to a substance and the development of cancer. A general lack of quantitative exposure data and the long latencies between onset of exposure and appearance of disease may make it difficult to derive quantitative dose-response relationships from epidemiological studies. However, the ability of such studies to link exposures to carcinogens to cancer in humans outweighs these limitations.

Because of the long latency periods associated with chemically induced cancer in humans, these studies cannot be used to detect disease until after irreparable harm has been done. To protect workers or other human populations, therefore, it is necessary to assess the risks of such effects before they occur. The data used for this purpose derive from animal bioassays; these data are used to predict potential human responses and to infer a causal relationship between exposure to a substance and the onset of disease.

Animal data. Animal studies frequently provide the best dose-response data for chemically induced cancer. When relying on such studies, assumptions must be made in order to extrapolate from animal bioassay data to humans; the most important of these are that physiologic, pharmacokinetic, and biochemical parameters are similar between mammalian species. To the extent that adequate metabolic data are available, such data may be used to refine the extrapolation from animals to humans. Despite the need to make such assumptions, it is widely accepted that animals are acceptable surrogates for estimating potential cancer risks in humans. This confidence derives from the observation, after many years of conducting bioassay studies, that there appears to be a reasonable concordance between carcinogenic effects in animals and these effects in humans.

Dose-Response and Quantitative Assessment of Risk

Unlike other chemically induced toxic effects discussed in this preamble, a large body of scientific knowledge has accumulated regarding the mechanisms by which carcinogens act and the quantitative relationship between dose and biological response. As a result of these investigations, several mathematical approaches have been developed that permit estimates to be made of the cancer risk that is associated with exposure to low doses of carcinogenic substances.

Since the dominant view of the carcinogenic process holds that most cancer initiators cause irreversible damage to DNA, there is reason to assume that the dose-response of most carcinogens will follow a linear, non-threshold relationship. The Office of Science and Technology Policy (OSTP 1985) recommends the use of models that incorporate low-dose linearity when the data are limited and uncertainty exists regarding the mechanisms of carcinogenic action. In conducting risk assessments for prior rulemakings, OSHA has generally relied on the linearized multistage model.

The multistage model used to assess cancer risks associated with exposure to substances in this group is GLOBAL83, a model developed by K.S. Crump and colleagues. If P(d) represents the lifetime risk of cancer at dose d, and A(d) is the extra risk over the background rate at dose d, then the multistage model has the following form:

$$A(d) = 1 - \exp[-(q_1 d + q_2 d^2 + \ldots + q_k d^k)]$$

where

$q_i > 0$
$i = 1,2,3,....,k$
and $A(d) = [P(d) - P(0)]/[1 - P(0)]$

For a unique set of q_i, this function will adequately describe (or fit) the experimentally derived data. How well the model describes the data may be mathematically determined by what are termed goodness-of-fit tests. Once the model is fit to the data, the maximum likelihood estimate (MLE) and the 95 percent upper confidence limit (UCL) of A(d) are calculated using the 95 percent upper confidence limit on parameter q_i (q_i*). The MLE is the point estimate of A(d), and is therefore considered the best estimate of extra risk at dose d.

The following discusses the carcinogenicity evidence for the chemicals listed in Table C15–1. A brief discussion of the data and a quantitative risk assessment (where appropriate) are included to demonstrate the reduction in cancer risk that could result from lowering the current OSHA PELs for these potential carcinogens.

ACRYLAMIDE
CAS: 79–06–1; Chemical formula: $CH_2=CHCONH_2$
H.S. No. 1008

The current OSHA PEL for acrylamide is an 8-hour TWA PEL of 0.3 mg/m³. The ACGIH has established a TLV–TWA of 0.03 mg/m³ for acrylamide based on the increased incidence of cancer seen in laboratory animals chronically exposed to acrylamide (Johnson et al. 1986; Bull et al. 1984). Acrylamide has been classified by the ACGIH as a suspected human carcinogen (A2).

Acrylamide is commonly used as a reactive monomer or intermediate in organic syntheses. Polyacrylamide is a polymer used in the manufacture of adhesives, fibers, paper sizing, molded parts, water coagulant aids, and textiles (ACGIH 1986, p. 12).

Past industrial experience and several animal studies have demonstrated that chronic exposure to acrylamide has clinically significant neurotoxic effects (ACGIH 1986, p. 12). In fact, the original ACGIH recommendation of 0.3 mg/m³ as a TWA was intended to protect workers against central nervous system toxicity.

Assays of acrylamide mutagenicity in *S. typhimurium* were negative, with or without microsomal activation (Bull et al. 1984; Miller et al. 1984). However, subchronic exposure to 75 mg acrylamide/kg/day in the diet caused chromosome breaks and aberrations in spermatogonia in mice (Shiraishi 1978). Furthermore, Smith et al. (1985) found that females mated with male rats that had been given 30 or 60 mg acrylamide/liter in drinking water suffered a significantly increased incidence of post-implantation loss. Litters sired by males exposed to 60 mg/L had a significant increase in pre-implantation loss. The authors concluded that acrylamide produces dominant lethality in the male rat (Smith et al. 1985).

No data are available at the present time on the carcinogenic effects of acrylamide exposure in humans. The evidence that acrylamide causes cancer in experimental animals is described in two studies, Bull et al. (1984) and Johnson et al. (1986). Bull et al. (1984) tested acrylamide as a skin tumor initiator in female Sencar mice, using 12-o-tetradecanoyl-phorbol-13-acetate (TPA) as a promoter. Acrylamide was administered 6 times during a 2-week period in doses ranging from 0 to 50 mg/kg body weight. Tumor incidence increased in a dose-related manner, regardless of whether the route of exposure was gastric intubation, i.p. injection, or topical application. The systemic routes of exposure were the most effective. A dose-response relationship was also observed in the induction of lung adenomas in both sexes of A/J mice exposed to acrylamide by either gastric intubation or i.p. injection. These mice were exposed to doses of acrylamide ranging from 0 to 25 mg/kg body weight 3 times per week for 8 weeks.

Johnson et al. (1986) exposed male and female Fischer 344 rats to acrylamide in drinking water for 2 years. Doses ranged from 0 to 2.0 mg acrylamide/kg body weight/day. A statistically significant increase in mortality caused by cancer was observed at the highest dose level during the last 4 months of the study. The incidences of several types of tumors in both sexes were also significantly increased at this dosage. In females, the more frequently observed tumor types were tumors of the mammary gland, central nervous system, thyroid gland (follicular epithelium), oral tissues, uterus, and clitoral gland. In males, increased incidences of tumors in the central nervous system, thyroid gland, and scrotum were observed.

Risk estimate for acrylamide. For the EPA, Crump et al. (1987) performed a risk assessment for acrylamide, derived in part from the results of the Johnson et al. study (1986). For the purposes of risk assessment, the incidences of certain tumors in female rats were pooled: tumors of the mammary gland, brain and spinal cord, thyroid gland, uterus, and oral cavity. The Maximum Likelihood Estimates (MLEs) and Upper Confidence Limits (UCLs) for the current and proposed exposure limits are presented in Table C15–2. GLOBAL 83, a multistage model developed by K.S. Crump, was used to predict these risks. The risk estimate shows that, at OSHA's current PEL of 0.3 mg/m³, the excess risk of death from cancer for workers exposed over their working lifetimes is 10 per 1,000 workers. At the proposed PEL of 0.03 mg/m³, this number would be reduced to 1 per 1,000 exposed workers.

OSHA preliminarily concludes, based on the results of the quantitative risk estimate shown in Table C15–2, that the risks of cancer posed to workers at the current PEL are clearly significant. The Agency finds that reducing the exposure limit to the proposed 0.03 mg/m³ level will reduce this significant risk by a factor of 10, to 1 per 1,000 workers, which is consistent with the Supreme Court's guidance in the *Benzene* decision. OSHA therefore proposes to lower the 8-hour TWA PEL to 0.03 mg/m³.

TABLE C15–2.—MULTISTAGE MODEL ESTIMATES OF CANCER RISK ASSOCIATED WITH WORKING LIFETIME EXPOSURE TO ACRYLAMIDE

Exposure level	Excess cancer deaths per 1,000 workers	
	MLE	UCL
0.3 mg/m³[a]	10	45
0.03 mg/m³[b]	1	5

[a] Current OSHA PEL.
[b] Proposed PEL.
MLE = Maximum likelihood estimate of risk.
UCL = 95 percent upper confidence limit on maximum likelihood estimate of risk.

AMITROLE
CAS: 61–82–5: Chemical Formula: $C_2H_4N_2$
H.S. No. 1020

Amitrole is used as an herbicide and plant growth regulator. There is no current OSHA PEL for amitrole. OSHA proposes a TWA limit of 0.2 mg/m³, the same limit recommended by the ACGIH, based on positive carcinogenicity studies conducted in rats and mice. NIOSH recommends a 10-hour TWA of 0.3 mg/m³ for amitrole.

Amitrole is a potent anti-thyroid agent and has been shown to cause tumors, particularly of the thyroid and pituitary glands, in experimental animals (ACGIH 1986, p. 25). Its tumor-producing activity is thought to be related to its goitrogenic effects, which cause an increase in thyroid stimulating hormone (TSH). Other antithyroid agents that cause TSH stimulation, such as propylthiouracil, have also been shown to produce thyroid tumors (Guyton 1981).

Amitrole has not been shown to be mutagenic in the Ames bacterial mutation assay, a dominant lethal test in male mice, or in assays that measure recessive sex-linked lethal mutations in Drosophila melanogaster (ACGIH 1986, p. 25).

An excess incidence of tumors has been reported to occur among pesticide workers exposed to amitrole alone and in combination with phenoxy herbicides. Although these studies indicate the possible association of increased tumor incidence with exposure to amitrole, confounding factors, such as smoking and concurrent exposure to other pesticides, complicate interpretation of these data.

The Swedish National Board of Occupational Safety and Health ordered an epidemiological evaluation to assess the incidence of cancer among railroad workers exposed to herbicides (Axelson and Sundell 1974). Amitrole was among the pesticides utilized by these workers. Cohorts were separated into groups according to whether they were exposed to amitrole and combinations of other herbicides, phenoxy acids and combinations of other herbicides, or other herbicides alone. A statistically significant increase in the incidence of total tumors and lung tumors was found among workers exposed to amitrole and combinations of other herbicides. Smoking frequency among members of this group was reported to be similar to the frequency of smoking in the general Swedish population.

In a 1980 follow-up to Axelson and Sundell (1974), Axelson and co-workers combined data from the earlier study with data on workers exposed from 1972 to 1978. Cohorts were divided into the following exposure groups: Amitrole alone, phenoxy acids alone, and amitrole and phenoxy acids combined. The reanalyzed data did not show a statistically significant increase in cancer incidence among the workers exposed to amitrole alone; however, the incidence of tumors among workers exposed to amitrole and phenoxy acids together was significantly increased.

Amitrole has been found to be carcinogenic in laboratory animals following dietary exposure to relatively high doses. Attempts to induce tumors by dermal application and subcutaneous injection have been unsuccessful. Studies investigating the carcinogenic potential of amitrole in laboratory animals are reviewed below. The inhibitory effects of amitrole on the production of liver tumors induced by 4-dimethylaminoazobenzene are also discussed.

The effects of lifetime exposure to amitrole were investigated in rats, mice, and hamsters fed diets containing 1, 10, or 100 ppm amitrole (Steinhoff et al. 1983). There was a significant increase in the incidence of thyroid tumors in male and female rats and in the incidence of pituitary tumors in female rats exposed to 100 ppm. An excess incidence of tumors was not found in male or female rats exposed to 1 or 10 ppm. The results of this experiment are presented in Table C15-3. Tumor induction was not observed in male or female mice or hamsters. Another study reported negative results for rats fed diets containing 10, 50, or 100 ppm amitrole (Jukes and Schaffer 1960).

Dermal applications of 0.1 or 10 mg of amitrole produced no increased incidence of tumors in mice (IARC 1974).

In contrast to the negative results obtained in mice following lifetime dietary exposure to 1, 10, or 100 ppm amitrole (Steinhoff et al. 1983), positive results were observed in male and female mice following dietary exposure to higher levels (2192 ppm) of amitrole for 1 year (Innes et al. 1969). Carcinomas of the thyroid were observed in 89 percent (64/72) of the exposed animals (tumor incidence in controls is not reported).

TABLE C15-3. Incidence of Rat Thyroid and Pituitary Tumors Associated With Ingestion of Amitrole

Tumor Site	Concentration in diet (ppm)			
	0	1	10	100
Thyroid (Male)				
- Benign	5/75	9/75	4/75	45/75*
- Malignant	3/75	0/75	3/75	18/75*
Thyroid (Female)				
- Benign	7/75	12/75	8/75	44/75*
- Malignant	0/75	1/75	4/75	28/75*
Pituitary (Female)				
- Benign	14/75	20/75	15/75	36/75*
- Malignant	1/75	2/75	4/75	5/75

* $p < 0.001$, Fisher Exact Test

Positive results were also observed in mice exposed to 1 percent (10,000 ppm) amitrole in the diet (duration of exposure not indicated; Feinstein et al. 1978). Liver tumors developed in 7 percent of the exposed mice; however, the incidence of tumors in unexposed controls was not reported. A small number of thyroid tumors was also reported. The authors hypothesized that the reason more thyroid tumors were not seen was because the animals died of the high toxic doses before such tumors were expressed.

Chronic dietary administration of amitrole in dogs (10, 50, 100, or 500 ppm) and in rainbow trout (1200 or 4800 ppm) did not result in the development of tumors (IARC 1974).

Risk estimate for amitrole. The study by Steinhoff et al. (1983) provides sufficient information to estimate quantitatively the excess cancer risk associated with exposure to amitrole in the workplace. The linearized multistage model was chosen to estimate risk. The incidence of malignant thyroid tumors in female rats was used because these tumors demonstrate a clear monotonic response. Female rats were assumed to weigh 250 g and to consume 25 g of food per day. Human risks were estimated at exposure levels corresponding to the proposed PEL of 0.2 mg/m³, as well as for exposure levels of 0.4 mg/m³ and 1.0 mg/m³. The excess estimated cancer risk, in terms of excess deaths per 1000 employees, is shown in Table C15–4.

TABLE C15–4. Multistage Model Estimates of Cancer Risk Associated With Working Lifetime Exposure to Amitrole

Exposure Level	Excess Cancer Deaths per 1,000 Workers	
	MLE	UCL
0.2 mg/m³[a]	13	17
0.4 mg/m³	26	35
1.0 mg/m³	65	84

[a] Proposed OSHA PEL.
MLE = Maximum likelihood estimate of risk.
UCL = 95 percent upper confidence limit on maximum likelihood estimate of risk.

Exposure to 0.2 mg/m³ of amitrole for an occupational lifetime (45 years) is associated with an estimated 13 excess cancer deaths per thousand employees (1.3 percent). This rate is based on the maximum likelihood estimate (MLE). The 95-percent upper-bound estimate of risk corresponding to this dose is 17 excess cancer deaths per 1,000. By comparison, the maximum likelihood estimates of risk for lifetime exposure to 0.4 mg/m³ or 1.0 mg/m³ are 26 or 65 excess deaths per 1,000 employees, respectively.

Exposure to amitrole has been shown to be associated with an increased incidence of thyroid and pituitary tumors in experimental animals. Although human studies have not demonstrated conclusively that amitrole is carcinogenic, the studies by Axelson and Sundell (1974) and Axelson et al. (1980) provide evidence that amitrole may increase cancer risk among exposed workers. OSHA's risk assessment, based on the animal data, shows that this significant excess cancer risk can be substantially reduced for employees who are currently exposed above the proposed 0.2 mg/m³ limit. Therefore, OSHA is proposing to establish a 0.2 mg/m³ TWA exposure limit for amitrole.

ASPHALT FUMES
CAS: 8052–42–4; Chemical formula: None
H.S. No. 1028

There is no current OSHA PEL for asphalt fumes. The ACGIH recommends a TLV–TWA of 5 mg/m³, based on asphalt's ability to induce skin tumors in mice. NIOSH recommends a ceiling (15 minutes) of 5 mg/m³ for asphalt fumes, measured as total particulates.

Asphalt, also called bitumen, is a mixture of hydrocarbons that is produced by the evaporation of the lighter hydrocarbons from petroleum distillation and subsequent partial oxidation of the residue. Occupational exposure to asphalt fumes can occur during its manufacture or as a result of the secondary heating of asphalt in processes such as road building, roofing, and the coating of construction metals (Thayer et al. 1981). Asphalt is considered a potential carcinogen because of its physical and chemical similarity to coal tar pitch, a recognized human carcinogen. (Benz(a)pyrene (BaP), which is found in coal tar pitch, is a known carcinogen that has been regulated by OSHA in a 6(b) rulemaking.)

The process of manufacturing asphalts or bitumens removes many of the lower molecular weight compounds that have low boiling points, including PAHs with 3 to 7 rings. Therefore, the amount of BaP in asphalt is lower than the amount in coal tar pitch.

The mutagenicity data on asphalt are limited. Claxton and Hufsingh (1980) and Lewtas (1981, 1983) reported positive results for extracts of roofing tar fumes in the Ames *Salmonella*

typhimurium assay. Penalva et al. (1983) also reported that an extract of asphalt was mutagenic in *Salmonella typhimurium* in the presence of biological activation by cytochrome P_{450}. The vapors, particles, and aerosols of this substance were weakly mutagenic in *Salmonella typhimurium*, both in the presence and the absence of biological activation.

Several studies of the carcinogenicity of asphalt have been conducted. Four studies reported negative results (Hueper and Payne 1960; Wallcave et al. 1972; Bingham et al. 1980; and Emmett et al. 1981), and three studies reported positive results (Simmers 1965, 1966; Thayer et al. 1981). These studies are summarized below.

Four studies have reported findings on the carcinogenicity of asphalt by skin painting. Thayer et al. (1981) reported positive tumorigenic activity when two different types of condensates from roofing asphalt volatiles and two types of condensates from coal tar pitch volatiles were tested at two temperatures, 232 and 316 degrees F.

Groups of CD–1 and CH3/HeJ mice were treated with one of the four types of asphalt condensates or one of the four types of coal tar pitch condensates. The mice treated with asphalt received a 25-mg dose of the condensate twice weekly for 18 months. The mice treated with coal tar solids received a dose of 1.5 to 4.2 mg of the condensate (0.15 μg and 0.45 μg BaP, respectively) twice weekly for 18 months. In addition to these treatments, separate groups of mice were treated with the asphalt or coal tar preparations plus ultraviolet light (UVL).

CH3/HeJ mice were more sensitive than the CD–1 mice, with nearly 100 percent of the CH3/HeJ mice and about half of the CD–1 mice developing skin papillomas. UVL decreased the carcinogenic response in all test groups. Also, the asphalt volatiles prepared at the higher temperature produced a greater response. Although Thayer et al. (1981) report a statistically significant increase in the incidence of skin tumors, it is difficult to estimate quantitatively the cancer risk from these data because of the lower reliability of the estimate of q_1 (the slope of the dose-response curve) determined from data providing one dose level and a 100-percent tumorigenic response.

An additional skin painting study (Simmers 1965) supports the results of Thayer et al. (1981). However, in the Simmers study (1965), the asphalt was applied in a solution containing benzene, a human carcinogen.

There is conflicting evidence concerning the carcinogenicity of asphalt following dermal application and inhalation exposure. Hueper and Payne (1960), Wallcave et al. (1971), Bingham et al. (1980), and Emmett et al. (1981) reported negative results by skin painting. Hueper and Payne (1960) also reported negative results when guinea pigs and rats were exposed to asphalt fumes by inhalation.

A positive carcinogenic response was reported by Simmers (1966) and by Hueper and Payne (1960) when rats and mice were exposed to asphalt by injection.

Studies by Hammond et al. (1976), Menck and Henderson (1976), and Milham (1982) reported increased standardized mortality ratios or proportionate mortality ratios for lung cancer among roofers and slaters. It is difficult to show a definite association between asphalt exposure and lung cancer because most people who work with asphalt have concomitant exposure to coal tars (Hammond et al. 1976).

A survey by Baylor and Weaver (1968) reported no significant differences in the health of 462 asphalt workers, compared with the health of controls. These workers had asphalt exposures for a period of at least 5 years and were then given a physical examination, which included a medical and occupational history. Additional information was obtained by questionnaire from paving companies, roofing manufacturers, and truck operators. No adverse health effects were reported in this survey (Baylor and Weaver 1968). However, without mortality data and a longer period of follow-up, no firm conclusions can be drawn from these studies.

Asphalt's ability to induce skin tumors directly in mice and rats demonstrates this substance's potential carcinogenicity. Exposures to asphalt fumes should also be reduced because these fumes contain benzo[a]pyrene. BaP is present in coal tar and is the constituent primarily responsible for the high carcinogenic risk associated with exposure to coal tar pitch. OSHA considered the possibility of performing a quantitative risk assessment for asphalt and concluded that the studies described above did not have sufficient dose-response data to provide an adequate basis for such a risk assessment. OSHA preliminarily concludes that workers exposed at the current unregulated level are at significant risk of cancer. The Agency believes that establishing a limit of 5 mg/m^3 for daily exposure to asphalt fumes will substantially reduce this significant risk.

BERYLLIUM AND COMPOUNDS
CAS No.: 7440–41–7
H.S. No. 1033

OSHA's current limits for beryllium are 0.002 mg/m^3 as an 8-hour TWA, 0.005 mg/m^3 as a ceiling, and 0.025 mg/m^3 as a 30-minute peak. The ACGIH has established a TLV–TWA of 0.002 mg/m^3. NIOSH (1977) has recommended a ceiling limit of 0.5 $\mu g/m^3$ (0.0005 mg/m^3).

The ACGIH recommendation is based on human evidence describing non-malignant respiratory disease and berylliosis associated with exposure to beryllium. Because of the uncertainty regarding the minimal concentrations of beryllium necessary to produce chronic respiratory disease, and because of the serious nature of the disease, ACGIH recommended a TLV–TWA of 0.002 mg/m^3.

At the time of publication of NIOSH's 1972 criteria document on beryllium, NIOSH judged the evidence on beryllium-related cancer to be equivocal. In testimony at OSHA's 1977 hearing on a standard for beryllium, NIOSH presented additional epidemiologic and animal evidence indicating that beryllium is carcinogenic. In particular, NIOSH cited the studies of Bayliss and Wagoner (1977) and Mancuso (personal communication, 1977) showing significant increases in bronchogenic cancer among beryllium-exposed workers. NIOSH therefore recommended that exposure to beryllium not exceed the reliable limit of detection of 0.5 $\mu g/m^3$.

The ACGIH TLV of 0.002 mg/m^3 (TWA) is less stringent than OSHA's existing PELs. The NIOSH REL is based on analytical and sampling limits of detection, which do not necessarily satisfy OSHA's requirements regarding significant risk and feasibility. To consider the carcinogenic effects of beryllium, OSHA would have to perform a quantitative risk assessment, which could not be completed in time for this rulemaking. In light of these facts, OSHA proposes to maintain the Agency's existing PELs of 0.002 mg/m^3 TWA, 0.005 mg/m^3 as a 30-minute ceiling, and 0.025 mg/m^3 as a peak.

CARBON TETRACHLORIDE
CAS: 56–23–5; Chemical Formula: CCl_4
H.S. No. 1073

The current OSHA PELs for carbon tetrachloride are 10 ppm as an 8-hour TWA, 25 ppm as a ceiling limit not to be exceeded for more than 5 minutes every 4 hours, and 200 ppm as a peak limit. The ACGIH has established a 5 ppm 8-hour TWA limit, with a skin notation. A 60-minute limit of 2 ppm has been recommended by NIOSH (1977); this limit reflects the lowest reliably

detectable airborne concentration at the time that the recommendation was made. Carbon tetrachloride is classified as a probable human carcinogen by EPA (group B2) and IARC (group 2B) and as a suspected human carcinogen by ACGIH (category A2), based on positive carcinogenicity studies in rats, mice, and hamsters.

In humans, there have been three case reports of liver tumors developing after carbon tetrachloride exposure (Tracey and Sherlock 1968; Johnstone 1948; Simler et al. 1964). In each case, the patient had been acutely overexposed to carbon tetrachloride, leading to nausea, stomach pains, and signs of severe liver damage.

Blair et al. (1979) studied causes of death in 330 laundry and dry cleaning workers potentially exposed to carbon tetrachloride, as well as to trichloroethylene and tetrachloroethylene. Causes of death based on death certificates were compared to the age, sex, race, and cause-specific distribution of U.S. deaths from the same time period. The proportionate mortality ratio (PMR) for all malignant neoplasms was 128, which was statistically significant, indicating that the study group had a 28 percent higher proportion of total deaths due to cancer compared with the U.S. general population. The excess cancer deaths were due to liver, lung, and cervical cancer and leukemia. Although the excess lung and cervical cancer may reflect socioeconomic differences among these workers, the excess liver cancer seen in this study is consistent with findings in animal studies on carbon tetrachloride.

In animals, carbon tetrachloride has produced hepatocellular carcinomas in all species evaluated (rats, mice, and hamsters). Male rats were given 47 or 94 mg/kg carbon tetrachloride and females were given 80 or 159 mg/kg by gavage for 78 weeks (NCI 1976a,b; 1977). The incidence of hepatocellular carcinomas was increased in animals exposed to carbon tetrachloride as compared with pooled colony controls but was statistically significant only for low-dose females. The lower incidence of carcinomas in female rats at the high dose (1/49) compared to the low-dose (4/49) was attributed by the authors to the increased lethality that occurred among these rats before tumors could be expressed.

In this same study, mice of both sexes received 1250 or 2500 mg/kg carbon tetrachloride by gavage. Hepatocellular carcinomas were found in 49/49 low-dose and 47/48 high-dose males (compared with 5/77 in the control males) and in 40/40 low-dose and 43/45 high-dose females (compared with 1/80 in the control females) (NCI 1976a,b; 1977).

Edwards et al. (1942) administered carbon tetrachloride by gavage to a mouse strain known to have a low incidence of spontaneous hepatomas. The incidence of hepatomas was 52 percent (28/54) for males and 32 percent (6/19) for females. Previous hepatoma incidence data for untreated mice of this strain were 2/71 for males and 0/81 for females. Carbon tetrachloride administered by gavage has also been shown to produce neoplastic changes in the livers of four additional strains of mice (Andervont 1958; Edwards 1941; Eschenbrenner and Miller 1943).

Della Porta et al. (1961) gave weekly gavage treatments to hamsters for 30 weeks, and the animals were observed for an additional 25 weeks. All 10 hamsters dying or killed between weeks 43 and 55 had liver cell carcinomas, in comparison with 0/254 in historical controls.

Risk estimate for carbon tetrachloride. Four data sets have sufficient dose response information to allow quantitative risk estimation: The rat and mouse bioassay data (NCI 1976a, 1976b, 1977); the Edwards et al. (1942) mouse data; and the Della Porta et al. (1961) hamster data. In order to increase sample sizes, the data for male and female animals in each of the studies were pooled. The estimated risk presented in Table C15–11 is the geometric mean of the risk calculated from each data set.

Inhalation risk was calculated assuming an air intake of 20 m^3 per 24-hour day and a 40 percent absorption rate for humans (U.S. EPA 1984). All four studies suggest that a common biological mechanism, cell death and regeneration, occurs and leads to the development of the same tumor type.

Table C15–11 presents the estimates of lifetime human risk from carbon tetrachloride exposure, calculated by the linearized multistage model (GLOBAL83), at the proposed 2 ppm limit, the ACGIH limit of 5 ppm, and the current 10 ppm OSHA PEL. Both the maximum likelihood estimates (MLE) and the 95 percent upper confidence limits of human risk are given, as well as the corresponding expected number of excess cancer deaths per 1,000 exposed over a working lifetime.

TABLE C15-11. Multistage Model Estimates of Cancer Risk Associated with Working Lifetime Exposure to Carbon Tetrachloride

Exposure Level	Excess Cancer Deaths per 1,000 Workers	
	MLE	UCL
2 ppm[a]	3.7	5.2
5 ppm[b]	9.2	13.0
10 ppm[c]	17.9	26.0

[a] Proposed OSHA PEL.
[b] ACGIH TLV.
[c] Current OSHA PEL.
MLE = Maximum likelihood estimate of risk.
UCL = 95 percent upper confidence limit on the maximum likelihood estimate of risk.

Based on this risk estimate, the MLE at the current OSHA limit of 10 ppm is 17.9 excess deaths per 1000 exposed workers, clearly indicating that a significant cancer risk exists at the current PEL.

Risk at the current ACGIH limit of 5 ppm is estimated to be 9.2 excess deaths per 1000 workers exposed over their working lifetimes. At the proposed limit of 2 ppm, residual risk continues to be significant, according to the Supreme Court's guidance in the *Benzene* decision; the risk predicted at 2 ppm is 3.7 excess deaths for 1000 workers exposed over their working lifetimes. However, risk at the 2 ppm limit is substantially reduced compared with risk at the current OSHA PEL of 10 ppm. The estimate shows that approximately 14 cancer deaths would potentially be avoided by reducing the limit to 2 ppm. However, because the 2 ppm limit was set by NIOSH on the basis of the limits for the sampling and analytical method available at the time this 60-minute PEL was recommended. OSHA solicits comments on the technological feasibility of the proposed limit.

CHLOROFORM
CAS: 67-66-3; Chemical Formula: $CHCl_3$
H.S. No. 1086

The current OSHA PEL for chloroform is 50 ppm as a ceiling limit. The ACGIH has established a TLV-TWA of 10 ppm and assigned chloroform an A2 designation. NIOSH (1977) recommends that workplace exposures not exceed 2 ppm as detected by a 60 minute sample; this limit represented the limit of detection at the time NIOSH made the recommendation.

Chloroform is considered to be a probable carcinogen in humans by the ACGIH and the United States Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC). Chloroform is given an overall weight-of-evidence classification of B2 by the EPA, and an IARC classification of 2B. These classifications are based on sufficient animal evidence for carcinogenicity and insufficient epidemiological evidence to reach a conclusion based on the human data. The following discussion is based on information from the EPA Health Assessment Document for chloroform (U.S. EPA 1985).

It is currently believed that the carcinogenicity of chloroform results from the formation of reactive metabolites, such as phosgene, that bind to cellular macromolecules. Although there is some evidence to suggest that chloroform is weakly mutagenic, the results of most mutagenicity tests are negative.

In humans, there are no epidemiological studies that evaluate populations exposed only to chloroform, although there are several studies that examine populations exposed to chloroform in chlorinated drinking water. However, because chloroform is not the only potential carcinogen present in chlorinated water, the epidemiological data are considered inadequate to use as the basis for a quantitative risk assessment. Thus, a causal relationship between cancer and chloroform exposure cannot be determined based on epidemiological studies alone, although these studies can be used to provide general support for findings in animal studies.

A case-controlled study indicates a significant association between colon cancer and exposure to chlorinated drinking water contaminated with organic material (Young et al. 1981). Significant positive associations were also found for chloroform levels in drinking water and the incidence of mortality due to cancer of the bladder, rectum, and large intestine (Hogan et al. 1979). Similar results also have been found by others (Cantor et al. 1978 and Gottlieb et al. 1981). However, although these studies suggest an association between exposure to chloroform and an increased risk of cancer, a definite causal relationship between the development of colon and bladder cancer and exposure to chloroform

cannot be determined solely from these studies.

In animals, several long-term studies provide strong evidence for the carcinogenic activity of chloroform. Chloroform has been shown to produce statistically significant increases in renal epithelial tumors in male rats and hepatocellular carcinomas in several strains of mice. The carcinogenic activity of chloroform in these studies is specific to the kidney and liver.

The carcinogenic activity of chloroform was investigated in rats exposed to chloroform by gavage for 78 weeks (NCI 1976). Male rats were administered doses of 90 or 180 mg/kg/day, and female rats were administered doses of 100 or 200 mg/kg/day. A statistically significant dose-related increase in renal epithelial tumors was observed in treated male rats compared with untreated, matched controls; these tumors were described as carcinomas and adenomas. No increase in the incidence of tumors was observed in chloroform-treated female rats.

In this same study, the carcinogenicity of chloroform was evaluated in mice exposed chronically to chloroform by gavage (NCI 1976). Male mice were exposed to doses of 138 or 277 mg/kg/day and females to 238 or 477 mg/kg/day for 78 weeks. There were significant dose-related increases in the incidence of hepatocellular carcinomas in chloroform-treated male and female mice. The increase of tumors in male mice for low and high doses was 36 percent and 98 percent, respectively. For female mice, the increases were 80 percent for the low dose and 95 percent for the high dose of chloroform.

The carcinogenic potential of chloroform in mice was further investigated in two additional studies (Roe et al. 1979; Jorgenson et al. 1985). Doses of 17, 60, or 100 mg/kg/day were administered to four different strains of male and female mice (C57BL, CBA, CF/1, and ICI) by gavage for 80 weeks (Roe et al. 1979). The incidence of kidney tumors, described as hypernephromas, was significantly elevated in the ICI strain. Moderate to severe renal changes were observed in the male mice of the other strains, but no significant increase in renal tumors was reported. Tumors were not observed in female mice.

The carcinogenicity of chloroform administered in drinking water was investigated in male rats and female mice (Jorgenson et al. 1985). Animals were treated with drinking water containing chloroform concentrations of 200, 400, 900, or 1800 mg/L for 104 weeks. There was a marked increase in the number of kidney tumors (described as tubular cell adenomas and adenocarcinomas) in rats. However, the incidence of tumors in female mice was not significantly increased.

Risk estimate for chloroform. The NCI (1976) rat study, which demonstrated a statistically significant increase in the incidence of renal tumors in male rats, was the data set used for the quantitative risk estimation. Although there are no data concerning the carcinogenicity of chloroform following inhalation exposure, the risk from inhaled chloroform is considered to be equivalent to the risk from ingested chloroform. The linearized multistage, one hit, and Weibull models were used. The maximum likelihood estimates of excess cancers over an occupational lifetime for a population of 1000 and the 95 percent upper bound estimates are summarized in Table C15–12. The Weibull model is similar to the logit and probit models. However, by using only one data set, the logit, probit, and multihit models failed to converge.

The results of the data analysis presented here are similar to the results of other models described by the EPA (1985) for chloroform. These three models clearly demonstrate, based on the MLE estimates, that a significant cancer risk exists at the current PEL of 50 ppm. The risks estimated to exist at the current PEL are of the same order of magnitude as the risks determined by OSHA to be associated with other carcinogens that OSHA has regulated (e.g., benzene, ethylene oxide). Therefore, OSHA preliminarily concludes that a significant risk of cancer exists at the current PEL of 50 ppm, with estimated risks ranging from 9 to 32 excess deaths per 1,000 workers. The Supreme Court indicates that a reasonable person "might well consider a risk of 1.0 per 1000 significant, and take steps to decrease or eliminate that risk" (*I.U.D.* v. *A.P.I.*, 448 U.S. 655). OSHA also preliminarily finds that revising the PEL to 2 ppm will substantially reduce this risk by from 92 to 99 percent. Therefore, OSHA is proposing a 2 ppm short-term limit (15 minutes) as the PEL. OSHA's preliminary feasibility analysis is based on limited data at this level, and the Agency accordingly requests additional feasibility information from the public.

Table C15-12. Multistage Model Estimates of Cancer Risk Associated with Working Lifetime Exposure to Chloroform

Exposure Level	Excess Cancer Deaths Per 1,000 Workers	
	MLE	UCL
Multistage		
2 ppm[a]	0.22	3.6
10 ppm[b]	1.17	8.90
50 ppm[c]	12.20	44.20
One Hit		
2 ppm[a]	2.58	3.81
10 ppm[b]	6.43	9.44
50 ppm[c]	32.00	46.80
Weibull		
2 ppm[a]	0.07	0.65
10 ppm[b]	0.56	3.22
50 ppm[c]	9.08	31.80

[a] Proposed OSHA PEL.
[b] ACGIH TLV.
[c] Current OSHA PEL.
MLE = Maximum likelihood estimate of risk.
UCL = 95 percent upper confidence limit on the maximum likelihood estimate of risk.

CHROMIC ACID, CHROMATES: ZINC CHROMATES
CAS: 7440-47-3; 13530-65-9
H.S. No. 1092; 1436

The current OSHA limit for chromic acid and chromates is a ceiling limit of 0.1 mg/m³ measured as CrO_3. The ACGIH has established a TLV-TWA of 0.05 mg/m³ as Cr(VI) for both the soluble and insoluble forms of chromate (except zinc chromate), and has designated insoluble chromates as confirmed human carcinogens (A1). NIOSH (1975) has recommended that exposure to the noncarcinogenic forms of chromium (VI) be limited to 0.025 mg Cr(VI)/m³ as a 10-hour TWA and 0.05 mg Cr(VI)/m³ as a 15-minute ceiling. For the carcinogenic (i.e., insoluble) forms of chromium (VI), NIOSH recommends a 10-hour TWA limit of 0.001 mg Cr(VI)/m³.

The ACGIH recommendation for both soluble (noncarcinogenic) and insoluble (carcinogenic) forms of Cr(VI) is based largely on reports by Bloomfield and Blum (1928) and by the U.S. Public Health Service (1953) that demonstrate nasal irritation and some evidence of liver enlargement and kidney dysfunction among chromate workers exposed to 0.06 to 0.07 mg Cr(VI)/m³. The ACGIH also cites a report by Mancuso and Hueper (1951) of excess lung cancer among chromate workers exposed to 0.01 to 0.15 mg/m³ soluble chromate and 0.1 to 0.58 mg/m³ insoluble chromate. Animal data cited by the ACGIH indicate that insoluble chromate salts were likely to have been responsible for the increased incidence of cancer seen in the Mancuso and Hueper study. The ACGIH (1986) concluded that the 0.05 mg/m³ TLV-TWA would protect workers from chromium-induced nasal irritation and possible liver or kidney damage, and, in the case of the insoluble chromates, would provide an adequate margin of safety from respiratory cancer. (It should be noted that the 0.05 mg/m³ limit, expressed as Cr(VI), approximates 0.01 mg/m³ measured as CrO_3.)

NIOSH (1975) cited several studies showing inflammation and ulceration of the nasal cavity at short-term exposure levels greater than 0.1 mg CrO_3/m³. In its 1973 Criteria Document on chromic acid, NIOSH recommended that the current OSHA ceiling limit (0.1 mg CrO_3/m³) be supplemented with an 0.05 mg CrO_3/m³ 10-hour TWA limit. In its 1975 Criteria Document on chromium (VI), NIOSH reaffirmed these limits but extended their application to all forms of noncarcinogenic chromate. Thus, the 0.1 mg CrO_3/m³ ceiling limit corresponds to a 0.05 mg Cr(VI)/m³ ceiling limit, and the 0.05 mg CrO_3 TWA limit corresponds to a 0.025 mg Cr(VI)/m³ TWA. For the carcinogenic (insoluble) forms of Cr(VI), NIOSH recommends the lowest detectable level, which is 0.001 mg Cr(VI)/m³ as a 10-hour TWA.

Zinc chromate is an insoluble, carcinogenic form of chromate. As such, the current OSHA limit for chromic acid and chromates applies, as does the NIOSH limit of 0.001 mg/m³ limit for

carcinogenic chromates. The ACGIH (1986) reviewed several small epidemiologic studies of zinc chromate workers, all of which reported excesses of lung cancer. Because of the consistent evidence, the ACGIH (1986) classified zinc chromate as a confirmed human carcinogen (A1) and reduced the TLV to 0.05 mg Cr(VI)m^3.

Evaluation of the alternate recommendations is complicated by the different valence states of chromium compounds, the different methods of measurement (CrO_3 or Cr(VI)), and differences in defining those substances that present a cancer hazard (soluble vs. insoluble or valence state). The 0.05 ppm TWA-TLV is less restrictive than the current 0.05 ppm ceiling limit (as Cr(VI)), and would not be considered a revised PEL. OSHA therefore tentatively proposes that the existing PEL of 0.1 mg/m^3 (measured as CrO_3) be maintained. Because of the problems noted above, OSHA will consider whether the NIOSH REL should be adopted in place of the 0.1 mg/m^3 limit (measured as CrO_3) during the public hearing phase of this rulemaking. OSHA will also consider whether to place these substances on its regulatory agenda for future consideration for section 6(b) rulemaking, rather than making any changes as part of this rulemaking.

CHROMYL CHLORIDE
CAS: 14977-61-8; Chemical Formula: CrO_2Cl_2
H.S. No. 1094

There is no existing OSHA PEL for chromyl chloride. The ACGIH recommends that a TWA of 0.025 ppm be established, based on this substance's carcinogenic potential (ACGIH 1986, p. 141). The evidence in humans is considered sufficient for the carcinogenicity of chromium and chromium compounds, and these have been given a Group 1 classification by the International Agency for Research on Cancer. As discussed below in connection with chromic acid, chromates, and zinc chromates, the chromium compounds present several important issues that require detailed analysis and can most appropriately be handled in an individual section 6(b) rulemaking. OSHA intends to commence work on this rulemaking as priorities and research permit.

DIMETHYL SULFATE
CAS: 77-78-1; Chemical Formula: $(CH_3)_2SO_4$
H.S. No. 1142

OSHA's current limit for dimethyl sulfate is 1 ppm. The ACGIH considers this substance a suspected human carcinogen and has given it a classification of A2 (ACGIH 1986, p. 212). The ACGIH's TLV-TWA for this substance is 0.1 ppm.

Dimethyl sulfate is commonly used in the manufacture of many organic chemicals. It has been shown to be carcinogenic in rats by inhalation exposure, subcutaneous injection, and prenatal exposure. The rat is the only animal species in which the carcinogenesis of dimethyl sulfate has been tested (IARC 1974).

The carcinogenic activity of dimethyl sulfate was investigated in male rats chronically exposed to subcutaneous injections of 8 or 16 mg/kg body weight per week (Druckrey et al. 1966). Local sarcomas with metastases to the lung and regional lymph nodes were observed at both dose levels. A single subcutaneous injection of dimethyl sulfate (50 mg/kg) also produced local sarcomas with metastases to the lung (Druckrey et al. 1970). However, tumors did not develop following chronic weekly intravenous injections of dimethyl sulfate (2 or 4 mg/kg) (Druckrey et al. 1970). Control data were not reported for either of these studies.

The carcinogenic potential of dimethyl sulfate exposure by inhalation was also evaluated in male rats (Druckrey et al. 1970). Animals were exposed to approximately 3 or 10 ppm dimethyl sulfate for 1 hour per day five times weekly for 130 days. Malignant tumors developed in 15 percent (3/20) of the rats exposed at 3 ppm and in 18 percent (5/27) of the rats exposed at 10 ppm.

Pregnant rats were exposed to a single intravenous injection of dimethyl sulfate (20 mg/kg body weight) on day 15 of gestation and the incidence of malignant tumors in the offspring was investigated for 1 year. Tumors were reported in 7/59 of the offspring. However, the incidence of tumors in the control group was not indicated. The results of this study are complicated because several rats died (number of deaths not specified) from the acute toxic effects of dimethyl sulfate, and the incidence of tumors in the control group was not reported.

There is little information available regarding the carcinogenicity of dimethyl sulfate in humans. A case study of workers exposed to dimethyl sulfate reported that three workers developed bronchial cancer (Druckrey et al. 1966). However, an epidemiological study by the E.I. du Pont de Nemours Company (cited in ACGIH 1986, p. 213) demonstrated no increase in the incidence of respiratory cancer among workers exposed to dimethyl sulfate.

OSHA considered the possibility of performing a quantitative risk assessment for dimethyl sulfate and concluded that the studies described above did not have sufficient dose-response data to provide an adequate basis for such a risk assessent. Dimethyl sulfate induces malignant tumors in animals both by inhalation and ingestion, and there is thus sufficient evidence in animals to predict that workers exposed to dimethyl sulfate are at significant risk of developing cancer; exposures at levels only three times the existing PEL resulted in a significant number of tumors. OSHA preliminarily concludes that reducing the current limit to 0.1 ppm as an 8-hour TWA will reduce this risk and will substantially reduce this significant risk of cancer mortality.

NICKEL (SOLUBLE COMPOUNDS)
CAS: 7440-02-0; Chemical Formula: Varies
H.S. No. 1283

The current OSHA PEL for all forms of inorganic nickel (as Ni) is 1 mg/m^3 TWA. The ACGIH has recommended that the TLV-TWA for soluble forms of nickel be reduced to 0.1 mg/m^3. NIOSH recommends that exposure to any form of inorganic nickel be maintained at or below 0.015 mg/m^3.

A variety of toxic effects results from exposure to nickel compounds. Soluble nickel salts cause contact dermatitis in sensitized individuals and eye irritation (ACGIH 1986, p. 422). High rates of asthmatic lung disease have been reported among nickel-plating workers (EPA 1986).

Three soluble nickel compounds have been tested for their carcinogenic potential: Nickel chloride, nickel sulfate, and nickel acetate. In addition, the sparingly soluble compounds, nickel carbonate and nickel hydroxide, have been studied. As a whole, the results of animal studies suggest that some soluble nickel compounds are potentially carcinogenic. Results from occupational studies are inconclusive for soluble nickel compounds because of the presence of several types of nickel compounds in the facilities studied. One cohort of nickel refinery electrolysis workers exposed to nickel sulfate experienced an increased risk of lung cancer compared with the facility's roasting and smelting workers (Doll 1958). OSHA proposes to lower the PEL for soluble nickel compounds to 0.1 mg/m^3, due to recent evidence that, in animals, exposure to low levels causes lung damage that is indicative of pre-neoplastic changes.

Nickel chloride has been reported to be mutagenic in *Salmonella typhimurium and Cornebacterium*, but negative in *E. coli* (EPA 1986). The positive studies are not considered conclusive, however, because the *S. typhimurium* report is an abstract lacking detailed data and *Cornebacterium* is not the usual species

used in these tests. Amacher and Paillet (1980) reported that nickel chloride was mutagenic in mouse lymphoma cells and demonstrated a dose-response relationship.

Some *in-vitro* studies using soluble nickel compounds report finding chromosomal aberrations (EPA 1986). These studies do not demonstrate a dose-response relationship or statistical significance, which weakens their findings. Several *in-vivo* studies have failed to detect chromosomal aberrations (EPA 1986). However, several *in-vitro* studies on nickel sulfate and nickel chloride have reported findings of sister chromatid exchanges (EPA 1986).

Some animal studies on soluble nickel compounds suggest that these compounds are carcinogenic in animals. Strain A mice receiving intraperitoneal injections of nickel acetate had an increased rate of lung adenomas and adenocarcinomas that was statistically significant in the high dose group (Stoner et al. 1976). The animals were injected 3 times per week for 8 weeks at 72, 180, or 360 mg/kg.

EPA (1986) reported a study in which rats were given monthly intramuscular injections of 35 mg/kg nickel acetate for 4 to 6 months (Haro et al. 1968, as reviewed by Rigaut 1983). Twenty-two percent of the treated rats developed sarcomas. Payne (1964) observed tumor responses in rats after intramuscular implantation of 7 mg nickel acetate, nickel sulfate, nickel chloride, or nickel carbonate. Implant site sarcomas developed in 1 of 35 rats exposed to nickel acetate, 1 of 35 rats exposed to nickel sulfate, none of 35 rats exposed to nickel chloride, and 4 of 35 rats exposed to nickel carbonate.

Results of other studies on nickel sulfate have been negative. Three studies used intramuscular injection in rats and reported that no tumors developed in the treated group (Gilman 1962; Gilman 1966; and Kasprazak et al. 1983). An ingestion study also reported no tumors among treated rats or dogs (Ambrose et al. 1976).

Gilman (1966) administered 5 mg nickel hydroxide to rats by intramuscular injection in each thigh. Nineteen out of 40 injection sites developed sarcomas. Kasprazak et al. (1983) gave rats intramuscular injections of nickel hydroxide in gel, crystalline, or colloidal form. Five out of 19 animals receiving the gel developed sarcomas (2 with metastasis to the lung), 3 out of 20 receiving the crystalline form developed sarcomas (1 with metastasis to the lung), and none of 13 rats receiving the colloid developed tumors.

Bingham et al. (1972) exposed rats by inhalation to 0.1 mg/m^3 nickel chloride for 12 hours a day for 2 weeks. Animals showed evidence of pulmonary damage and hyperplasia. Rats and guinea pigs exposed daily to 1.0 mg/m^3 (as Ni) nickel chloride for 6 months showed increased lung weight, which is an indication of pulmonary damage and hyperplasia (Clary 1977). Rabbits inhaling 0.3 mg/m^3 (as Ni) nickel chloride aerosol for 30 days showed a doubling in alveolar cell number and volume of alveolar epithelial cells, as well as nodular accumulation of macrophages and laminated structures (Johansson et al. 1983). These studies indicate that exposure above the current OSHA PEL of 1.0 mg/m^3 for soluble nickel is associated with increased cell turnover in the lung; the hyperplasia observed in the lungs of treated animals is indicative of pre-neoplastic change.

Electrolysis workers at a refinery in Kristiansand, Norway experienced the highest lung cancer risk in the plant (Mangus et al. 1982). Electrolysis workers were exposed to an aerosol composed predominantly of nickel sulfate, which was estimated (to contain nickel) at a concentration of 0.2 mg/m^3 (EPA 1986). However, exposure to nickel subsulfide and oxides may have occurred in the electrolysis building, and the electrolysis workers may have worked in other process departments (Grandjean et al. 1988). Roasting and smelting workers were exposed to an estimated average of 0.5 mg/m^3 (as Ni) of roasting dust.

The standardized mortality ratios (SMRs) for lung cancer were 550 for electrolysis workers, 390 for other process workers, and 360 for roasting and smelting workers. The pattern of SMRs for nasal cancer was different: 2600 for electrolysis workers, 2000 for other process workers, and 4000 for roasting and smelting workers. The results seem consistent with studies showing that roasting and smelting workers have the highest concentrations of nickel in the nasal mucosa, presumably because of the relatively larger particles resulting from roasting. Electrolysis workers have higher plasma and urine levels of nickel, suggesting that nickel aerosolized by this process penetrates to the deep lung (EPA 1986).

In contrast to the study of Norwegian nickel refinery workers, an increased risk of lung cancer was not found among electrolysis workers at Port Colborne, Ontario (EPA 1986). The characteristics of exposure, however, may not have been similar to those experienced by the workers in Norway.

Risk estimate for soluble nickel compounds. OSHA considered the possibility of performing a quantitative risk assessment for the nickel compounds. However, the animal studies on the effects of exposure to the soluble compounds of nickel do not contain sufficient dose-response data for such an assessment. Risk estimates can be derived from the study by Mangus et al. (1982), which reported excesses in lung cancer and nasal tumors among electrolysis workers exposed predominantly to soluble nickel aerosols. To perform the risk assessment, OSHA used the multiplicative and average relative risk models (EPA 1986) applied to the excess lung cancer response reported by Mangus et al. (1982). The results of the risk assessment are reported in Table C15–5.

TABLE C15-5. Multistage Model Estimates of Lung Cancer Risk Associated With Working Lifetime Exposure to Soluble Nickel

Exposure Level	Excess Cancer Deaths Per 1,000 Workers: Estimate Using Multiplicative Relative Risk Model	Estimate Using Average Relative Risk Model	Midpoint of Range
0.1 mg/m^3 [a]	0.25	2.5	1.4
1.0 mg/m^3 [b]	2.5	25.0	14.0

[a] Proposed OSHA PEL.
[b] Current OSHA PEL.

Animal studies have clearly demonstrated that lung changes indicative of pre-neoplastic responses occur as a result of exposure to soluble nickel at levels ranging from 0.1 mg/m^3 to 1.0 mg/m^3 for periods of time that were far less than the lifetime of the animals. From these studies, it is clear that the current OSHA PEL of 1.0 mg/m^3 for soluble nickel is inadequate to offer protection against these pathological changes.

For example, using the midpoint of the range of excess deaths predicted by the two models (Table C15–5), 14 excess deaths would be predicted to occur among 1,000 workers exposed over their working lifetimes at the current limit. This risk is reduced by 90 percent at the proposed level, i.e., is reduced to 1.4 excess deaths per 1,000 exposed workers. The residual risk at 0.1 mg/m^3 is still significant, if the guidelines provided by the Supreme Court in the *Benzene* decision are used. Soluble nickel has exhibited carcinogenic activity in animals treated by injection. The finding by Mangus et al. (1982) of excess lung and nasal tumor cancer among workers exposed to soluble nickel, although complicated because of concurrent exposure to insoluble nickel, is consistent with these animal findings. A quantitative assessment of cancer risk based on the Mangus et al. (1982) study shows that the potential cancer risk at the current PEL represents a significant cancer risk, and that reducing the exposure limit for soluble nickel to 0.1 mg/m^3 results in a substantial reduction of that risk. Because the 0.015 mg/m^3 NIOSH limit is based on analytical and sampling limits of detection, the significant risk and feasibility requirements to which the Agency may not be satisfied. OSHA preliminarily concludes that reducing the current PEL for soluble nickel is necessary and proposes to reduce its limit to a 0.1-mg/m^3 8-hour TWA, measured as elemental nickel, as an interim PEL. As future priorities permit. OSHA may consider the need for a more restrictive standard for these compounds.

2-NITROPROPANE
CAS: 79–46–9; Chemical Formula: $CH_3CH(NO_2)CH_3$
H.S. No. 1291

OSHA's current limit for 2-nitropropane (2-NP) is 25 ppm; the ACGIH has an established limit for this substance of 10 ppm as an 8-hour TWA and classifies 2-nitropropane as a suspected human carcinogen (A2). 2-Nitropropane is used as a chemical intermediate, solvent, and a component in paint, ink, and varnishes (Fiala et al. 1987). Approximately 185,000 workers are exposed to 2-NP during its production and use in printing, highway maintenance (traffic markings), shipbuilding and maintenance (marine coatings), furniture and plastic product finishes, and food packaging (NIOSH 1980).

In rats and chimpanzees, 2-NP is metabolized by microsomal enzymes in the liver to acetone, low levels of isopropanol, and nitrite (Mueller et al. 1983). Methemoglobin formation is associated with the metabolism of nitropropane and has been reported in cats exposed to 280 ppm of 2-NP for 7 hours. Sensitivity to the toxic effects of 2-NP in animals varies by species (Dequidt et al. 1972; ACGIH 1986, p. 441).

The mechanisms of carcinogenicity of 2-NP are thought to involve the release of nitrite and the formation of a reactive azoxy intermediate that can react with cellular macromolecules (Williams and Weisburger 1986).

In mutagenicity tests, 2-NP increased the frequency of mutations in all strains of *Salmonella typhimurium* with and without metabolic activation. Positive mutagenicity results were reported in *Salmonella typhimurium* strains TA100, TA1535, and TA98 by Lofroth et al. (1981) and Speck et al. (1982). 2-NP was not shown to be mutagenic in the mouse micronucleus test (Hite and Skeggs 1979).

Acute exposures to 2-NP from occupational accidents have been reported to cause severe liver toxicity and subsequent death in humans (ACGIH 1986, p. 441). However the

available epidemiology data on the chronic health effects of occupational exposure to 2-NP do not contain sufficient dose-response data to use as a basis for quantitative risk estimation. An unpublished retrospective mortality study of 1,481 potentially exposed workers from a nitropropane production plant found no increase in liver cancer or liver disease mortality. However, lack of exposure data, the small number of workers with long exposures (greater than 15 years), and a short latency period make interpretation of the results of this study difficult (Miller and Temple 1979; Bolender 1983).

There are two studies that report high incidences of liver tumors in male rats exposed to 2-NP by gavage and inhalation. Fiala et al. (1987) administered, by gavage, 1 mmol/kg body weight (approximately 27 mg/treatment per 300-gram rat) of 2-NP in a 10 percent aqueous Emulphor EL-620 vehicle to male Sprague-Dawley rats three times weekly for 16 weeks. Dosing was discontinued after 16 weeks because of excessive mortality in the treated rats. Seventy-seven weeks from the first treatment, the surviving rats were sacrificed and subjected to necropsy. All (100 percent) of the treated rats examined had developed hepatocarcinomas.

The results of the Fiala et al. study (1987) support the earlier positive results reported by Lewis et al. (1979). In the Lewis et al. study (1979), male Sprague-Dawley rats and male New Zealand White rabbits were exposed via inhalation to 27 ppm or 207 ppm of 2-NP for 7 hours/day, 5 days/week for 6 months. At the end of 6 months, all 10 rats in the high-dose group exhibited hepatocellular carcinomas and neoplastic nodules. No exposure related lesions were seen in the rats exposed to 27 ppm, and no exposure related lesions were observed in any of the rabbits.

One high-dose and two low-dose studies reported negative results for rats exposed to 2-NP vapors. Griffin et al. (1978) reported no hepatic carcinomas on exposing male and female rats to 200 ppm of 2-NP by inhalation using a protocol similar to that described by Lewis et al. (1979). Although no hepatic carcinomas were observed, the following effects (generally occurring more extensively in males) were seen: Increased liver weights (both sexes); hepatic nodules; hepatocellular necrosis; and peripheral compression.

Two low-dose studies by Griffin et al. (1980, 1981) also produced negative results. Male and female Sprague-Dawley rats were exposed by inhalation to 25 ppm of 2-NP for 7 hours/day, 5 days/week for 22 months. No pathological changes associated with exposure to 2-NP were seen.

Although the results of both the Lewis et al. (1979) and the Fiala et al. (1987) studies show statistically significant increases in liver carcinomas, neither study provides sufficient dose-response information to use as a basis to quantify the excess cancer risk to humans exposed to 2-NP. Both studies were terminated before the natural lifetime expectancy of the controls, so it is not possible to determine a background incidence of cancer risk. No historical information is provided on tumor incidence for these animals.

2-Nitropropane produced a high incidence of liver tumors in male rats by two routes of administration: Inhalation and ingestion. Its ability to cause mutations in *Salmonella typhimurium* further supports the premise that 2-NP is a potential human carcinogen. OSHA considered whether to perform a quantitative risk assessment on 2-NP. OSHA preliminarily concludes that the studies described above do not contain sufficient dose-response data to use as the basis for quantitative risk estimation using standardized risk assessment models. However, two studies (Fiala et al. 1987, Lewis et al. 1979) demonstrate that exposure to 2-NP, either by gavage or inhalation, produced hepatocarcinomas in rats. In addition, this substance produced positive results in two mutagenic assays (Lofroth et al. 1981, Speck et al. 1982).

OSHA is proposing an 8-hour PEL for 2-NP of 10 ppm. The Agency preliminarily concludes that a reduction in the PEL is necessary to protect exposed workers from the significant risk of cancer potentially associated with exposure to 2-NP at the current PEL. The proposed limit will substantially reduce this significant occupational risk.

STYRENE
CAS: 100–42–5; Chemical Formula: $C_6H_5CH=CH_2$
H.S. No. 1372

OSHA's current occupational limits for styrene are 100 ppm as an 8-hour TWA, 200 ppm as a ceiling limit not to be exceeded for more than 5 minutes in any 3-hour period, and 600 ppm as a peak limit. The ACGIH has recommended limits of 50 ppm as an 8-hour TWA and 100 ppm as a 15-minute STEL for styrene. NIOSH has a recommended standard for styrene of 50 ppm as a 10-hour TWA, with a 15-minute ceiling of 100 ppm.

An increased incidence of cancer has been reported among workers exposed to styrene. In addition, styrene has been demonstrated to be carcinogenic in animals. The discussion below summarizes the human and animal data and presents OSHA's quantitative assessment of the cancer risk potentially associated with occupational exposure to styrene.

McMichael et al. (1976), in a nested case-control study, identified a sample of male workers who had worked for 5 or more years at a tire manufacturing plant where exposure to styrene (and butadiene) occurred. The authors found the age-standardized relative risk for this cohort (128 workers), compared with that of the total plant population (6,678 workers), to be 6.2 for lymphatic and hematopoietic cancer, 3.9 for lymphatic leukemia, and 2.2 for stomach cancer. In a follow-up unpublished analysis (discussed in EPA 1987), the relative risk for lymphatic and hematopoietic cancer was revised to 2.4.

In a retrospective cohort mortality study, Meinhardt et al. (1982) identified five deaths from leukemia and aleukemia (1.8 expected, SMR = 278) among 600 workers in a synthetic rubber manufacturing facility. Workers at this plant had been exposed to styrene (and butadiene) for at least 6 months; the mean concentration of styrene at the plant was 0.94 ppm. Because of the concurrent exposure to butadiene reported among the study cohort, these studies can be said to support but not conclusively to prove that exposure to styrene is associated with an elevated risk in workers of hematopoietic cancer and leukemia.

In a study sponsored by the Chemical Manufacturers Association (Dow 1978, as cited in EPA 1987), male and female Sprague-Dawley rats were exposed to styrene vapor at concentrations of 600 to 1200 ppm, 6 hours per day, 5 days per week, for 18 or 20 months. The higher exposure level was reduced to 1000 ppm after the first 2 months of exposure because of excessively reduced weight in the male rats. A statistically significant increased incidence of mammary tumors was reported in low-dose female rats (7 of 87) compared with controls (1 of 85); no increase in mammary tumors was reported among high-dose female rats. The authors questioned the significance of this response, since historical control animals from the same laboratory showed a higher background incidence of mammary tumors than the controls used in this study.

An increased incidence of leukemia and lymphosarcoma was also observed in both low-dose and high-dose females; both experimental groups exhibited the same incidence (6 of 85), compared with 1 of 85 in the controls. Although the

increased incidence was not statistically significant compared with the incidence in concurrent controls, the increase was highly significant compared with historical control rates. The tumor response in male rats was confounded by excessive non-treatment-related mortality.

In a 1979 NCI study, male and female B6C3F1 mice and Fischer 344 rats were treated by gavage 5 days per week for 78 weeks (low-dose rat groups were treated for 103 weeks). The study was terminated at 91 weeks for mice and 104 to 105 weeks for rats. Dose-related increases in alveolar/bronchiolar adenomas and carcinomas were observed only in the low-dose (150 mg/kg) and high-dose (300 mg/kg) male mice; the incidence of tumors for vehicle controls, low dose, and high-dose male mice was 0/20, 6/44, and 9/43, respectively. Although the historical incidence of tumors among untreated controls was 12 percent (32/271), the historical incidence of vehicle controls was 0/40.

Quantitative Risk Assessment for Styrene. OSHA assessed the excess cancer risk associated with 45 years of occupational exposure to styrene using both the NCI (1979) male mouse lung tumor response and the Dow (1978) female rat leukemia/lymphosarcoma response. Risk estimates derived using the multistage model and the NCI data set yielded estimated excess cancer deaths of 280 or 150 per 1,000 employees exposed to 100 ppm or 50 ppm over their working lifetimes, respectively (95 percent upper-bound estimates were 460 or 220 per 1,000, respectively). However, the daily doses associated with 45 years of occupational exposure to 100 ppm or 50 ppm styrene are well above the daily dose administered to the high-dose group of mice in the NCI gavage study, which places the estimated human doses outside the linear range of the model. As a consequence, the NCI gavage study is not suited to estimating risk in the range of exposure represented by the current and proposed limits for this substance.

Because the daily human doses corresponding to 45 years of exposure to 100 ppm or 50 ppm styrene in the Dow (1978) study are well below the daily doses administered to the female rats, these data can be used as the basis for a quantitative risk assessment. The risk estimates based on this study are presented in Table C15-6.

TABLE C15-6. Multistage Model Estimates of Cancer Risk Associated With Working Lifetime Exposure to Styrene*

Exposure Level	Excess Cancer Deaths per 1,000 Workers	
	MLE	UCL
50 ppm[a]	9.5	17
100 ppm[b]	19.0	33

* Based on 1978 Dow study sponsored by the Chemical Manufacturers Association.
[a] Proposed OSHA PEL.
[b] Current OSHA PEL.
MLE = Maximum likelihood estimate of risk.
UCL = 95 percent upper confidence limit on maximum likelihood estimate of risk.

Styrene has been shown to be carcinogenic in two species of animals and by two routes of administration. Human studies also implicate styrene as a potential human carcinogen, but these studies are confounded by concurrent exposure to butadiene in the cohorts studied. However, it is noteworthy that the excess cancers that have been found in workers exposed to styrenebutadiene (hematopietic cancer and leukemia) involve the same tumor site affected in rats exposed to styrene by inhalation.

OSHA's quantitative risk assessment based on the rat inhalation study indicates that an excess of 19 cancer deaths will occur among 1,000 employees exposed to the current PEL of 100 ppm styrene for 45 years; clearly, this represents a significant risk. Reduction of the PEL to 50 ppm will reduce this significant risk substantially; the reduction from 100 to 50 ppm reduces the risk existing at the current PEL by 50 percent. Therefore, OSHA proposes to revise its existing PEL for styrene to 50 ppm as an 8-hour TWA; OSHA also proposes to supplement the TWA-PEL with a 100-ppm 15-minute STEL to ensure that workplace exposures are maintained under good industrial hygiene control. OSHA is proposing the 50-ppm limit as an interim measure. As future priorities permit, the Agency will consider additional rulemaking for this potent occupational carcinogen, at which time OSHA will investigate whether it is feasible to reduce exposures further.

o-TOLUIDINE

CAS: 95-53-4; Chemical Formula: $CH_3C_6H_4NH_2$

H.S. No. 1399

OSHA's current 8-hour TWA for o-toluidine is 5 ppm. The ACGIH identifies o-toluidine as a suspected human carcinogen and has accordingly placed it in the A2 category (ACGIH 1986, p. 586). The ACGIH has a TLV-TWA of 2 ppm, with a skin notation, for this substance. The International Agency for Research on Cancer (IARC 1982) classifies o-toluidine as a probable carcinogen (category 2A) based on sufficient evidence of its carcinogenicity

in rats and mice following oral administration (IARC 1982). IARC judged the human evidence inadequate to establish o-toluidine's carcinogenicity in human tests.

o-Toluidine is mutagenic in short-term tests, inducing sister chromatid exchanges and unscheduled DNA synthesis in mammalian cells in vitro and chromosomal anomalies in yeast. o-Toluidine was negative in the micronucleus test in mice in vivo, but induced cell transformations in the BHK (baby hamster kidney) assay. IARC considers these data to be sufficient evidence of o-toluidine's activity in short-term tests (IARC 1982).

There are a number of studies that report an excess of bladder tumors in dyestuff workers exposed to o-toluidine and other chemicals; however, there are no studies that examine a population of workers exposed to o-toluidine alone. Workers exposed to toluene, o-nitrotoluene, o-toluidine, and 4,4 methylene bis (2-methylaniline) in manufacturing were observed to have an excess of bladder tumors. However, the concurrent exposures of these workers to these other potential carcinogens make these data inappropriate for use in the quantitative assessment of o-toluidine's carcinogenic risk in human populations. A few reports of bladder tumors in persons exposed primarily to o-toluidine have been reported, but insufficient follow-up time and incomplete data have prevented the establishment of a clear quantitative association between o-toluidine exposure and cancer in humans. For this reason, IARC considers the data from human studies inadequate to establish an association between exposure to o-toluidine and cancer (IARC 1982).

o-Toluidine has been determined to be carcinogenic in rats and mice following oral administration. In rats, statistically significant increases in subcutaneous fibromas, fibrosarcomas, and cancers of the urinary bladder have been reported. Studies in mice have resulted in statistically significant increases in hemangiosarcomas and hepatocellular carcinomas.

The National Cancer Institute (NCI 1979) conducted long-term carcinogenicity studies with o-toluidine in rats and mice. Both of these studies were positive for carcinogenicity. The mouse study used groups of 50 female and 50 male B6C3F1 mice fed o-toluidine hydrochloride in the diet at levels of 1000 ppm or 3000 ppm for 102 to 103 weeks. There was no excess mortality in the tested animals. At the 3000-ppm dose level, there was a statistically significant increase in hemangiosarcomas at all sites in males and a statistically significant increase in hepatocellular carcinomas and adenomas in females.

The National Cancer Institute also conducted a 2-year feeding study with 50 male and 50 female Fischer 344 rats. There was a dose-related trend in mortality (which was not caused by cancer); all the males in the high-dose group died by 100 weeks. However, the females at both dose levels were observed to have significant increases in transitional-cell carcinomas or papillomas of the urinary bladder, and the high-dose females developed fibroadenomas of the mammary gland. The males at both dose levels showed significant increases in fibromas of the subcutaneous tissue and mesotheliomas in multiple organs (NCI 1979). The high mortality in the males complicates the interpretation of these latter findings.

Weisburger et al. (1978) reported positive findings for o-toluidine in long-term feeding studies in rats and mice. The study in rats was conducted with two groups of 25 male CD rats fed o-toluidine in the diet via one of two regimens: 8000 ppm for 3 months and then 4000 ppm for an additional 15 months; or 16,000 ppm for 3 months and then 8000 ppm for an additional 15 months. Statistically significant increases in the incidence of subcutaneous fibromas and fibrosarcomas were observed in both dose groups. In addition, there was a non-statistically significant increase in the incidence of transitional-cell carcinomas of the urinary bladder in these animals.

Weisburger et al. (1978) also reported the results of a long-term study in mice. Groups of 25 male and 25 female CD-1 mice were fed diets containing o-toluidine at two dose levels: 16,000 ppm for 3 months and then 8000 ppm for an additional 15 months; or 32,000 ppm for 3 months and then 8000 ppm for an additional 15 months. There was a statistically significant, dose-related increase in the incidences of vascular tumors (hemangiosarcomas and hemangiomas of the abdominal viscera) in both sexes of treated mice, compared with results in control mice.

Risk estimate for o-toluidine. Four of these carcinogenicity studies of o-toluidine have yielded sufficient and adequate data for quantitative risk estimation: The two NCI studies (NCI 1978) and the two Weisburger et al. (1978) studies. OSHA has used the NCI study in rats as the basis for its quantitative risk assessment because it provides the most appropriate data. Table C15-7 presents the Maximum Likelihood Estimates (MLE) of excess deaths per 1,000 employees predicted to result from exposure to o-toluidine at the current OSHA PEL of 5 ppm and at the proposed PEL of 2 ppm. These data were calculated using a multistage model, GLOBAL83.

Table C15-7 shows an excess MLE estimate of risk of 1.4 per 10,000 workers exposed over their working lifetimes at the current PEL. This risk would be reduced to 0.5 per 10,000 exposed workers after promulgation of the proposed limit of 2 ppm. This level of risk is lower than the levels OSHA has regulated for some carcinogens, such as ethylene oxide, arsenic, and benzene. However, this risk is approximately the same as that associated with exposure to formaldehyde; in the case of formaldehyde, OSHA considered a reduction in exposure of approximately this amount to be appropriate (see the discussion at 52 FR 46211-37, December 4, 1987). Based on that analysis, OSHA preliminarily concludes that the significant risk of carcinogenicity to which workers are currently exposed at the existing PEL would be substantially reduced by promulgation of the proposed PEL.

TABLE C15-7. Multistage Model Estimates of Cancer Risk Associated with Working Lifetime Exposure to o-Toluidine

Exposure Level	Excess Cancer Deaths per 1,000 Workers	
	MLE	UCL
5 ppm[a]	0.137	1.6
2 ppm[b]	0.055	0.64

[a] Current OSHA PEL.
[b] Proposed OSHA PEL.
MLE = Maximum likelihood estimate of risk.
UCL = Upper bound (95 percent) confidence limit on maximum likelihood estimate of risk.

p-TOLUIDINE
CAS: 106-49-0; Chemical Formula: $CH_3C_6H_4NH_2$
H.S. No. 1400

OSHA has no current PEL for p-toluidine. The ACGIH considers this substance a suspected human carcinogen and has given it a classification of A2 (ACGIH 1986) and a TLV-TWA of 2 ppm. There is sufficient evidence for the carcinogenesis of p-toluidine in experimental animals; there is no human epidemiological evidence.

One sludy investigates the carcinogenic potential of lifetime exposure to p-toluidine in experimental animals (Weisburger et al. 1976). Male and female mice were exposed to p-toluidine in the diet for a total of 18 months. During the first 6 months of the experiment, mice were exposed to 1000 and 2000 mg p-toluidine/kg diet. As a result of the weight loss that occurred in mice exposed to the 2000 mg/kg diet dose, the concentrations of p-toluidine were reduced to 500 and 1000 mg/kg diet during the last 12 months of exposure. The rate of food consumption by the animals was not reported and was assumed to be 3 g/day. Thus, the average doses of p-toluidine received during the 18-month exposure were calculated to be 80 and 160 mg/kg body weight per day (Weisburger et al. 1976).

For both the low and high dietary doses of p-toluidine, a significant increase in the incidence of hepatomas was observed. The incidence of tumors in the control, 80, and 160 mg/kg/day groups were 3/38, 10/38, and 12/35, respectively. The same study (Weisburger et al. 1976) showed negative results in male rats exposed to two doses of p-toluidine in the diet for 18 months (1000 and 2000 mg/kg diet).

Risk estimate for p-toluidine. To assess the quantitative risk of p-toluidine's carcinogenicity, OSHA used the Weisburger et al. (1976) data which, despite some limitations, e.g., changes in dose levels during the experiment and the absence of data concerning the amount of food animals consumed during the exposure period, were considered adequate for risk assessment purposes.

The maximum likelihood estimates (MLE) of excess cancers per 1,000 workers over an occupational lifetime and the 95 percent upper-bound estimates were obtained by using a linearized multistage model (GLOBAL83). These values are summarized in Table C15-8. This table shows the number of cancer deaths potentially associated with working lifetime exposure to 20, 5, or 2 ppm p-toluidine.

TABLE C15-8. Multistage Model Estimates of Cancer Risk Associated with Working Lifetime Exposure to p-Toluidine

Exposure Level	Excess Cancer Deaths per 1,000 Workers	
	MLE	UCL
2 ppm[a]	12	19
5 ppm	29	46
20 ppm	112	172

[a] Proposed OSHA PEL.
MLE = Maximum likelihood estimate of risk.
UCL = Upper bound (95 percent) confidence limit on maximum likelihood estimate of risk.

OSHA preliminarily concludes, as Table C15–8 shows, that workers exposed to p-toluidine, which is currently not regulated by OSHA, are at significant risk of developing hepatomas. For example, the MLE at 20 ppm is 112 excess cancer deaths per 1,000 workers exposed over a working lifetime. Promulgating the proposed PEL of 2 ppm will substantially reduce this significant risk. According to this scenario, a 90-percent reduction in excess cancer deaths would be achieved by establishing the 2-ppm limit. The risks existing at the present uncontrolled level are clearly significant and have been determined to be so in several previous OSHA rulemakings. OSHA is proposing a 2-ppm limit as an interim measure. As future priorities permit, the Agency will consider additional rulemaking to investigate whether it is feasible and appropriate to reduce exposures further.

VINYL BROMIDE
CAS: 593–60–2: Chemical Formula: C_2H_3Br
H.S. 1425

OSHA has no current PEL for vinyl bromide. The ACGIH has established an 8-hour TWA of 5 ppm for this substance; NIOSH has no REL for vinyl bromide. The ACGIH places vinyl bromide on its A2 list of industrial substances suspected of having carcinogenic potential in humans. Vinyl bromide is used as an intermediate in organic synthesis and in the manufacture of polymers, copolymers, and flame retardants. Its principal use is as a flame retardant.

Henschler and Hoos (1982) believe that vinyl bromide undergoes the same mechanism of biotransformation as its structural analog, vinyl chloride, a recognized human carcinogen that has been regulated by OSHA in a section 6(b) rulemaking. The microsomal oxidation of vinyl bromide leads to epoxide formation, which results, in turn, in the formation of a reactive intermediate. This intermediate has the potential to form covalent bonds with DNA to produce a mutagenic response. Vinyl bromide has been reported to be mutagenic in *Salmonella typhimurium* and *tradescantia* (IARC 1979; NIOSH/OSHA 1978).

No epidemiological studies have been conducted on populations exposed to vinyl bromide. Benya et al. (1982) reported a positive carcinogenic response in an inhalation study of rats exposed to vinyl bromide vapor; this study is important because inhalation is a major mode of occupational exposure. The results of the Van Duuren (1977) study were equivocal (described below), in that female Swiss albino mice were exposed dermally or by subcutaneous injection either to vinyl bromide in acetone or to polymerized vinyl bromide in an aqueous latex solution.

Benya et al. (1982) exposed male and female Sprague-Dawley rats to 0, 9.7, 52, 247, or 1,235 ppm vinyl bromide by inhalation for 6 hours daily, 5 days per week, for 2 years. The incidence of angiosarcomas, primarily of the liver, was found to be statistically significant in all dose groups tested except controls. The combined incidences of hepatic angiosarcomas in the treated male and female rates were 1/288, 17/240, 86/240, 122/240, and 84/240 for their respective dose levels. One control female rat developed an hepatic angiosarcoma. Table C15–9 summarizes the incidence of angiosarcoma in control and treated rats.

TABLE C15 9. Incidence of Angiosarcomas in Control and Vinyl Bromide Exposed Rats

Group	Exposure level (ppm)	Males			Females		
		No. of animals	No. with angiosarcoma	p	No. of animals	No. with angiosarcoma	p
1	Control	144	0	—	144	1	-
2	10	120	7	<0.025	120	10	<0.01
3	50	120	36	<0.001	120	50	<0.001
4	250	120	61	<0.001	120	61	<0.001
5	1250	120	43	<0.001	120	41	<0.001

Source: Benya et al. (1982)

Van Duuren injected a group of female ICR/Ha Swiss mice once weekly for 48 weeks with 0.05 ml of commercial polymerized vinyl bromide aqueous latex suspension; the animals were observed for 420 days. Nineteen of the 30 mice developed sarcomas at the site of injection. Animals in a positive control group that had been injected with b-propriolactone (0.3 mg/.05 ml trioctanoin) developed 18 sarcomas and 3 squamous cell carcinomas (in 30 mice). No tumors developed in untreated controls or in controls injected with trioctanoin, an organic solvent, alone (Van Duuren 1977).

In another injection study by the same author, a group of female IRC/Ha Swiss mice were treated with 25 mg vinyl bromide per animal in 0.05 ml trioctanoin once weekly for 48 weeks. The mice were observed for 420 days. One control group was given a weekly injection of trioctanoin alone and the other control group was untreated. No local tumors were seen in any of the test groups, although pathological examination of the animals appears to have been incomplete (Van Duuren 1977).

Application of vinyl bromide to the skin of female ICR/Ha Swiss mice at a dose of 15 mg per animal administered in 0.1 ml of acetone 3 times weekly for 420 days resulted in no tumors. When this solution was applied once and was followed by an application of phorbol myristyl acetate (PMA) 3 times weekly, 1 of 30 mice developed a skin papilloma at 412 days, one control treated with PMA developed a tumor after 44 days, and no untreated controls developed tumors (Van Duuren 1977).

In another dermal study, a dose of 0.1 ml of polymerized vinyl bromide in an aqueous latex suspension was applied 3 times weekly to the skin of female ICR/Ha Swiss mice for 420 days. No skin tumors developed, when this solution was applied once, followed by an application of PMA 3 times weekly, 1 of 30 mice developed a skin tumor at 175 days. No untreated controls developed skin tumors (Van Duuren 1977).

Risk estimate for vinyl bromide. The Benya et al. (1982) study was a well-designed and conducted study that yielded sufficient information for quantitative risk estimation. The route of administration used in the study, inhalation, is directly applicable to occupational exposure, and the incidence of hepatic angiosarcoma was significant. Angiosarcoma is a rare and malignant neoplasm that has a very low background incidence in animals and humans. Therefore, its appearance in the exposed rats supports the premise that vinyl bromide is potentially carcinogenic in humans. Also, it is the same tumor that is associated with the exposure of workers and animals to vinyl chloride, a recognized human carcinogen and a compound whose structure is similar to that of vinyl bromide.

To estimate excess cancer risk over background incidence for a chemical, experimental data (experimental doses and corresponding responses) are used to define various parameters of an assumed response model. At low doses, the slope of this dose-response curve is referred to as q_1. The 95 percent upper-bound confidence limit for this slope is referred to as q_1^* or the chemical's potency. q_1 and q_1^* are then used to determine the respective maximum likelihood estimate (MLE) of risk and the 95 percent upper-bound confidence limit (UCL) on risk associated with a given lifetime occupational exposure. A non-threshold, linearized multistage model (GLOBAL83) was chosen to estimate the risk potentially associated with exposure to vinyl bromide because the scientific rationale for this model is biologically the most plausible. Additionally, the choice of a non-threshold model is consistent with current methodologies when positive mutagenicity data are available (EPA 1984).

To choose the appropriate data set to use with the model, the most sensitive species and sex are chosen. In the case of vinyl bromide, both male and female

rats responded equally, and data from the two groups were therefore combined by calculating the geometric means of the risk estimates derived from the male and female response data (Anderson 1983). The high-dose data for each test group were dropped, since their inclusion makes the dose-response curve non-monotonic and precludes proper fitting of the linearized multistage risk model (EPA 1984).

Since cancer risk modeling assumes lifetime exposure, adjustments were made to fit the animal data to this criterion. The adjustments made for the data in Benya et al. (1982) were: Multiplying dose by 5/7 to adjust for days of exposure per week and by 6/24 to adjust for hours of exposure per day. These adjusted doses were then changed to human equivalent doses.

Three hypothetical occupational exposure limits, 5 ppm, 20 ppm, and 250 ppm, were used to calculate the maximum likelihood estimates of risk of developing angiosarcoma of the liver. Five ppm has been the ACGIH limit since 1978. Twenty ppm was chosen as an intermediate exposure level, and 250 ppm was the exposure level before the ACGIH reduced it in 1978. These occupational dose levels were also adjusted for lifetime exposure. The adjustments made were: multiplying dose by 5/7 to adjust for days worked per week, by 50/52 to adjust for vacation time, by 8/24 to adjust for hours of exposure per day, and by 45/70 to adjust for work years per lifetime.

Because inhalation is the primary route of exposure to vinyl bromide in occupational settings, the occupational dose was calculated assuming that air intake in humans is 20 m^3 per 24-hour day (Anderson 1983). The fraction of vinyl bromide absorbed was assumed to be 100 percent, because no absorption rate data were available for vinyl bromide. Because the log p (lipid solubility) value for vinyl bromide (1.52) is similar to that of vinyl chloride (1.38), OSHA assumed that the absorption rates of these two compounds would also be similar. The absorption rate for vinyl chloride used in risk estimations is assumed to be 100 percent (IRIS 1988).

The MLE shown in Table C15–10 for an occupational exposure to 250 ppm is 0.87, or 87 percent. According to the linearized multistage risk model, 870 of 1,000 workers exposed over their working lifetimes to vinyl bromide at 250 ppm are at risk of developing angiosarcoma. The MLE for an occupational exposure to 5 ppm of vinyl bromide is 0.04; this indicates that, at the proposed PEL, 40 workers per 1,000 exposed to this substance over their occupational lifetimes are at risk of developing angiosarcoma.

TABLE C15-10. Multistage Model Estimates of Cancer Risk Associated with Lifetime Exposure to Vinyl Bromide

Exposure Level	Excess Cancer Deaths per 1,000 Workers	
	MLE[a]	UCL[a]
5 ppm[b]	40	48
20 ppm[c]	155	180
250 ppm[d]	870	930

[a] Geometric mean of male and female rats.
[b] Proposed OSHA PEL.
[c] Intermediate exposure level.
[d] ACGIH limit before 1978.
MLE = Maximum likelihood estimate of risk.
UCL = 95 percent upper confidence limit on maximum likelihood estimate on risk.

Table C15–10 shows that workers exposed to this substance, which is currently not regulated by OSHA, are clearly at significant risk of developing hepatic angiosarcomas, the same rare type of tumor associated with exposure to vinyl chloride, a structurally similar substance. Promulgating the proposed PEL of 5 ppm will not eliminate this significant risk, because, as Table C15–10 shows, the upper-bound estimate of residual risk at 5 ppm is 48 excess deaths per 1,000 exposed workers. Thus, residual risk at 5 ppm is clearly significant. OSHA is proposing the 5 ppm limit as an interim measure; as future priorities permit, the Agency will consider additional rulemaking for this potent occupational carcinogen. At the present time. OSHA preliminarily concludes that establishing a PEL of 5 ppm will substantially reduce the significant risk potentially associated with exposure at the uncontrolled levels possible in the absence of an OSHA limit for this substance.

VINYL CYCLOHEXENE DIOXIDE
CAS: 106–87–6; Chemical Formula: $C_8H_{12}O_2$
H.S. No. 1426

OSHA has no PEL for vinyl cyclohexene dioxide (VCD), and NIOSH has no REL for this substance. The ACGIH classifies VCD as a suspected

human carcinogen (A2) and recommends a TLV–TWA of 10 ppm for it. Vinyl cyclohexene dioxide is a colorless liquid used as a chemical intermediate and as a monomer in the manufacture of polyglycols containing unreacted epoxy groups (Hine et al. 1981). It is also used as a reactive diluent for other diepoxides and certain epoxy resins (IARC 1976).

Turchi et al. (1981) assayed the mutagenicity of VCD and several other epoxides using the TA100 strain of *S. typhimurium* and V79 Chinese hamster cells; these authors also investigated the alkylating properties of these chemicals. VCD tested positively in the *S. typhimurium* test (point mutation) and in the V79 Chinese hamster cell test (both point mutation and chromosome aberration) and had an intermediate alkylating capacity relative to other epoxide compounds tested.

There are no data concerning the adverse health effects of VCD in humans. There are no reports as a result of industrial experience that reveal carcinogenic effects in workers caused by VCD exposure (ACGIH 1986).

Four studies have reported the development of skin tumors in mice exposed dermally to VCD (Hendry et al. 1951; Kotkin and Falk 1963; Weil et al. 1963; and Van Duuren et al. 1963). The study of Van Duuren et al. (1963) included controls and is thus particularly well suited for an evaluation of VCD's carcinogenic potential.

These authors painted 30 male Swiss ICR/Ha mice with 0.1 ml of a 10-percent solution of VCD in benzene three times per week (approximately 100 mg of solution per application). Two negative controls were used; one set of 150 mice was treated with benzene alone and another set of 207 mice was not treated with anything. Fourteen of the 30 VCD-treated mice developed skin tumors after an undefined length of time (mean survival time was 326 days). The incidences of skin tumors in the controls were 11/150 and 13/207 for the benzene-treated and untreated mice, respectively. The incidence of skin tumors in the VCD-treated mice was significantly greater than the incidence observed in either of the controls (Van Duuren et al. 1981).

The study of Van Duuren et al. (1963) demonstrates the carcinogenicity of VCD in experimental animals. OSHA considered the possibility of conducting a quantitative risk assessment VCD, and the Agency preliminarily concluded that the dose-response data in this study are unsuitable for quantitative risk assessment purposes because the VCD was administered in a solution of benzene, which is itself regulated as a carcinogen and classified as such by several authorities (IARC, NTP, NIOSH, and ACGIH). Even though the Van Duuren et al. study included a control for the independent carcinogenic effects of benzene, the possibility of a synergistic or additive effect of benzene on VCD cannot be completely ruled out.

Vinyl cyclohexene dioxide has been shown to be carcinogenic by dermal application in mice, and four studies have confirmed these effects. Based on these animal studies showing VCD's carcinogenicity, OSHA preliminarily concludes that exposed employees are at significant risk of cancer potentially associated with exposure to VCD at the uncontrolled levels permitted in the absence of any OSHA limit. The Agency preliminarily concludes that promulgation of a 10-ppm 8-hour-TWA PEL will substantially reduce this significant risk.

Preliminary Conclusions for this Group of Substances

The Supreme Court in *I.U.D.* v. *A.P.I.* (supra, the *Benzene* decision) gave OSHA directions as to its decisional process, and of course that case involved a carcinogen. OSHA is following the Supreme Court's guidance within the context of this present broader rulemaking. In the current rulemaking, OSHA has considered or performed preliminary perform risk assessments for each of the 17 chemicals discussed in this section. The risk assessments follow the approach OSHA has used in prior rulemakings for carcinogens, a process that has repeatedly been upheld by the courts. The risk assessment review process has necessarily been more limited for the hundreds of substances being regulated today than is the case for single-substance rulemakings, and OSHA requests comment on the approach it has taken in the present rulemaking.

OSHA is conducting its significant risk analyses utilizing the principles suggested by the Supreme Court and adopted in its carcinogen rulemakings subsequent to *I.U.D.* v. *A.P.I.* OSHA is proposing to lower its existing exposure limits based on these analyses when significant risk is indicated at the existing PEL. OSHA is preliminarily proposing either the ACGIH or NIOSH numerical level, based on the results of these significant risk analyses.

In some cases (all of the risk assessments have not yet been finalized) it is possible for OSHA to conclude that not enough data are available to quantify risks at the level of detail the Agency has formerly used. In those cases, OSHA will preliminarily decide whether a lower limit is justified; without this latitude, the Agency would indeed be in the "mathematical straitjacket" alluded to by the Court in the *Benzene* decision. In other circumstances, OSHA may decide that not enough evidence is available to propose a lower limit.

OSHA must also demonstrate the feasibility of the level set. In some cases, OSHA believes it has sufficient preliminary data on the feasibility of the proposed limits for these substances. (Of course, all data on feasibility are welcome.) In some cases further analysis might indicate that neither the ACGIH nor the NIOSH-recommended level is the lowest feasible level and that significant risk remains below either level. However, this rulemaking would be inordinately delayed by the amount of effort necessary to make feasibility and significant risk determinations for a greater range of levels than those already established by the ACGIH and NIOSH. In such circumstances, the level proposed here should be considered to be an interim level. As priorities and resources become available, a second-stage rulemaking will be considered to refine these exposure levels, and the interim level should thus be considered a "backstop."

For some substances in this rulemaking other than the 17 discussed in this section, there may be evidence in the literature of carcinogenicity, even though the ACGIH has established limits for these based on other-than-cancer effects. For these few substances, OSHA has not initiated a risk assessment, because this additional effort would have delayed this rulemaking unreasonably.

In sum, where OSHA preliminarily found that there was sufficient evidence of potential carcinogenicity to meet the Agency's legal requirements, the Agency has proposed a level based on the risk of cancer. Where there was not sufficient evidence readily available, OSHA proposed a level based on these substances' non-carcinogenic effects. At a later stage, depending on priorities and resources, OSHA will further review the data to determine whether a second-stage rulemaking based on carcinogenicity is appropriate for these few chemicals.

Overall, OSHA believes its analyses of proposed limits for carcinogenic chemicals meet the Agency's legal requirements. Accordingly, OSHA preliminarily concludes that these limits will lead to substantial reductions in the significant risk currently confronting workers exposed to these substances.

16. Substances for Which Current ACGIH TLVs Are Less Stringent Than Existing OSHA PELS

Introduction

There are 13 substances for which the ACGIH has increased its recommended TLVs since the time that OSHA adopted the 1968 TLVs under the authority of section 6(a) of the Act. These substances are listed in Table C16–1, along with their current OSHA PELs, ACGIH TLVs. NIOSH RELs, CAS numbers, and HS numbers. Evaluating the protectiveness and appropriateness of exposure limits that are less stringent than the corresponding limits on OSHA's Z tables represents a special case in this rulemaking. OSHA has previously stated (see 50 FR 51120, December 13, 1985) the principle to be followed before the Agency raises an exposure limit. This issue is discussed below.

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TABLE C16-1. Substances for Which the ACGIH's Limits are Higher Than the Current PELs

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1101 Copper (fume)	7440-50-8	0.1 mg/m^3 TWA	0.2 mg/m^3 TWA	--
1126 1,1-Dichloroethane	75-34-3	100 ppm TWA	200 ppm TWA 250 ppm STEL	--
1179 Fluorine	7782-41-4	0.1 ppm TWA	1 ppm TWA 2 ppm STEL	--
1197 Hexachloroethane	67-72-1	1 ppm TWA Skin	10 ppm TWA	Lowest feasible level
1284 Nickel carbonyl	13463-39-3	0.001 ppm TWA	0.05 ppm TWA	1 ppb TWA
1347 Rhodium (metal fume and insoluble salts)	7440-16-6	0.1 mg/m^3 TWA	1 mg/m^3 TWA	--
1348 Rhodium (soluble salts)	7440-16-6	0.001 mg/m^3 TWA	0.01 mg/m^3 TWA	--
1352 Silica, Amorphous-Diatomaceous Earth	68855-54-9	20 mppcf TWA (6 mg/m^3)	10 mg/m^3 TWA	--
1353 Silica, Amorphous-Precipitated and Gel	None	20 mppcf TWA (6 mg/m^3)	10 mg/m^3 TWA	--

TABLE C16-1. Substances for Which the ACGIH's Limits are Higher Than the Current PELs (continued)

H.S. Number/ Chemical Name	CAS No.	CURRENT PEL*	ACGIH TLV**	NIOSH REL***
1362 Silver (metal dust and fume)	7440-22-4	0.01 mg/m^3 TWA	0.1 mg/m^3 TWA	--
1386 Tetraethyl lead	78-00-2	0.075 mg/m^3 TWA Skin	0.1 mg/m^3 TWA Skin	--
1388 Tetramethyl lead	75-74-1	0.075 mg/m^3 TWA Skin	0.15 mg/m^3 TWA Skin	--
1419 Uranium (soluble compounds)	7440-61-1	0.05 mg/m^3 TWA	0.2 $mg.m^3$ TWA 0.6 mg/m^3 STEL	--

* OSHA's TWA limits are for 8-hour exposures; its STELs are for the durations specified; and its ceilings are peaks not to be exceeded for any period of time.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

BILLING CODE 4510-26-C

In 1978, OSHA issued a cotton dust standard; this standard did not go into effect in any of the nontextile industries. However, although the new standard's PEL for cotton dust did not apply in these segments, the Z–1 limit for cotton dust continued to apply to them. In 1983, OSHA determined that it would better effectuate the purposes of the Act to exclude the knitting and other nontextile industries from coverage by the Z table limit for cotton dust. In revoking the Z table limit, OSHA stated:

> When it [the Agency] proposes to eliminate a class [of operations or industry sectors] from either a 6(a) or 6(b) standard on health grounds, the evidence must affirmatively indicate that significant risk is unlikely to exist for that class at exposures likely to exist after the standard has been eliminated * * *. OSHA must be able to support with substantial evidence any change it is propounding [50 FR 51120 et seq., Dec. 13, 1985].

Accordingly, the Agency must be able to show that exposed workers will not be placed at increased risk for the health effects at issue even after the limit in question has been raised or revoked. In conformance with this interpretation, OSHA has carefully examined the bases underlying the adoption of increased exposure limits by the ACGIH. After reviewing the available data for these substances, OSHA has made a preliminary determination that adequate evidence exists to increase the permissible exposure limits for only one of these substances (fluorine), and the Agency is now proposing to raise the limit for this chemical to 1 ppm as an 8-hour TWA, with a STEL of 2 ppm to provide additional protection against excessive short-term exposures. For the remaining 11 substances in this group, OSHA believes that the available toxicological data are insufficient to meet the increased burden of proof appropriate when the raising of an exposure limit is under consideration. For these substances, OSHA is not proposing to revise the current PELs at this time, but requests comments and data on the issue.

The following discussion summarizes OSHA's preliminary analyses and findings for each of the 11 substances in this group.

COPPER (FUME)
CAS: 7440–50–8; Chemical Formula: Cu
H.S. No. 1101

The current OSHA limit for copper fume is 0.1 mg/m³ as an 8-hour TWA. Since OSHA adopted this limit in 1971, the ACGIH has increased the recommended TLV to 0.2 mg/m³ as an 8-hour TWA. The ACGIH's previously recommended TLV of 0.1 mg/m³ was based on personal communications (Newton Whitman 1957; 1962) that reported that the taste perception of welders was altered when they were exposed to copper fume at levels ranging from 1 to 3 mg/m³ for short periods but that exposure to 0.02 to 0.4 mg/m³ did not cause such complaints (ACGIH 1966). At the time, the ACGIH judged the 0.1-mg/m³ TLV to be "sufficiently low to provide freedom from irritation from the fume by a reasonable margin" (ACGIH 1966).

In 1972, the ACGIH received a personal communication from a member of the U.K. Industrial Hygiene Unit, Her Majesty's Factory Inspectorate (Luxon 1972) reporting that employees exposed to copper fume at levels up to 0.4 mg/m³ during welding and copper metal refining operations experienced no ill effects from exposure. Based on this additional evidence, the ACGIH increased its TLV for copper fume to 0.2 mg/m³ in 1975.

OSHA preliminarily judges that the evidence cited by the ACGIH (1986) in support of the increase in its TLV for copper fume is not sufficient to provide a basis for OSHA to propose raising the limit for this substance. The basis for this finding is that the ACGIH's action was based largely on a personal communication, making it impossible for the Agency to evaluate the evidence appropriately.

1,1-DICHLOROETHANE
CAS: 75–34–3; Chemical Formula: CH_2ClCH_2Cl
H.S. No. 1126

The current OSHA limit for 1,1-dichloroethane, which is a hepatotoxin, is 100 ppm TWA. The ACGIH recommended TLV is a 200-ppm TWA with a 250-ppm STEL; NIOSH has no REL for this substance. The previous ACGIH TLV of 100 ppm was based on the observation that 1,1-dichloroethane has an acute toxicity approximately half that of carbon tetrachloride and a chronic toxicity somewhat less than that of carbon tetrachloride (for which a TLV of 10 ppm had been set). In 1973, the ACGIH adopted the higher 200-ppm TLV based on unpublished data from the Dow Chemical Company showing that rats, rabbits, guinea pigs, and dogs exhibited no gross or microscopic organ pathology after exposure to 500 or 1000 ppm of 1,1-dichloroethane for 6 months. The ACGIH cited no human data in support of raising the TLV.

Because no human toxicity data are available for 1,1-dichloroethane and because the Dow data are unpublished and thus not available for scrutiny, OSHA preliminarily concludes that the evidence for this substance is insufficient to warrant increasing the PEL at this time.

FLUORINE
CAS: 7782–41–4; Chemical Formula: F
H.S. No. 1179

OSHA's current PEL for fluorine is 0.1 ppm; NIOSH has no REL for fluorine. In 1973, the ACGIH revised its TLV to 1 ppm and, subsequent to that change, adopted a TLV–STEL of 2 ppm. The ACGIH's previous 0.1-ppm TLV, which was adopted by OSHA in 1971, was based on a 30-day inhalation study in rats and dogs (Stokinger 1949) in which no consistent pulmonary, renal, or blood effects were observed following exposure to 0.5 ppm. The ACGIH believed that a TLV of 0.1 ppm would "provide a working environment of probable safety from the effects of F_2" (ACGIH 1966). Subsequently, the ACGIH reviewed a 7-year study (Lyon et al. 1962) of 61 workers exposed to fluorine concentrations "far in excess of 0.1 ppm" (ACGIH 1986), which reported a lack of significant medical findings. This evidence, along with more recent animal evidence (Keplinger and Suissa 1968) suggesting that animals were not as sensitive to fluorine as was reported by Stokinger (1949), led the ACGIH to increase its TLV to 1 ppm. The STEL of 2 ppm was supported by a study (Ricca 1970) in which human volunteers repeatedly exposed to 10 ppm reported only slight irritation.

OSHA believes that the human and animal evidence is adequate to support a proposed increase in the 8-hour TWA for this substance from 0.1 ppm to 1 ppm. OSHA is proposing at this time to revise the PEL for fluorine to 1 ppm as an 8-hour TWA and 2 ppm as a 15-minute STEL.

HEXACHLOROETHANE
CAS: 67–72–1; Chemical Formula: CCl_3CCl_3
H.S. No. 1197

OSHA's current PEL for hexachloroethane is a 1-ppm TWA, with a skin notation, which was adopted from the 1968 ACGIH TLV. The NIOSH REL for this substance is the lowest feasible level, based on hexachloroethane's potential carcinogenicity. The basis for the 1-ppm TLV was to prevent the "serious injury potential to several organ systems" shown by animal studies (ACGIH 1986). Subsequently, the ACGIH revised its TLV upward to 10 ppm based, in part, on a study by Weeks et al. (1979) that reported no adverse effects among several animal species exposed daily to 15- or 48-ppm concentrations of hexachloroethane. The ACGIH also cited an NCI study (NCI 1978b) in which

"extremely heavy dosages * * * administered continuously for a long period of time" resulted in the development of hepatocellular tumors in mice but not in rats. The 10-ppm TLV was further supported by a personal communication of a TLV Committee member who reported that no ill effects occurred among workers "who handled the material with few precautions" during World War II (ACGIH 1986). No exposure data were supplied to support this personal communication.

In 1978, NIOSH reviewed the results of an NCI bioassay in which hexachloroethane was administered by gavage to mice and rats. Both male and female mice exhibited an excess incidence of hepatocellular carcinoma, but rats did not. NCI concluded that early mortality may have obscured detection of a carcinogenic effect in rats. Toxic kidney damage was also found in mice and rats treated with hexachloroethane. Based on this evidence, NIOSH (1978n) has recommended that exposure to hexachloroethane be maintained at the lowest detectable level.

OSHA does not believe that the evidence relied on by the ACGIH is adequate to support raising the PEL at this time. The human evidence cited by the ACGIH is anecdotal and lacks the exposure data necessary to permit OSHA to assess whether significant risk is absent (and likely to remain so) at the 10-ppm exposure level. In addition, OSHA is concerned, as is NIOSH, with the development of tumors in hexachloroethane-exposed mice demonstrated in the NCI study. OSHA therefore retains its PEL of 1 ppm TWA, with a skin notation, and preliminarily concludes that increasing the PEL for hexachloroethane would increase the risk of cancer potentially associated with exposure to this substance.

NICKEL CARBONYL
CAS: 13463–39–3; Chemical Formula: $Ni(CO)_4$
H.S. No. 1284

The current OSHA PEL and the NIOSH recommended limit for nickel carbonyl is 0.001 ppm TWA. In 1976, the ACGIH increased its TLV for nickel carbonyl from 0.001 to 0.05 ppm. The ACGIH's former 0.001-ppm TLV was based primarily on the reported association of nasal and lung cancer among workers exposed to nickel carbonyl during work in nickel refinery operations. In addition, the ACGIH cited evidence (Sunderman et al. 1959) that rats exposed to nickel carbonyl developed lung tumors that metastasized to the kidney. At the time, the ACGIH (1966) noted that these tumors were not of a type generally associated with exposure to environmental agents.

In its 1976 documentation for the 0.05-ppm TLV for nickel carbonyl, the ACGIH cited the work of Doll et al. (1970), who evaluated the exposures of nickel refinery workers in whom cancers had been found. Doll found that there had been no exposures to nickel carbonyl in the facility, and this finding led the ACGIH to conclude that nickel carbonyl was not the causative agent of the cancers reported among the refinery workers in the earlier studies it had relied on to set the 0.001-ppm TLV. A report that no excess nasal or lung tumors had occurred among workers exposed over a 50-year period in a nickel refinery in Wales (Renzoni, personal communication, 1975) appeared to the ACGIH to corroborate Doll's results. The ACGIH concluded that the TLV for nickel carbonyl should be raised based on the acute, systemic effects of this substance and that carcinogenicity was not an appropriate basis for limit-setting (ACGIH 1976). In the 1986 documentation for the 0.05-ppm TLV for nickel carbonyl, the ACGIH concluded that "although the evidence that nickel carbonyl is carcinogenic to humans is inconclusive, this recommended TLV (i.e., one set at 0.05 ppm) is also adequate to minimize any potential carcinogenic effects" (ACGIH 1986).

OSHA finds the evidence discussed by the ACGIH insufficient to warrant an increase in the limit since some of the evidence is in the form of a personal communication, particularly since NIOSH has concluded that occupational exposures should be maintained at the lowest detectable level because of nickel carbonyl's potential carcinogenicity. OSHA therefore retains its existing PEL for nickel carbonyl of 0.001 ppm TWA.

RHODIUM COMPOUNDS (METAL FUME: SOLUBLE AND INSOLUBLE SALTS)
CAS: 7440–16–6; Chemical Formula: Rh
H.S. No. 1347; 1348

The current OSHA PEL for rhodium metal fume and insoluble salts is 0.1 mg/m^3; the current PEL for soluble rhodium compounds is 0.001 mg/m^3. The ACGIH recommends a 1-mg/m^3 TLV for rhodium metal and insoluble salts and a 0.01 mg/m^3 TLV for soluble rhodium salts. The current OSHA PELs for rhodium compounds (i.e., the 1968 ACGIH TLVs) were based on the then-existing TLVs for platinum because of concern that exposure to rhodium might be associated with respiratory sensitization effects. This concern was prevalent because rhodium belongs to the platinum family of metals and because the toxicologic data on rhodium that were available were "meager" (ACGIH 1966).

The ACGIH's decision to increase the TLVs for rhodium compounds was based primarily on a personal communication to the TLV Committee (Johnson 1981). This communication indicated that, in a major precious metals refinery, "procedures which were abandoned for the refining of platinum because of cases of sensitization have been carried out for a year with analogous rhodium compounds without any problems" (ACGIH 1986). In addition, the ACGIH noted that none of the substances in the platinum group was known to produce respiratory effects similar to those of platinum. The ACGIH reported that rhodium exhibited "slight" carcinogenic activity in mice (ACGIH 1986). After considering all of this evidence, the ACGIH judged the previous TLVs to be inappropriate and increased them tenfold.

OSHA preliminarily concludes that the evidence adduced by the ACGIH is not sufficient to meet the standard of proof the Agency must achieve before it can raise an exposure limit. This conclusion is based on the fact that the ACGIH relied heavily on a personal communication when making its decision, and no exposure or other data are available to support the ACGIH's action. Thus OSHA is unable adequately to evaluate the toxicologic evidence pertaining to the rhodium compounds and retains the existing PEL's for rhodium metal fume and insoluble salts (0.1 mg/m^3 TWA) and rhodium soluble salts (0.001 mg/m^3 TWA).

SILICA, AMORPHOUS—DIATOMACEOUS EARTH
CAS: 68855–54–9; Chemical Formula: SiO_2
H.S. No. 1352

OSHA's current limit for amorphous silica is 20 mppcf, equivalent to 6 mg/m^3 (ACGIH 1984), as total dust. The ACGIH has established a limit for this dust, as total dust, of 10 mg/m^2 8-hour TLV–TWA). Amorphous silica (diatomaceous earth) is composed of the skeletons of prehistoric plants known as diatoms. These skeletons are largely non-crystalline, although diatomaceous earth can contain varying amounts of crystalline quartz, which has led, in the opinion of the ACGIH (1986, p. 520) to conflicting results in studies of the pulmonary effects of exposure to this colorless to gray, odorless powder.

Cooper and Cralley (1958) reported "doubtful" linear-nodular changes in the lungs of workers exposed only to

amorphous (noncrystalline) silica for 5 years or more. Other studies (Vigliani and Mottura 1948; 1948; Gardner 1942) also found mild silicosis only or no evidence of serious lung pathology in diatomite workers. Kovalevich (1959) reported silicosis in diatomite workers. However, intratracheal instillation of diatomaceous earth dust in animals showed evidence of fibrosis (Gardner 1942) and silicosis (Kovalevich 1959), although another study (Tebbens and Beard 1957) exposed guinea pigs to this substance at an average concentration of 60 mg/m³ for 37–50 weeks and found both gross and microscopic changes in the lungs but no fibrosis.

In setting its limit for diatomaceous earth, the ACGIH (1986, p. 520) assumed that this substance itself is either "weakly fibrogenic or nonfibrogenic," and thus that those studies discussed above that report adverse pulmonary effects actually involved exposure to diatomaceous earth having an unmeasured but significant crystalline quartz content. Based on this reasoning, the ACGIH considers amorphous silica-diatomaceous earth to be a nuisance dust. However, OSHA does not consider the evidence for diatomaceous earth's lack of fibrogenicity sufficent to demonstrate the absence of significant risk at the ACGIH's revised TLV.

OSHA is proposing to retain an 8-hour TWA of 6 mg/m³ (equivalent to 20 mppcf) for this form of silica. OSHA believes that the health evidence for this substance is not sufficiently persuasive permit an increase in the limit at the present time. The Agency is proposing to change the units in which its permissible exposure limit is expressed; this change is being made to facilitate the accurate monitoring of employee exposures.

SILICA, AMORPHOUS, PRECIPITATED AND GEL
CAS: None; Chemical Formula: SiO_2
H.S. No. 1353

OSHA currently has a limit of 20 mppcf (equivalent to a limit of 6 mg/m³ if expressed in mg/m³ for amorphous silica. The ACGIH recommends a TLV–TWA of 10 mg/m³ measured as total dust containing less than 1 percent quartz. There are numerous methods of producing precipitated silica; those that apply heat to siliceous products produce airborne dusts; these are less toxic than quartz dust, because the particles are generally sheathed in a molecular layer of amorphous silica (ACGIH 1986, p. 521).

Studies of laboratory animals have shown no fibrosis after intratracheal and intraperitoneal injection of precipitated silica or silica gel (Klosterkotter 1954; Klosterkotter 1958). Schepers reported in 1957 that rats exposed for 1 year and guinea pigs and rabbits exposed for 2 years to a concentration of 126 mg/m³ of precipitated amorphous silica displayed no pulmonary fibrosis; the effects of exposure were limited to macrophage accumulations and mild proliferation of reticulin fibers (Schepers 1957).

In a study of human exposures to precipitated amorphous silica, Wilson reported no ill effects in 165 workers exposed for an average of 8.6 years (Wilson, Stevens et al. 1981).

The ACGIH considers the precipitated and gel form of amorphous silica an inert dust, based on the evidence discussed above. However, OSHA notes that effects were seen in animals exposed to this substance for 1 to 2 years and does not find that this evidence demonstrates the absence of significant risk necessary to support an increase in a PEL. Accordingly, OSHA is retaining its current PEL of 6 mg/m³ (equivalent to 20 mppcf) at the present time. The Agency is proposing to change the units in which its permissible exposure limit is expressed to facilitate the accurate monitoring of employee exposures.

SILVER (METAL DUST AND FUME)
CAS: 7440–22–4; Chemical Formula: Ag
H.S. No. 1362

The current OSHA standard for silver metal and soluble compounds (including the metal dust and fume) is 0.01 mg/m³. NIOSH has no REL for this substance, but the ACGIH has established a 0.1-mg/m³ TLV for silver metal dust and fume. The previous TLV of 0.01 mg/m³, which was established for all forms of silver, was designed to protect workers against developing argyria. This condition arises from the accumulation of silver in the body and results in an unsightly, widespread blue-grey discoloration of the skin that can persist for long periods of time. The skin of exposed workers may also become black and have a metallic luster. Argyria may also manifest itself in the conjunctiva of the eye, which may be affected sufficiently to cause lens and visual disturbances.

In arriving at the previous TLV of 0.01 mg/m³ for silver, the ACGIH relied on a publication by Pillsbury and Hill (1939), which stated that an accumulated intake of from 1 to 5 grams of silver would lead to generalized argyria. Assuming a 20-year exposure duration, a 10-m³/day respiratory volume, and a 50-percent body retention, the ACGIH estimated that exposure to 0.05 mg/m³ was sufficient to cause argyria. The former TLV of 0.01 mg/m³ thus appeared to incorporate a safety factor to account for the uncertainties involved in using this approach to develop a TLV. The ACGIH's current TLV of 0.1 mg/m³ for silver metal dust and fume was determined in a similar fashion, except that the ACGIH assumed a lower percent retention and apparently did not incorporate a safety margin (ACGIH 1986). Because the increase in the TLV from 0.01 to 0.1 mg/m³ is based on assumptions regarding the extent to which silver metal is systemically absorbed rather than on human data demonstrating the absence of a significant risk at the revised TLV, OSHA finds the ACGIH's reasoning unpersuasive. Thus DSHA is not at this time proposing to increase the PEL for silver metal dust and fume.

TETRAETHYL LEAD (TEL)
CAS: 78–00–2; Chemical Formula: $(C_2H_5)_4Pb$
H.S. No. 1386

OSHA's current 8-hour limit for tetraethyl lead is 0.075 mg/m³ as lead, with a skin notation; NIOSH has no REL for this substance. The ACGIH is now recommending that worker exposures not exceed 0.1 mg/m³ TWA; ACGIH also recommends a skin notation. The previous TLV of 0.075 mg/m³ was based almost exclusively on a personal communication from the Medical Department of the Ethyl Corporation, which stated that a level of 0.075 mg/m³ "is a good guideline for an allowable air concentration of TEL" (ACGIH 1966). The ACGIH documentation for the 0.075-mg/m³ TLV also pointed out that the ability of tetraethyl lead to penetrate the skin "makes reliance on the airborne concentration impractical in many situations," and that urinary lead levels were a more reliable indicator of exposure than blood lead levels (ACGIH 1966).

In its documentation for the 0.1-mg/m³ TLV, the ACGIH again cited the communication from the Ethyl Corporation. In addition, the organization cited a personal communication from Linch (1968), who reported that an improved analytical procedure for measuring airborne concentrations of tetraethyl lead had been used to determine the relationship between airborne tetraethyl lead levels and urinary lead levels. He reported that urinary lead concentration was not significantly elevated "above a high normal" value (0.15 mg/L) when the airborne TEL level was 121 ug/m³ ACGIH 1986). As a result of this communication, the ACGIH adopted a revised TLV of 0.1 mg/m³ in 1970.

OSHA does not find the evidence presented by the ACGIH to be sufficiently comprehensive or detailed

to permit significant risk to be ruled out at the 0.1-ppm level. The Agency is particularly reluctant to increase the PEL for TEL in light of this substance's ability to be absorbed percutaneously. OSHA is therefore not proposing to raise its PEL for tetraethyl lead.

TETRAMETHYL LEAD (TML)
CAS: 75–74–1; Chemical Formula: $(CH_3)_4Pb$
H.S. No. 1388

The current OSHA limit for tetramethyl lead (TML) is 0.075 mg/m³ with a skin notation, while the ACGIH has recommended a TLV of 0.15 mg/m³, also with a skin notation. There is no NIOSH REL for TML. In establishing the previous TLV of 0.15 mg/m³, the ACGIH cited the work of DeTreville (1962), who reported that tetramethyl lead is about three times more volatile than tetraethyl lead and thus resulted in employee exposures to airborne TML about three times higher than those for TEL. Despite the heavier TML exposure of employees, urinary lead levels were not significantly different from the urinary lead levels of employees exposed to TEL. The ACGIH concluded that a 0.075-mg/m³ TLV for TML, identical to the TLV recommended at the time for TEL, should furnish an adequate margin of safety. The revised TLV of 0.15 mg/m³ was based on a personal communication by Linch (1968), who reported that exposure to 0.179 mg/m³ tetramethyl lead was not associated with a significant increase in urinary lead levels.

Based on the same reasoning as that described above in connection with tetraethyl lead, OSHA is not proposing at this time to increase the existing OSHA limit for TML.

URANIUM (SOLUBLE COMPOUNDS)
CAS: 7440–61–1; Chemical Formula: U
H.S. No. 1419

The current OSHA limit for soluble uranium compounds is 0.05 mg/m³. NIOSH has no REL for soluble uranium compounds. Since 1968, the ACGIH has increased its TLV for soluble uranium from 0.05 mg/m³ to 0.2 mg/m³, with a 0.6-mg/m³ STEL. The previous TLV of 0.05 mg/m³ was based on animal studies relating exposure level and duration to the resulting tissue concentration of uranium and on other chronic animal studies showing the kidney to be the most sensitive target organ. In 1968, the ACGIH List of Intended Changes included a TLV of 0.2 mg/m³ for all forms of uranium, and this value was adopted by the ACGIH in 1969. The basis for adopting the 0.2-mg/m³ TLV for soluble uranium compounds was a study by Wing et al. (1963), reporting no adverse effects from radiation exposure over a 25-year period. Although no data were discussed in the ACGIH (1986) documentation regarding typical exposure levels at the plants studied, the documentation does mention that seven accidental, brief exposures to soluble uranium compounds at levels two- to five-fold the former TLV of 0.05 mg/m³ did not result in physiologic changes or significant body burden.

OSHA does not find that the evidence brought forward by the ACGIH is sufficiently detailed or comprehensive to meet the Agency's increased standard of proof for relaxing an existing standard. In addition, OSHA notes that the 25-year period of observation in the Wing et al. (1963) study is not long enough to rule out the occurrence of some forms of radiation-induced cancer and, further, that the power of the study to detect health effects occurring in a small percentage of the population was very limited. OSHA is accordingly not proposing to raise the current PEL for soluble uranium compounds.

17. Substances for Which OSHA is Proposing Short-Term Exposure Limits; Introduction

OSHA is proposing to add a short-term exposure limit (STEL) to a total of 134 substances; 126 of these STELs are values recommended by the ACGIH, while the remaining eight are NIOSH ceiling values for periods of 15 minutes or more. These substances are listed in Table C17–1.

When OSHA adopted the ACGIH TLVs via the Walsh-Healey Act and the OSH Act's section 6(a) mechanism, the ACGIH had not established the short-term TLV category; as a consequence, none of the substances on OSHA's Z–1 table have STELs. (Some of the substances on OSHA's current Z–2 tables, whose limits derive from standards established by the American National Standards Institute rather than the ACGIH, have "acceptable ceiling concentrations" that act in effect as short-term exposure limits.)

The ACGIH defines a STEL as

> a 15-minute time-weighted average exposure which should not be exceeded at any time during a work day even if the eight-hour time-weighted average is within the TLV. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than four times per day. There should be at least 60 minutes between successive exposures at the STEL. An averaging period other than 15 minutes may be recommended when this is warranted by observed biological effects (ACGIH 1987).

Basis Under Which ACGIH Established STELs

The ACGIH establishes STELs for substances that cause a wide variety of acute effects; these effects include irritation, narcosis, lung damage, systemic effects, and organic poisoning. The ACGIH first considered adding STELs to the TLV–TWAs for some substances in 1971 when it appointed a subcommittee to study the appropriateness of adding such exposure limits to its TLV list.

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Table C17-1. Substances for Which OSHA is Proposing STELs and Values Being Proposed

H.S. Number/ Chemical Name	CAS No.	ACGIH STEL	NIOSH Ceiling/STEL*
1001 Acetaldehyde	75-07-0	150 ppm	--
1002 Acetic acid	64-19-7	15 ppm	--
1007 Acrolein	107-02-8	0.3 ppm	--
1010 Allyl alcohol	107-18-6	4 ppm	--
1011 Allyl chloride	107-05-1	2 ppm	--
1012 Allyl glycidyl ether (AGE)	106-92-3	10 ppm	--
1013 Allyl propyl disulfide	2179-59-1	3 ppm	--
1021 Ammonia	7664-41-7	35 ppm	--
1022 Ammonium chloride (fume)	12125-02-9	20 mg/m^3	--
1042 Bromine	7726-95-6	0.3 ppm	--
1045 2-Butanone (MEK)	78-93-3	300 ppm	--
1047 n-Butyl acetate	123-86-4	200 ppm	--
1049 sec-Butyl alcohol	78-92-2	150 ppm	--
1050 tert-Butyl alcohol	75-65-0	150 ppm	--
1056 p-tert-Butyltoluene	98-51-1	20 ppm	--
1063 Camphor (Synthetic)	76-22-2	3 ppm	--
1064 Caprolactam (Dust)	105-60-2	3 mg/m^3	--
1065 Caprolactam (Vapor)	105-60-2	40 mg/m^3	--
1069 Carbon dioxide	124-38-9	30,000 ppm	--
1070 Carbon disulfide	75-15-0		10 ppm (15 min)
1072 Carbon tetrabromide	558-13-4	0.3 ppm	--
1074 Carbonyl fluoride	353-50-4	5 ppm	--
1078 Chlorinated camphene	9001-35-2	1 mg/m^3	--
1079 Chlorine	7782-50-5		0.5 ppm (15 min)
1080 Chlorine dioxide	10049-04-4	0.3 ppm	--
1082 2-Chloro-6-trichloromethyl pyridine (nitrapyrin)	1929-82-4	20 mg/m^3	--
1085 Chlorodifluoromethane	75-45-6	1250 ppm	--
1086 Chloroform	67-66-3		2 ppm (60 min)
1089 o-Chlorostyrene	1331-38-8	75 ppm	--
1090 o-Chlorotoluene	95-49-8	75 ppm	--
1091 Chlorpyrifos	2921-88-2	0.6 mg/m^3	--
1095 Clopidol (Coyden)	2971-90-6	20 mg/m^3	--
1103 Crufomate	299-86-5	20 mg/m^3	--
1110 Cyclonite	121-82-4	3 mg/m^3	--
1114 Decaborane	17702-41-9	0.15 ppm	--
1116 Di-sec-octyl-phthalate	117-81-7	10 mg/m^3	--
1119 Dibutyl phosphate	107-66-4	2 ppm	--
1122 1,3-Dichloro-5,5-dimethylhydantoin	118-52-5	0.4 mg/m^3	--

Table C17-1. Substances for Which OSHA is Proposing STELs and Values Being Proposed (continued)

H.S. Number/ Chemical Name	CAS No.	ACGIH STEL	NIOSH Ceiling/STEL*
1125 p-Dichlorobenzene	106-46-7	110 ppm	--
1127 Dichloroethyl ether	111-44-4	10 ppm	--
1137 Diethylamine	109-89-4	25 ppm	--
1143 Dimethylaniline	121-69-7	10 ppm	--
1149 Dipropylene glycol methyl ether	34590-94-8	150 ppm	--
1159 Ethanolamine	141-43-5	6 ppm	--
1161 Ethyl acrylate	140-88-5	25 ppm	--
1162 Ethyl benzene	100-41-4	125 ppm	--
1163 Ethyl bromide	74-96-4	250 ppm	--
1164 Ethyl ether	60-29-7	500 ppm	--
1168 Ethylene dichloride	107-06-2		2 ppm (15 min)
1170 Ethylene glycol dinitrate	628-96-6		0.1 mg/m^3 (20 min)
1177 Ferrovanadium dust	12604-58-9	3 mg/m^3	--
1179 Fluorine	7782-41-4	2 ppm	--
1182 Formamide	75-12-7	30 ppm	--
1184 Furfuryl alcohol	98-00-0	15 ppm, Skin	--
1185 Gasoline	8006-61-9	500 ppm	--
1194 n-Heptane	142-82-5	500 ppm	--
1201 Hexane isomers	- -0	1000 ppm	--
1203 Hexone (Methyl isobutyl ketone)	108-10-1	75 ppm	--
1208 Hydrogen fluoride	7664-39-3		6 ppm (15 min)
1209 Hydrogen sulfide	7783-06-4	15 ppm	--
1216 Iron pentacarbonyl	13463-40-6	0.2 ppm	--
1218 Isoamyl alcohol	123-51-3	125 ppm	--
1224 Isopropyl acetate	108-21-4	310 ppm	--
1225 Isopropyl alcohol	67-63-6	500 ppm	--
1227 Isopropyl glycidyl ether	4016-14-2	75 ppm	--
1228 Isopropylamine	75-31-0	10 ppm	--
1231 Ketene	463-51-4	1.5 ppm	--
1234 Manganese, fume	7439-96-5	3 mg/m^3	--
1242 Mercury, (organo) alkyl compounds	7439-97-6	0.03 mg/m	-
1243 Mesityl oxide	141-79-7	25 ppm	--
1248 Methyl 2-cyanoacrylate	137-05-3	4 ppm	--
1249 Methyl acetate	79-20-9	250 ppm	--
1250 Methyl acetylene/ propadiene mixture	74-99-7	1250 ppm	--
1252 Methyl alcohol	67-56-1	250 ppm, Skin	--
1254 Methyl chloride	74-87-3	100 ppm, Skin	-

Table C17-1. Substances for Which OSHA is Proposing STELs and Values Being Proposed (continued)

H.S. Number/ Chemical Name	CAS No.	ACGIH STEL	NIOSH Ceiling/STEL*
1255 Methyl chloroform (1,1,1-trichloroethane)	71-55-6	450 ppm	--
1258 Methyl formate	107-31-3	150 ppm	--
1261 Methyl isobutyl carbinol	105-30-6	40 ppm, Skin	--
1267 alpha-Methyl styrene	98-83-9	100 ppm	--
1270 o-Methylcyclohexanone	583-60-8	75 ppm, Skin	--
1281 Morpholine	110-91-8	30 ppm, Skin	--
1282 Naphthalene	91-20-3	15 ppm	--
1286 Nitric acid	7697-37-2	4 ppm	--
1289 Nitrogen dioxide	10102-44-0		1 ppm (15 min)
1290 Nitroglycerin	55-63-0		0.1 mg/m^3 (20 min)
1295 Octachloronaphthalene	2234-13-1	0.3 mg/m^3	--
1296 Octane	111-65-9	375 ppm	--
1297 Oil mist (Mineral)	8012-95-1	10 mg/m^3	--
1298 Osmium tetroxide	20816-12-0	0.006 mg/m^3	--
1299 Oxalic acid	144-62-7	2 mg/m^3	--
1301 Ozone	10028-15-6	0.3 ppm	--
1304 Pentaborane	19624-22-7	0.015 ppm	--
1306 Pentane	109-66-0	750 ppm	--
1307 2-Pentanone (Methyl propyl ketone)	107-87-9	250 ppm	--
1308 Perchloroethylene	127-18-4	200 ppm	--
1309 Perchloryl fluoride	7616-94-6	6 ppm	--
1317 Phenylhydrazine	100-63-0	10 ppm	--
1319 Phorate (Thimet)	293-02-2	0.2 mg/m^3	--
1320 Phosdrin (Mevinphos)	7786-34-7	0.3 mg/m^3	--
1321 Phosphine	7803-51-2	1 ppm	--
1322 Phosphoric acid	7664-38-2	3 mg/m^3	--
1323 Phosphorus oxychloride	10025-87-3	0.5 ppm	--
1324 Phosphorus pentasulfide	1314-80-3	3 mg/m^3	--
1324 Phosphorus trichloride	7719-12-1	0.5 ppm	--
1325 Picloram (Tordom)	1918-02-1	20 mg/m^3	--
1328 Picric acid	88-89-1	0.3 mg/m^3	--
1329 Propionic acid	79-09-4	15 ppm	--
1336 n-Propyl acetate	109-60-4	250 ppm	--
1338 Propyl alcohol	71-23-8	250 ppm	--
1340 n-Propyl nitrate	627-13-4	40 ppm	
1341 Propylene dichloride	78-87-5	110 ppm	--
1342 Propylene glycol monomethyl ether	107-98-2	150 ppm	--

Table C17-1. Substances for Which OSHA is Proposing STELs and Values Being Proposed (continued)

H.S. Number/ Chemical Name	CAS No.	ACGIH STEL	NIOSH Ceiling/STEL*
1346 Resorcinol	108-43-3	20 ppm	--
1366 Sodium fluoroacetate	62-74-8	0.15 mg/m^3	--
1372 Styrene (Phenylethylene)	100-42-5	100 ppm	--
1375 Sulfur dioxide	7446-09-5	5 ppm	--
1379 Sulfuryl fluoride	2699-79-8	10 ppm	--
1382 Tantalum	7440-25-7	10 mg/m^3	--
1387 Tetrahydrofuran	109-99-9	250 ppm	--
1397 Toluene	108-88-3	150 ppm	--
1398 Toluene-2,4-diisocyanate	584-84-9	0.02 ppm	--
1403 1,1,2-Trichloro-1,2,2-trifluorethane	76-13-1	1250 ppm	--
1408 Triethylamine	121-44-8	15 ppm	--
1411 Trimethylamine	75-50-3	15 ppm	--
1416 Tungsten & compounds (insoluble)	7440-33-7	10 mg/m^3	--
1417 Tungsten & compounds (soluble)	7440-33-7	3 mg/m^3	--
1418 Uranium (insoluble compounds)	7440-61-1	0.6 mg/m^3	--
1424 Vinyl acetate	108-05-4	20 ppm	--
1428 Vinylidene chloride	75-35-4	20 ppm	--
1431 Xylene (o,m,p-isomers)	1330-20-7	150 ppm	--
1435 Zinc chloride fume	7646-85-7	2 mg/m^3	--
1437 Zinc oxide (fume)	1314-13-2	10 mg/m^3	--
1434 Zinc stearate	557-01-1	20 mg/m^3	--
1435 Zirconium compounds	7440-67-7	10 mg/m^3	--

* NIOSH ceiling limits that are recommended for time periods of 15 minutes or more are treated as short-term exposure limits.

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In 1973, this subcommittee recommended that the ACGIH establish STELs as a third category (along with TLV–TWAs and ceilings) of exposure limits. The STEL was defined as the maximum concentration to which workers can be exposed *for a period up to 15 minutes* continuously without suffering from

1. Intolerable irritation,
2. Chronic or irreversible tissue change, or
3. Narcosis of sufficient degree to increase accident proneness, impair self-rescue, or materially reduce work efficiency (ACGIH 1984).

The ACGIH stipulated that no more than four excursions per day were permissible, with at least 60 minutes between exposure periods, and that the daily TLV–TWA could not be exceeded.

In 1974, the ACGIH agreed by consensus that 425 of the 520 compounds in its 1973 list should be assigned STELs, but these were not in fact published until 1976, when "Tentative Values" for STELs were listed in the organization's annual booklet. In 1978, the ACGIH emphasized that, according to its definition, a STEL was not a TWA value but a maximal allowable concentration, or absolute ceiling, not to be exceeded for any time during the 15-minute excursion period. The TWA–STEL should not be used as an engineering design criterion or considered as an emergency exposure level (ACGIH 1978).

ACGIH redefined the application of STELs in 1979, 1982, and 1984. The 1987–1988 ACGIH TLV booklet states that the TLV–STEL is "the concentration to which workers can be exposed continuously for a short period of time without suffering from (1) irritation, (2) chronic or irreversible tissue damage, or (3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency * * * provided that the daily TLV–TWA is not exceeded."

In 1982, the ACGIH qualified the conditions under which STELs are recommended to situations "only where toxic effects have been reported from high short-term exposures in either humans or animals." In 1984, the ACGIH proposed the deletion of STELs for 142 substances in its Notice of Intended Changes; most of these STELs were deleted in 1986. Another 53 STELs were proposed for deletion in 1986. These two major revision efforts successfully eliminated many STELs for substances with inadequate toxicological support data. As the introduction to the most recent edition of the *Threshold Limit Values and Biological Exposure Indices* (1986) indicates:

> For the vast majority of substances with a TLV–TWA, there is not enough toxicological data available to warrant a STEL. Nevertheless, excursions above the TLV–TWA should be controlled even where the eight-hour TWA is within recommended limits (ACGIH 1967). At present, a total of 122 STELs remain in the ACGIH's most recent TLV list; the organization has removed its recommended STELs for 297 substances on the ground that insufficient toxicological data existed on which to base a STEL.

The ACGIH has stressed that STELs are set on physiological grounds rather than in response to sampling and analytical limitations (ACGIH 1984).

Separate from the STEL category, the ACGIH in the 1970s established a fourth limit, a general "excursion factor" that should always be observed implicitly but is not specifically assigned to each chemical. The "excursion limit" recommended by the ACGIH is as follows:

> Short-term exposures should exceed three times the TLV–TWA for no more than a total of 30 minutes during a work day and under no circumstances should they exceed five times the TLV–TWA, provided that the TLV–TWA is not exceeded (ACGIH 1987).

The basis for this excursion recommendation is that any process whose emissions display a variability greater than would be permitted by this excursion factor is not under good industrial hygiene control, and the ACGIH believes that in such cases, efforts should be made to restore control (ACGIH 1986). Where specific STELs exist, they take precedence over the general excursion limit (ACGIH 1987). Thus *all* ACGIH TLV–TWAs have implicit excursion limits, but only a few substances (i.e., those for which specific toxicological evidence indicates that a STEL is necessary) have explicit STELs.

Significance of Risk

The STELs being proposed by OSHA in this rulemaking, which parallel those STELs remaining in the ACGIH's most recent list (ACGIH 1987–1988)) are thus limits for substances where there is toxicological evidence of recognized acute effects resulting from short-term exposure. (STELs also are appropriate to reduce significant risk remaining at the 8-hour TWA limit. See *Public Citizen HRG* v. *Tyson*, 796 F.2d 1479, 1505 (D.C. Cir. 1986). That issue does not arise for most of the substances covered in this rulemaking. If evidence is presented or available on this issue, OSHA will consider an appropriate regulatory response.) The health effects associated with short-term exposures for some of these substances are shown in Table C17–2.

TABLE C17–2. HEALTH EFFECTS SUPPORTING PROPOSED ACGIH STELS

H.S. Number/ Chemical Name	ACGIH STEL**	Health Effects
1001 Acetaldehyde.	150 ppm	Eye irritation; narcosis; potential injury to respiratory tract.
1002 Acetic acid.	15 ppm	Irritation.
1007 Acrolein	0.3 ppm	Irritation; lung edema.
1010 Allyl alcohol.	4 ppm	Irritation.
1011 Allyl chloride.	2 ppm	Mucous membrane irritation.
1012 Allyl glycidyl ether (AGE).	10 ppm	Irritation.
1013 Allyl propyl disulfide.	3 ppm	Irritation; lacrimation.
1021 Ammonia	35 ppm	Irritation; temporary blindness.
1022 Ammonium chloride (fume).	20 mg/m³	Irritation.
1042 Bromine	0.3 ppm	Respiratory tract irritation.
1045 2-Butanone (MEK).	300 ppm	Eye and nose irritation.
1047 n-Butyl acetate.	200 ppm	Throat irritation.
1049 sec-Butyl alcohol.	150 ppm	Irritation; narcosis.
1050 tert-Butyl alcohol.	150 ppm	Narcosis.
1063 Camphor (synthetic).	3 ppm	Eye and nose irritation; anosmia.
1064 Caprolactam (dust).	3 mg/m³	Irritation.
1065 Caprolactam (vapor).	40 mg/m³	Irritation.
1072 Carbon tetrabromide.	0.3 ppm	Upper respiratory tract irritation; injury to lungs, liver, and kidney.
1080 Chlorine dioxide.	0.3 ppm	Irritation.
1082 2-Chloro-6-trichloromethyl pyridine (nitrapyrin).	20 mg/m³	Nuisance effects.
1085 Chlorodifluoro-methane.	1250 ppm	CNS effects; asphyxiation; narcosis.
1090 o-Chlorotoluene.	75 ppm	Cardiovascular effects.
1091 Chlorpyrifos.	0.6 mg/³	Cholinesterase inhibition.
1103 Crufomate.	20 mg/m³	Cholinesterase inhibition.
1110 Cyclonite	3 mg/m³	CNS effects.
1119 Dibutyl phosphate.	2 ppm	Irritation to respiratory tract; headaches.
1122 1,3-Dichloro-5,-5-dimethyl-hydantoin.	0.4 mg/m³	Respiratory irritation.

TABLE C17-2. HEALTH EFFECTS SUPPORTING PROPOSED ACGIH STELS—Continued

H.S. Number/ Chemical Name	ACGIH STEL**	Health Effects
1125 p-Dichlorobenzene.	110 ppm	Acute poisoning.
1127 Dichloroethyl ether.	10 ppm	Upper respiratory tract and eye irritation.
1137 Diethylamine.	25 ppm	Acute toxicity characterized by strong local irritation.
1149 Dipropylene glycol methyl ether.	150 ppm	Eye, nose, and throat irritation; central nervous system impairment.
1161 Ethyl acrylate.	25 ppm	Irritation.
1162 Ethyl benzene.	125 ppm	Skin and eye irritation.
1163 Ethyl bromide.	250 ppm	Narcosis.
1164 Ethyl ether.	500 ppm	Narcosis; nasal irritation.
1179 Fluorine.....	2 ppm	Eye and skin irritation.
1184 Furfuryl alcohol.	15 ppm	Eye irritation.
1194 n-Heptane.	500 ppm	Narcosis; respiratory irritation.
1201 Hexane isomers.	1000 ppm	Narcotic symptoms; eye and throat irritation; slight nausea, headache.
1203 Hexone (MIBK).	75 ppm	Irritant effects.
1209 Hydrogen sulfide.	15 ppm	Eye irritation.
1216 Iron pentacarbonyl.	0.2 ppm	Headaches; dizziness.
1218 Isoamyl alcohol.	125 ppm	Respiratory and eye irritation.
1224 Isopropyl acetate.	310 ppm	Eye and respiratory irritation.
1225 Isopropyl alcohol.	500 ppm	Narcotic effects and irritation.
1227 Isopropyl glycidyl ether.	75 ppm	Respiratory tract and eye irritation.
1228 Isopropylamine.	10 ppm	Respiratory irritation.
1231 Ketene.....	1.5 ppm	Respiratory irritation.
1236A Manganese, fume.	3 mg/m³	Central nervous system effects.
1243 Mesityl oxide.	25 ppm	Eye and mucous membrane irritation, breathing difficulty, headache and vertigo.
1248 Methyl 2-cyanoacrylate.	4 ppm	Nasal and eye irritation.
1249 Methyl acetate.	250 ppm	Ocular and nervous disturbances; eye, mucous membrane, upper and lower respiratory tract irritation.
1252 Methyl alcohol.	250 ppm	Recurrent headaches; diminution of vision.
1255 Methyl chloroform(1,1,1-trichloroethane).	450 ppm	Anesthesia.
1258 Methyl formate.	150 ppm	Visual disturbances (temporary blindness); narcotic symptoms, mucous membrane irritation; dyspnea.
1261 Methyl isobutyl carbinol.	40 ppm	Eye irritation.
1270 o-Methylcyclohexanone.	75 ppm	Eye and respiratory irritation.
1281 Morpholine.	30 ppm	Irritation and harmful effects to eyes and vision.
1282 Naphthalene.	15 ppm	Ocular effects.
1296 Octane.....	375 ppm	Acute effects on nervous system.
1299 Oxalic acid.	2 mg/m³	Severe local burns to eyes, mucous membranes, and skin.
1304 Pentaborane.	0.015 ppm	Central nervous system effects.
1306 Pentane.....	750 ppm	Narcotic and irritative effects.
1307 2-Pentanone (MPK).	250 ppm	Narcotic effects; irritation.
1308 Perchloroethylene.	200 ppm	Anesthetic effects.
1309 Perchloryl fluoride.	6 ppm	Respiratory irritation; fluorosis.
1323 Phosphorous oxychloride.	0.5 ppm	Irritation.
1324 Phosphorus pentasulfide.	3 mg/m³	Respiratory irritation.
1325 Phosphorus trichloride.	0.5 ppm	Respiratory irritation.
1328 Picloram (Tordom).	20 mg/m³	Systemic effects.
1336 Propionic acid.	15 ppm	Eye and respiratory irritation.
1339 Propyl alcohol.	250 ppm	Possible deep narcosis.
1343 Propylene glycol monomethyl ether.	150 ppm	Odor; eye irritation.
1372 Styrene, monomer.	100 ppm	Tremors with subsequent severe convulsions; pulmonary edema may follow severe single exposure.
1375 Sulfur dioxide.	5 ppm	Respiratory effects.
1387 Tetrahydrofuran.	250 ppm	Narcotic and irritative effects.
1397 Toluene.....	150 ppm	Impairment of coordination, momentary memory loss, anorexia.
1403 1,1,2-Trichloro-1,2,2-trifluoroethane.	1250 ppm	Impairment of psychomotor performance.
1408 Triethylamine.	15 ppm	Acute irritation of eyes, mucous membranes, and lungs.
1424 Vinyl acetate.	20 ppm	Irritation.
1428 Vinylidene chloride.	20 ppm	Overt toxicity.
1431 Xylene (o,m,p-isomers).	150 ppm	Narcosis, irritant effects.
1435 Zinc chloride (fume).	2 mg/m³	Respiratory irritation.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

Preliminary Conclusions

OSHA is proposing STELs where the Agency believes a short-term limit is needed to supplement the 8-hour TWA to protect workers from the adverse health effects associated with exposure to short-term excursions that would be permitted with the 8-hour limit alone. OSHA preliminarily concludes that, without a STEL, workers remain at risk of experiencing the broad range of recognized acute effects associated with elevated short-term exposures to these chemicals. Compliance with a STEL in addition to an 8-hour limit will substantially reduce the risk of health impairment and functional incapacity potentially faced by workers exposed to these substances during excursions to the levels permitted by the 8-hour limit alone. OSHA believes that, for this

group of substances, the toxicological evidence forms a reasonable basis for proposing to supplement the 8-hour permissible exposure limit with a short-term limit.

At the time of the final rule, OSHA will establish short-term exposure limits for these substances if it determines that STELs will substantially reduce significant risk.

18. Substances for Which OSHA Is Proposing To Add Skin Notations

There are a number of instances in this rulemaking for which OSHA is proposing to add a skin notation to the limit for a substance. In all, a skin notation is being added in 49 cases. Table C18–1 shows all of the substances for which the Agency is proposing to add skin notations.

The ACGIH began to include skin designations for the chemicals in its list for the first time in 1961 (Stokinger 1961). At that time, the organization stated that:

> This notation is to be interpreted simply as an indicator that skin absorption may contribute to the overall intake from exposure in addition to that from inhalation. It refers mainly to absorption from liquid contamination (Stokinger 1961).

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TABLE C18 1. List of Substances for Which OSHA Is Proposing to Add a Skin Notation

H.S. Number/ Chemical Name	CAS No.
1012 Allyl glycidyl ether (AGE)	106-92-3
1051 n-Butyl alcohol	71-36-3
1055 o-sec-Butylphenol	89-72-5
1066 Captafol (Difolatan)	2425-06-1
1084 o Chlorobenzylidene malonitrile	2698-41-1
1091 Chlorpyrifos	2921-88-2
1107 Cyclohexanol	108-93-0
1108 Cyclohexanone	108-94-1
1110 Cyclonite	121-82-4
1118 Diazinon	333-41-5
1120 2-N-Dibutylaminoethanol	102-81-8
1129 1,3-Dichloropropene	542-75-6
1131 Dicrotophos (Bidrin)	141-66-2
1138 Diethylene triamine	111-40-0
1141 Dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate	300-76-5
1146 Dioxathion (Delnav)	78-34-2
1156 Endosulfan	115-29-7
1160 Ethion (Nialate)	563-12-2
1173 Fenamiphos	22224-92-6
1175 Fenthion	55-38-9
1181 Fonofos	944-22-9
1184 Furfuryl alcohol	98-00-0
1195 Hexachlorobutadiene	87-68-3
1198 Hexafluoroacetone	684-16-2
1211 2-Hydroxypropyl acrylate	999-61-1
1220 Isooctyl alcohol	26952-21-6
1229 n-Isopropylaniline	643-28-7
1237 Manganese cyclopentadienyl tricarbonyl	12079-65-1
1241 Mercury (vapor)	7439-97-6
1242 Mercury, (organic) alkyl compounds	7439-97-6
1251 Methyl acrylonitrile	126-98-7
1252 Methyl alcohol	67-56-1
1256 Methyl demeton	8022-00-2
1265 Methyl parathion	298-00-0
1271 Methylcyclopentadienyl manganese tricarbonyl	12108-13-3
1273 4,4'-Methylene bis(2-chloroaniline)	5124-30-1
1313 Phenothiazine	92-84-2
1319 Phorate (Thimet)	298-02-2
1335 Propargyl alcohol	107-19-7
1339 Propyl alcohol	71-23-8
1342 1,2-Propylene glycol dinitrate	6423-43-4
1392 Thioglycolic acid	68-11-1
1394 Tin (organic compounds)	7440-31-5
1400 p-Toluidine	106-49-0
1401 m-Toluidine	108-44-1
1407 1,2,3-Trichloropropane	96-18-4
1414 Triorthocresyl phosphate	78-30-8
1426 Vinyl cyclohexene dioxide	106-87-6
1432 m-Xylene-alpha,alpha'-diamine	1477-55-0

BILLING CODE 4510-26-C

The ACGIH has expanded on its reasoning since the 1960s, and the preface to the most recent *Threshold Limit Values and Biological Exposure Indices* (1987–1988) explains that the skin designation is designed to call attention to the need for "appropriate measures for the prevention of cutaneous absorption so that the threshold limit is not invalidated" (p. 7). Thus a skin notation warns that exposure via the cutaneous route, including absorption through the eyes or mucous membranes, by either inhalation or direct contact, may contribute substantially to an employee's overall exposure and cause systemic toxicity.

In establishing most skin designations, OSHA has relied primarily on animal data, particularly on dermal LD_{50} values in rodents (mice, rats, rabbits, and guinea pigs). This evidence is occasionally supported by findings in humans, and in a few cases, human evidence provides the sole basis. The ACGIH has a policy of using a dermal LD_{50} of 2 g/kg as a general cutoff for determining when to classify a substance as sufficiently absorbable to present a hazard via the percutaneous route; that is, substances having a single-dose dermal LD_{50} of less than 2 g/kg receive a skin notation, while those with dermal LD_{50}s above this cutoff do not (ACGIH 1986, p. 332). The *Documentation* (ACGIH 1986) contains no cutoff value for chronic dermal exposures, i.e., for toxicity resulting from repeated applications of substances to the skin.

The following discussions describe OSHA's reasons for adding or deleting skin notations for some OSHA-regulated chemicals or the regulatory candidates under consideration.

o-sec-Butylphenol. In assigning a skin notation to this substance, the ACGIH relied on an unpublished Dow Chemical Company study showing that the dermal LD_{50} for butylphenol in guinea pigs is between 0.6 and 2.4 g/kg. This range clearly includes the single-dose percutaneous cutoff value of 2 g/kg, and skin absorption of butylphenol thus has the potential to contribute to overall exposure and to cause systemic effects in dermally exposed workers. OSHA preliminarily concludes that the addition of a skin notation is warranted by this avoidance and that the evidence of dermal contact will eliminate the risk of systemic toxicity posed by this chemical.

Phorate. Phorate, an organophosphate insecticide, has been proposed for a skin designation on the basis of its high acute percutaneous toxicity. In male and female rats, the dermal LD_{50} is 6.2 and 2.5 mg/kg, respectively, values substantially below the level used as the criterion for permeability via the percutaneous route (ACGIH 1986, p. 332). OSHA preliminarily concludes that preventing skin contact with this chemical will protect exposed workers from experiencing the neurologic effects associated with overexposure to this cholinesterase inhibitor.

Vinyl cyclohexene dioxide. The skin notation for vinyl cyclohexene dioxide is based on evidence that this substance is highly toxic in rats given a single skin application. The dermal LD_{50} in this species is 0.62 ml/kg. In addition, this chemical has been shown to cause skin tumors and cancers developing late in life in mice receiving dermal applications of a 30-percent solution of vinyl cyclohexene dioxide in acetone. The ACGIH (1986) reports that "extreme caution should be exercised in the use of this diepoxide" because of the "very limited toxicological data and * * * demonstrated carcinogenicity when * * * applied to the skin of the mouse." OSHA preliminarily concludes that the addition of a skin designation to the limit for this chemical is essential to protect workers both from systemic toxicity via the percutaneous route and from the potential risk of developing either systemic or skin cancers.

Substances for Which the ACGIH Has Deleted the Skin Notation

For four substances, the ACGIH has deleted the skin notations that have appeared in the 1968 edition of the *Documentation* and which were subsequently adopted by OSHA under the section 6(a) mechanism in 1971. Table C18–2 shows these chemicals.

OSHA is not proposing to delete the skin notations for these four substances. The Agency believes that deletion of these designations would in effect constitute an increase in the level of exposure permitted and thus a decrease in the extent of worker protection provided by the limits of the current Z tables. In accordance with principles established by OSHA (see the preamble for the final revisions to the cotton dust standard, 50 FR 51120 *et seq.*), the Agency must demonstrate that deleting these skin designations, which were established under the section 6(a) mechanism, will not pose a significant risk to exposed workers. The discussion below describes the ACGIH's reasons for recommending deletion of these notations.

TABLE C18-2. List of Substances for Which the ACGIH Has Deleted the Skin Notation

H.S. Number/ Chemical Name	CAS No.
1113 DDT	50-29-3
1149 Dipropylene glycol methyl ether	34590-94-8
1197 Hexachloroethane	67-72-1
1303 Paraquat, respirable dust	4685-14-7

The evidence on which the ACGIH based its decision to delete skin notations for the four chemicals in question is primarily animal evidence. For DDT and hexachloroethane, the ACGIH deleted the skin designation based on the relatively low dermal toxicity demonstrated by these substances in animal studies. OSHA preliminarily finds, however, that the absence of significant risk via dermal absorption has not been sufficiently shown for DDT and hexachloroethane, and thus OSHA is not proposing deletion at this time.

For the two remaining substances in this group, paraquat and dipropylene glycol methyl ether (DPGME), the skin notation was deleted because the ACGIH believes that the substance does not, in the case of paraquat, "penetrate the unbroken or uninjured skin" or believes, as in the case of DPGME, that the substance is "practically nontoxic * * * by the dermal route for rabbits" (ACGIH 1986). However, OSHA notes that at high doses paraquat does "injure and break down dermal barriers" and gain entry to the body. The *Documentation* records the case of a 44-year-old man who died of respiratory insufficiency after he was poisoned by the percutaneous absorption of an acutely toxic quantity of undiluted paraquat (ACGIH 1986). The ACGIH also reports that there is evidence that, despite DPGME's low single-dose dermal toxicity, repeated applications of the chemical to the skin of rabbits caused death "in a significant number of the exposed rabbits at levels of 3 ml/kg and above" (ACGIH 1986).

In accordance with the principles stated in the cotton dust preamble (50 FR 51120) OSHA does not find the evidence adduced by the ACGIH sufficient to provide a basis for the deletion of the skin notations for this group of substances. The Agency preliminarily concludes that deleting the skin notation from the limits for these four substances will not ensure that workers are protected against the risks potentially posed by percutaneous absorption of these substances.

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V. Summary of Preliminary Feasibility, Regulatory Impact, Regulatory Flexibility and Environmental Impact Analyses

The OSHA Act requires the Agency to consider the feasibility of proposed standards. Executive Order 12291 (46 FR 13197) requires that a regulatory analysis be conducted for any rule having major economic consequences on the national economy, individual industries, geographical regions, or levels of government. The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) similarly requires OSHA to consider the impact of the proposed regulation on small entities. Consistent with these requirements, OSHA has prepared a Feasibility Analysis, and a Preliminary Regulatory Impact and Regulatory Flexibility Analysis for this proposed rule. Details supporting this Summary are included in Appendix B of this proposal. Not all of the Supplements to Appendix B are published in this proposal. They are, however, available from OSHA. Instructions on how to obtain the Supplements are given at the end of Appendix B.

Approach

Because this rulemaking involves about 430 chemicals, OSHA has prepared the regulatory impact analysis in two phases. Phase I involved the use of a number of secondary data bases to collect information on the chemicals to be regulated and the industries in which they are used. These data bases provided information on the toxicity and health effects of exposure to the chemicals, and current information on engineering controls in use and emergency response procedures. Two data bases provided information on employee exposures. The 1982 National Occupational Exposure Survey (NOES) was based on a sample of about 4,500 businesses. The data base developed from this survey contains an estimate of the number of persons occupationally exposed to hazardous substances by Standard Industrial Classification (SIC). The second data base was OSHA's Integrated Management Information System (IMIS). The IMIS contains the results of air samples taken since 1979 by OSHA industrial hygienists in the course of compliance inspections. Both the NOES and IMIS data bases provided valuable information on the nature and extent of employee exposures to the substances to be regulated; however, they did not provide complete information on all substances. Supplementary information was obtained from industrial hygienists and engineers. These experts identified exposure controls in use, and the number and size of plants most likely to be affected by this rulemaking. These sources have provided OSHA with a substantial body of information on chemical use, exposures and controls.

Phase II of the data collection effort involved a sampling survey of over 5,300 firms in industries where chemical exposures were believed to pose potential problems. The survey, conducted during the first part of 1988, gathered data on chemicals, processes, exposures and controls currently in use. These additional data have permitted OSHA to refine the Phase I preliminary estimates of technical and economic feasibility. In addition, site visits to over 100 plants are underway to verify the data collected to date on chemicals, processes, controls and employee exposures. The reports covering these site visits will be submitted to the docket prior to the completion of the public hearing in this rulemaking.

Employee Exposure and Benefits

Revising OSHA's Z-Table limits for hazardous substances is expected to result in reduced risk of chemically related disease among exposed employees. Exposure to substances included in the rulemaking has been associated with a variety of adverse health effects, including impairment of organ system functions, mucous membrane irritation, neuropathy, narcosis, allergic sensitization, respiratory disease, cardiovascular disease, and cancer.

Using data from OSHA's IMIS system and information collected from the survey of over 5,300 establishments, OSHA estimates over 17 million employees are potentially exposed to hazardous substances in the workplace. OSHA also estimates that over 3.6 million employees are currently exposed above the proposed exposure limits for these substances. Table V–1 summarizes OSHA's estimates of the number of workers currently at risk of adverse health effects. OSHA estimates that promulgation of the proposed exposure limits will result in a potential reduction of over 55,000 work-related illness cases per year, over 23,600 lost-workday illness cases per year, and over 533,000 lost workdays due to illness per year. OSHA's preliminary estimate is that industry compliance with the proposed exposure limits will result in a reduction of 519 fatalities caused by exposure to substances that cause cancer, respiratory disease, cardiovascular disease, or liver or kidney disease per year.

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TABLE V-1

ESTIMATED NUMBER OF WORKERS POTENTIALLY AT RISK OF EXPERIENCING ADVERSE EFFECTS, BY TYPE OF ADVERSE EFFECT*

ADVERSE HEALTH EFFECT	NO. OF WORKERS POTENTIALLY EXPOSED TO SUBSTANCES ASSOCIATED WITH EFFECT, MINIMUM ESTIMATE	NO. OF WORKERS POTENTIALLY EXPOSED TO SUBSTANCES ASSOCIATED WITH EFFECT, MAXIMUM ESTIMATE	NO. OF WORKERS EXPOSED ABOVE PROPOSED LIMITS FOR SUBSTANCES, MINIMUM ESTIMATE	NO. OF WORKERS EXPOSED ABOVE PROPOSED LIMITS FOR SUBSTANCES, MAXIMUM ESTIMATE
NUISANCE EFFECTS	4,729,417	5,804,846	829,487	892,725
ODOR AND TASTE EFFECTS	718,522	808,537	59,102	59,102
SYSTEMIC TOXICITY	3,233,319	3,818,742	250,282	256,909
MUCOUS MEMBRANE IRRITATION	12,077,315	15,813,663	59,969	1,021,197
METABOLIC INTERFERENCES	2,277,113	2,345,975	746,879	746,879
LIVER/KIDNEY DISEASE	2,321,573	2,488,604	383,581	384,876
OCULAR DISTURBANCES	194	194	0	0
RESPIRATORY DISEASE	3,765,717	4,023,525	639,717	654,319
CARDIOVASCULAR DISEASE	164,576	164,576	44,355	44,355
NEUROPATHY	1,231,744	1,349,421	201,760	210,203
NARCOSIS	4,601,993	6,381,899	526,021	547,731
CANCER	3,663,053	3,784,374	499,716	499,716
ALLERGIC SENSITIZATION	2,710,576	2,903,153	296,444	297,255

*Double counting of employees simultaneously exposed to more than one substance in different adverse health effects categories, prevents the summation of workers exposed to all adverse health effects in this table.

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Nonregulatory Alternatives

OSHA believes that there are no nonregulatory alternatives that adequately protect most workers from the adverse health effects associated with exposure to the chemicals under consideration. OSHA believes that the tort liability laws and Workers' Compensation do not provide adequate worker protection due to market imperfections. Some employers have not complied with the standards recommended by professional organizations. The deleterious health effects resulting from continued high levels of exposure to hazardous substances require a regulatory solution.

Technological Feasibility

Consistent with OSHA regulations and policy, engineering controls and work practices to control employee exposure are preferred over the use of personal protective equipment.

Engineering controls involve the use of local exhaust ventilation, general ventilation, isolation of the worker and enclosure of the source of emissions, process modifications, equipment modifications, and substitution of non-hazardous chemicals. These methods may be used alone or in combination depending upon the industrial processes involved. These controls are widely used and will effectively control exposures either by themselves, or coupled with changes in work practices.

Perhaps the most widely used technique for controlling chemical exposure is the use of ventilation. General ventilation uses the movement of air within the general work space to displace or dilute the contaminant with fresh outside air. General ventilation may not be the preferred control method, however, due to the large volumes of air movement required. Local exhaust ventilation uses much smaller volumes of air, exhausted from the point or source at which contaminants are generated.

Isolation involves placing a physical barrier between the hazardous operation and the worker. Many modern, automated manufacturing processes are now fully enclosed in ventilated cabinets. The effectiveness of such a control technique depends on the frequency with which the workers have to enter the enclosure during normal operations. In other situations, rather than placing the process or machine in an enclosure, the worker is placed in an enclosure. Many processes which involve potential chemical exposures are operated remotely by operators in air-conditioned booths isolated from the hazardous materials.

Substitution refers to the replacement of a toxic chemical in a particular process or work area with another, less toxic product. Properly applied, substitution can be a very effective control technique. However, care must be taken to ensure that the proposed substitute performs in a similar manner to the product being replaced. In addition, it is essential that the substitute be carefully evaluated to ensure that in controlling one hazard, another different hazard is not inadvertently introduced. The substitute must also be compatible with existing manufacturing equipment and processes.

The success of these techniques will depend on the physical properties of the chemicals and emissions encountered (boiling point, vapor pressure, etc.) and the process operating conditions. In some cases, particularly with cleaning solvents, substitution may provide the quickest and most effective means of reducing exposure. In other situations, a major effort may be required to alter processes or install or expand local or general dilution ventilation.

OSHA believes that existing engineering controls are available to reduce exposure levels to the new proposed levels. Standard controls have been adapted in numerous situations to solve situation-specific problems in all of the industry sectors affected. Detailed industry-specific illustrations of this point are presented in the Technological Feasibility Chapter of the Preliminary Regulatory Impact Analysis.

Costs of Compliance

Costs of compliance with the proposed rulemaking would result from industry actions to lower workers' chemical exposure to the levels proposed. The 1988 sample survey of more than 5,300 firms was drawn from a universe of over one million firms potentially affected by the rule. Table V–5 at the end of this section presents a list of industries included in the analysis.

Survey respondents verified the number of work stations and workers related to each process, the process location and configuration, the controls already in place, and potential chemical exposures above new proposed levels. Process controls in place were compared to a list of control designs needed to limit exposures to new lower levels. Where the required controls were not reported to be in place, a compliance cost per work station was assigned. Process control costs were summed per establishment and certain maintenance workers were assigned a respirator cost. Costs for the surveyed establishments were then weighted (by SIC and size) to represent compliance costs for the universe of affected plants.

The survey found that about 500,000 establishments use the chemicals being regulated. Of this number, about 101,200 would incur some costs to comply with the proposed rule. The total estimated annualized capital plus annual operating costs are $927.83 million. Table V–2 presents the annual cost by industry sector, for large and small (fewer than 20 employees) plants.

Among all industry sectors affected by this proposal, about 101,200 establishments are estimated to incur, on average, an annual cost of $9,200.

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TABLE V-2

ANNUAL OPERATING AND ANNUALIZED CAPITAL COST OF COMPLIANCE BY INDUSTRIAL SECTOR (a)

SIC (b)	SIC DESCRIPTION	LARGE PLANTS	SMALL PLANTS	ANNUAL COST
20	FOOD PROD. (c)	$21,704,100	$11,789,000	$33,493,100
21	TOBACCO (c)	$19,700	$0	$19,700
22	TEXT. MILL (c)	$23,308,400	$6,170,000	$29,478,400
23	APPAREL PROD. (c)	$23,604,300	$8,139,900	$31,744,200
24	LUMBER & WOOD	$20,534,800	$175,551,300	$196,086,100
25	FURNITURE	$7,915,300	$6,805,300	$14,720,600
26	PAPER PROD.	$30,966,900	$290,800	$31,257,700
27	PRINTING & PUB.	$15,263,300	$60,425,000	$75,688,300
28	CHEMICAL PROD.	$31,745,500	$8,412,100	$40,157,600
29	PETRO. REFINING	$6,800,700	$414,600	$7,215,300
30	RUBBER & PLASTICS	$53,256,200	$22,225,900	$75,482,100
31	LEATHER PROD.	$1,464,400	$1,115,100 (c)	$2,579,500
32	STONE & CLAY	$15,079,300	$7,463,300	$22,542,600
33	PRIM. METAL	$34,721,200	$5,612,400	$40,333,600
34	FAB. METALS	$50,927,100	$5,010,500	$55,937,600
35	MACHINERY	$43,986,300	$13,754,100	$57,740,400
36	ELEC. MACH.	$24,210,900	$7,570,500	$31,781,400
37	TRANS. EQUIP.	$20,884,600	$26,214,500 (c)	$47,099,100
38	INSTRUMENTS	$10,257,300	$3,207,400	$13,464,700
39	MISC. MANUF.	$13,861,200	$4,334,300	$18,195,500
40	R.R. TRANS.	$532,200	$0	$532,200
45	AIR TRANS.	$1,828,900	$0	$1,828,900
47	TRANS. SERV.	$1,853,100	$0	$1,853,100
49	ELEC. GAS. SAN.	$19,373,900	$3,314,500	$22,688,400
50	WHOLESALE TRADE	$1,416,300	$2,638,300	$4,054,600
51	WHOLESALE, NON-DUR	$3,094,200	$5,764,000	$8,858,200
55	AUTO DEALERS (c)	$9,862,500	$2,092,200	$11,954,700
72	PERSONAL SRV. (c)	$15,648,500	$15,639,300	$31,287,800
73	BUSINESS SRV. (c)	$3,701,700	$5,252,100	$8,953,800
75	AUTO REPAIR (c)	$466,800	$1,044,100	$1,510,900
76	MISC. REPAIR SRV.	$669,500	$4,179,000	$4,848,500
80	HEALTH SERV. (c)	$2,413,000	$2,026,400	$4,439,400
TOTAL		$511,372,100	$416,455,900	$927,828,000

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

(a) Costs were calculated by annualizing the capital cost over the projected life of the equipment (10 years) using a 10 percent cost of capital and adding an annual operating and maintenance cost estimated at 10 percent of the capital cost.

(b) Industry sectors not identified in this table include industries with no major cost impact expected, the construction industry, which will be the subject of a separate regulatory analysis, and industries such as mining, over which OSHA has no jurisdiction.

(c) Costs in these sectors were based on expert judgement and secondary data collection. Survey data for SICs 55, 72, 73, 75 and 80 was insufficient to estimate compliance costs.

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Economic Impact

OSHA prepared two estimates of the economic effects of the proposal on potentially affected firms. The two estimates were based upon Zero Cost-Passthrough ("worst case") and Total Cost-Passthrough ("best case") scenarios.

In the first scenario it was assumed that all compliance costs would be absorbed by firms in the form of reduced profits. Table V–3 contains a summary of this "worst case" analysis. Under this scenario, the estimated average percent reduction in profits for all affected firms was less than one percent. The estimated reduction in profit of 8 percent for SIC 24, Lumber and Wood Products Manufacturers, was the highest among all industries.

In the second scenario it was assumed that all compliance costs would be passed on to the consumer in the form of higher prices. The potential price increase for an industry sector at the two-digit SIC level was estimated by dividing the sector's compliance cost by its total sales. In this scenario, there would be little impact on market prices; none of the estimated price increases exceeded one half of one percent (Table V–4).

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Table V-3

ECONOMIC EFFECTS: NO-COST PASSTHROUGH SCENARIO[1]

SIC	Industry	Annual Costs[2] ($ millions)	Total Sales[3] ($ millions)	R.o.R. on Sales (%)[4]	Pre-Reg Profits ($ m)	Post-Reg Profits ($ m)	% Change in Profits
20	FOOD PROD.	33.49	353,780.38	1.9	8,008.04	7,986.29	- 0.2715
21	TOBACCO	0.02	74,030.13	5.3	3,923.60	3,923.59	- 0.0003
22	TEXT. MILL	29.48	60,735.22	2.7	1,765.42	1,747.59	- 1.0100
23	APPAREL PROD.	31.74	74,474.65	2.8	1,813.22	1,793.56	- 1.0845
24	LUMBER & WOOD	196.09	57,994.48	3.9	1,974.51	1,814.21	- 8.1188
25	FURNITURE	14.72	37,648.27	3.5	1,411.02	1,400.96	- 0.7129
26	PAPER PROD.	31.26	103,694.14	3.7	3,778.20	3,761.24	- 0.4489
27	PRINTING & PUB.	75.69	134,830.21	4.8	6,471.85	6,412.25	- 0.9210
28	CHEMICAL PROD.	40.16	272,759.67	3.7	11,738.80	11,714.76	- 0.2048
29	PETRO. REFINING	7.22	196,400.57	2.7	4,964.85	4,960.84	- 0.0808
30	RUBBER & PLASTICS	75.48	86,538.58	4.3	3,423.75	3,376.10	- 1.3918
31	LEATHER PROD.	2.58	15,449.56	2.6	401.69	399.95	- 0.4328
32	STONE & CLAY	22.54	46,094.04	4.1	1,954.99	1,940.73	- 0.7300
33	PRIMARY METALS	40.33	112,564.26	3.3	3,714.62	3,691.27	- 0.6286
34	FAB. METALS	55.94	150,146.41	4.0	6,005.86	5,974.10	- 0.5288
35	MACHINERY	57.74	345,144.89	5.1	17,602.39	17,566.95	- 0.2013
36	ELEC. MACH.	31.78	245,982.70	5.0	12,299.14	12,279.63	- 0.1586
37	TRANS. EQUIP.	47.10	365,427.20	3.9	14,520.25	14,486.69	- 0.2311
38	INSTRUMENTS	13.46	83,359.57	4.9	3,373.26	3,365.00	- 0.2450
39	MISC. MANUF.	18.20	41,870.30	4.4	1,788.56	1,777.39	- 0.6245
40	R.R. TRANS.	.53	43,869.14	10.0	3,969.62	3,969.34	- 0.0072
45	AIR TRANS.	1.83	109,538.08	3.6	3,251.40	3,250.41	- 0.0304
47	TRANS. SERVICES	1.85	12,254.96	2.7	582.18	581.18	- 0.1719
49	ELEC.,GAS & SAN.	22.69	300,254.83	7.0	21,017.84	21,004.06	- 0.0655
50	WHOLESALE TRADE[5]	4.05	13,853.52	2.0	277.07	273.67	- 1.2285
51	WHOLESALE, NON-DUR	8.86	113,848.20	1.5	1,726.26	1,721.48	- 0.2771
55	AUTO DEALERS	11.95	341,574.50	1.9	6,489.92	6,482.81	- 0.1095
72	PERSONAL SERV.	31.29	24,270.74	7.3	1,771.76	1,750.02	- 1.2272
73	BUSINESS SERV.	8.95	22,165.94	6.6	1,462.95	1,455.45	- 0.5126
75	AUTO REPAIR	1.51	45,750.92	5.1	2,492.19	2,491.05	- 0.0457
76	MISC. REPAIR SERV.	4.85	2,665.52	5.5	146.60	142.69	- 2.6696
80	HEALTH SERVICES	4.44	170,234.25	4.5	7,807.72	7,804.54	- 0.0406

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

Notes:
1. All values in 1985 dollars.
2. Reproduced from Table VI-1.
3. Dun and Bradstreet, Dun's Marketing Identifiers (DMI) Database.
4. Rate of Return on Sales, Dun and Bradstreet, Industry Norms Database.
5. Consists of SIC 5093 (scrap and waste materials) only.

TABLE V-4

ECONOMIC EFFECTS: TOTAL-COST PASSTHROUGH

SIC	Industry	Annual Costs ($ millions)	Total Sales ($ millions)	Costs as a Percent of Sales
20	FOOD PROD.	33.49	353,780.38	0.0095
21	TOBACCO	0.02	74,030.13	0.0000
22	TEXT. MILL	29.48	60,735.22	0.0485
23	APPAREL PROD.	31.74	74,474.65	0.0426
24	LUMBER & WOOD	196.09	57,994.48	0.3381
25	FURNITURE	14.72	37,648.28	0.0391
26	PAPER PROD.	31.26	103,694.14	0.0301
27	PRINTING & PUB	75.69	134,830.21	0.0561
28	CHEMICAL PROD.	40.16	272,759.67	0.0147
29	PETRO. REFINING	7.22	196,400.57	0.0037
30	RUBBER & PLASTICS	75.48	86,538.58	0.0872
31	LEATHER PRODUCTS	2.58	15,449.56	0.0167
32	STONE & CLAY	22.54	46,094.04	0.0489
33	PRIM. METALS	40.33	112,564.26	0.0358
34	FAB. METALS	55.94	150,146.41	0.0373
35	MACHINERY	57.74	345,144.89	0.0167
36	ELEC. MACH.	31.78	245,982.70	0.0129
37	TRANS. EQUIP.	47.10	365,427.20	0.0129
38	INSTRUMENTS	13.46	83,359.57	0.0162
39	MISC. MANUF.	18.20	41,870.30	0.0435
40	R.R. TRANS.	.53	43,869.14	0.0012
45	AIR TRANS.	1.83	109,538.08	0.0017
47	TRANS. SERVICES	1.85	12,254.96	0.0151
49	ELEC,GAS & SAN.	22.69	300,254.83	0.0076
50	WHOLESALE TRADE[1]	4.05	13,853.52	0.0293
51	WHOLESALE, NON-DUR.	8.86	113,848.20	0.0078
55	AUTO DEALERS	11.95	341,574.50	0.0035
72	PERSONAL SERVICES	31.29	24,270.74	0.1289
73	BUSINESS SERVICES	8.95	22,165.94	0.0404
75	AUTO REPAIRS	1.51	45,750.92	0.0033
76	MISC. REPAIR SERV.	4.85	2,665.52	0.1819
80	HEALTH SERVICES	4.44	170,234.25	0.0026

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

Notes: 1. Consists of SIC 5093 (scrap and waste materials) only.

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Based on this analysis, OSHA concludes that the proposed standard is economically feasible for each sector. The impact on prices is slight and even in the worst cases, the reductions in profitability are small.

Regulatory Flexibility Analysis

In accordance with the Regulatory Flexibility Act (Pub. L. 96-353, 94 Stat.1664 (5 U.S.C. 601 *et seq.*), OSHA has made a preliminary assessment of how the proposed rulemaking will affect large and small establishments. The results of this preliminary assessment indicate that some small establishments may experience some adverse impact. The smaller profit margins of some small establishments may make it more difficult for them to absorb increases in compliance costs. OSHA requests comments on approaches to reduce the impact on small establishments. An important ameliorating factor for each affected firm will be its ability to pass through additional costs to the consumer. The ability of individual firms to do this will be dependent upon product demand elasticities. It is expected that all impacted firms will be able to pass through some portion of their increased costs.

Environmental Impact

The proposed standard has been reviewed in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality NEPA regulations, and the Department of Labor's NEPA compliance procedures and is not anticipated to have a significant impact on the external environment.

TABLE V-5.—SIC Groups Covered in the OSHA Analysis

Division D. Manufacturing:
Major Group 20. Food and kindred products
Major Group 21. Tobacco manufactures
Major Group 22. Textile mill products
Major Group 23. Apparel and other finished products, made from fabrics and similar materials
Major Group 24. Lumber and wood products, except furniture
Major Group 25. Furniture
Major Group 26. Paper and allied products
Major Group 27. Printing, publishing, and allied industries
Major Group 28. Chemicals and allied products
Major Group 29. Petroleum refining and related industries
Major Group 30. Rubber and miscellaneous plastics products
Major Group 31. Leather and leather products
Major Group 32. Stone, clay, glass, and concrete products
Major Group 33. Primary metal industries
Major Group 34. Fabricated metal products, except machinery and transportation equipment
Major Group 35. Machinery, except electrical
Major Group 36. Electrical and electronic machinery, equipment, and supplies
Major Group 37. Transportation equipment
Major Group 38. Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks
Major Group 39. Miscellaneous manufacturing industries
Division E. Transportation, Communications, Electric, Gas, and Sanitary Services:
Major Group 40. Railroad transportation
Major Group 44. Water transportation
Major Group 45. Transportation by air
Major Group 47. Transportation services
Major Group 49. Electric, gas, and sanitary services
Division F. Wholeale Trade:
Major Group 50. Wholesale trade—durable goods
Major Group 51. Wholesale trade—nondurable goods
Division G. Retail Trade: Major Group 55. Automotive dealers and gasoline service stations
Division I. Services:
Major Group 72. Personal services
Major Group 73. Business services
Major Group 75. Automotive repair, services, and garages
Major Group 80. Health services

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, as derived from Standard Industrial Classification Manual 1972, Executive Office of the President—Office of Management and Budget (1, pp. 5-7).

The listing excludes the construction industry (SICs 15, 16, and 17) which will be the subject of a separate regulatory analysis.

VI. Clearance of Information Collection Requirements

On March 31, 1983, the Office of Management and Budget (OMB) published a new 5 CFR Part 1320, implementing the information collection provisions of the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.* (48 FR 13666). Part 1320, which became effective on April 30, 1983, sets forth procedures for agencies to follow in obtaining OMB clearance not later than the date of publication of the proposal in the **Federal Register** for collection of information requirements contained in proposed rules. It also requires agencies to include a statement in the notice of proposed rulemaking indicating that such information requirements have been submitted to OMB for review under section 3504(h) of the Paperwork Reduction Act.

In addition to the above requirements, applicable federal regulations also provide, 5 CFR 1320 4(a), 1320.5(a), and 1320.5(d), respectively, as follows:

An agency shall not engage in a collection of information without obtaining Office of Management and Budget (OMB) approval of the collection of information and displaying a currently valid control number and, unless OMB determines it to be inappropriate, an expiration date. * * *

Notwithstanding any other provision of law, no person shall be subject to any penalty for failure to comply with any information collection request if the request does not display a currently valid OMB control number, or, in the case of an information collection request which is submitted to nine or fewer persons, the request fails to state that for this reason it is not subject to OMB review under the Act.* * *

Whenever a member of the public is protected from imposition of a penalty under this section for failure to comply with a collection of information, such penalty may not be imposed by an agency directly, by an agency through judicial process, or by any other person through judicial or administrative process.* * *

The proposed PELs update standard will create no additional recordkeeping requirements.

In accordance with the provisions of the Paperwork Reduction Act and the regulations issued pursuant thereto, OSHA certifies that it will submit the information collection requirements contained in its proposed update of the air contaminants rule on to OMB for review under section 3504(h) of that Act. Comments on these information collection requirements may be submitted by interested persons to the Office of Information and Regulatory Affairs of OMB, Attention: Desk Officer for OSHA.

VII. Summary and Explanation of the Proposed Standard.

Table Z-4 in the standard includes proposed new exposure limits for 428 substances. These include approximately 220 substances for which OSHA has exposure limits and approximately 205 substances for which OSHA has not specified exposure limits prior to this proposal.

OSHA is republishing Tables Z-1, Z-2, and Z-3 which include most existing

OSHA exposure limits. Asterisks have been placed next to the substances which OSHA proposes to remove from those tables. All these substances have been incorporated in Table Z–4 with new exposure limits. Table Z–4 lists the proposed permissible exposure limits for 428 substances. This includes the eleven substances for which increased PELs were considered and two substances for which deleting skin notations were considered, but for which no changes were made. Table VII–C lists 44 substances in which 2 alternate permissible exposure limits, based on the NIOSH–PELs and ACGIH TLVs, were evaluated. Part I–D of the preamble explains the basis for the choice of these two data bases. The OSHA recommended PEL is underlined in this Table. For most substances noted as changes in Table Z–4 the TWA limit is either lower or remains the same but there is a change, or there is an addition or deletion of a STEL or Ceiling limit. For one substance, the TWA has been raised.

The policy reasons for this proposal are explained in Part I of the preamble. The health basis of the new exposure limits are explained in Part IV. The feasibility analysis for the proposal is summarized in part V.

OSHA's preliminary conclusion that the proposed limits noted in Table Z–4 substantially reduce significant risk and are feasible, is based on the analysis in those parts.

Initially, OSHA is proposing these new limits for general industry. Additional consideration and consultation is needed to determine their applicability to other sectors (e.g., construction, maritime, and agriculture). To attempt to consider these sectors in this rulemaking would delay this important proceeding. OSHA is commencing that consultation for the construction sector. See Part I–H of the preamble for further discussion of this subject.

As a matter of form, the final regulation may delete those substances in the Table Z–4 from Tables Z–1, Z–2, and Z–3 rather than republishing them with asterisks. However, Part 1917, Marine Terminals, references the existing Tables Z–1, Z–2 and Z–3 which OSHA is not proposing to change in this proceeding. Therefore, OSHA may publish the final rule in the same format as the proposal so that there will be published current CFR exposure limits for Marine Terminals. In that case the asterisk will refer to limits only applicable to marine terminals. Suitable changes will be made in the language of 29 CFR 1910.1000 to indicate this. An alternative would be to republish the existing Tables Z–1, Z–2 and Z–3 in Part 1917 until such time as a proceeding to update them is completed.

OSHA is adding a new paragraph (d) to § 1910.1000. The old paragraph (d) is redesignated paragraph (f). That paragraph states that employers must not expose employees over the limits specified in Table Z–4. It defines TWA, STEL and Ceiling limits and indicates skin absorption should be prevented for substances so identified in Table Z–4.

OSHA is not considering any changes to paragraphs (a), (b), (c) and (e) in this rulemaking. Certain format changes have been made to redesignated paragraph (f) to clarify that the formulas for multiple exposure applies to substances listed in Table Z–4, substances specified standards listed in Sections 1910.1001–1047 as well as Tables Z–1, Z–2 and Z–3. OSHA interprets the existing language as having the same intent. OSHA is not reopening consideration of the formulas in redesignating paragraph (f).

A slight format change is also made in the introductory text of § 1910.1000 to reflect that Table Z–4 has been added.

The term "material" was used in the standard; it is equivalent to the term "substance" as used in the preamble.

The standard provides an explanation of skin notation and definitions of the following terms used in Table Z–4: Time Weighted Average (TWA). Short Term Exposure Limit (STEL) and Ceiling.

The standard states in paragraph 3.(2):

(2). An employee's skin exposure to materials listed in table Z–4 with an "S" Notation shall be limited through the use of gloves, coveralls, goggles, or other appropriate personal protection equipment or method necessary to prevent possible skin absorption.

The skin notation is used where the substance may be absorbed through the skin. It also may be used where skin contact could damage or irritate the skin. This sub-paragraph indicates for those substances, methods must be used to limit skin exposure. As the language indicates it may be limited through use of appropriate personal protection equipment. Appropriate engineering controls or work practices may also be used. No specific order of priority is stated.

The standard states in paragraph 3.(3):

(3). The following definitions apply to paragraph (d) of this section and Table Z–4:

(i) Time weighted average (TWA) is the average airborne exposure of an employee in any 8-hour work shift of a 40-hour work week which shall not be exceeded.

(ii) Short term exposure limit (STEL) is the employee's 15-minute time-weighted average exposure which shall not be exceeded at any time during a work day. This applies even if the eight hour time-weighted average is within the TWA.

(iii) Ceiling is the employee's exposure which shall not be exceeded during any part of the work day. If instantaneous monitoring is not feasible, then the ceiling shall be assessed by sampling over a 15-minute period as would be done for a STEL, unless a different time period is specifically indicated.

OSHA intends that the effective date of new exposure limits issued in final form based on this proposal shall be 90 days after the date of publication in the Federal Register. This is set forth in section 6(b)(4) of the OSH Act.

In addition, OSHA has set forth start-up dates for most of its health standards. It takes time for employers to evaluate exposures and purchase, install and make operable equipment to control such exposures.

In the case of this proposed standard, start-up dates need to be sufficient to take into account the fact that many employers will have to evaluate and make operable controls for several different chemicals. This may require more time than would be necessary for only one chemical.

OSHA believes that 6 months from the date of publication is a reasonable time to evaluate exposures and come into compliance with any combination of respirators, work practices and engineering controls. OSHA standards generally have had a period of approximately this length or shorter where compliance with an exposure limit was to be achieved with any suitable combination of controls. See, for example, the benzene standard, 29 CFR 1910.1028(m)(2), 52 FR 34460, 345676 (September 11, 1987) and the formaldehyde standard, 29 CFR 1910.1048(p)(2)(iv), 52 FR 46168, 46296 (December 4, 1987). OSHA experience is that the 6 month period is appropriate and sufficient to come into compliance with any combination of controls. Comment is requested.

OSHA has also generally provided a more extended period to come into compliance using the hierarchy of controls contained in 29 CFR 1910.1000(e), with its preference for engineering and work practice controls. It takes more time, in general, to plan, purchase equipment, install and make operational engineering controls than to implement other types of control strategies. Examples of representative phase-in periods include 1 to 10 years (depending on the sector) for the lead standard, 29 CFR 1910.1025(e), 4 years for the cotton dust standard, 29 CFR 1910.1043(m), 2 years for the benzene standard, 29 CFR 1910.1028(m)(2)(ii) and 14 months for the formaldehyde

standard, 29 CFR 1910.1048(p)(2)(v). These dates have varied depending upon OSHA estimates of the difficulties involved. OSHA's experience has been that generally the times proposed here have been sufficient. See the detailed analysis reported in the cotton dust standard, 50 FR 51164, December 13, 1985.

In the case of this proposal, OSHA estimates that compliance can be reasonably achieved by all employers, including those who would have to control exposures for several different chemicals, within 4 years, using the present hierarchy of controls. OSHA requests comment on this estimate.

OSHA will be shortly publishing a Federal Register notice requesting public comment on the hierarchy of controls currently contained in 29 CFR 1910.1000(e). Based on comment, evidence and data received during the course of that rulemaking, it is possible that changes in the hierarchy may be made. If more flexibility were to be permitted in the use of engineering controls, a shorter period to come into compliance with the new exposure limits might be appropriate. On the other hand, during the period of uncertainty about the outcome of the methods of compliance rulemaking, employers seeking to comply with the new exposure limits may install controls under the existing hierarchy that may turn out later not to be required. Accordingly, it may be appropriate to set a start-up time for installing engineering controls that is contingent on the completion date of the methods of compliance rulemaking.

OSHA requests public comment on the approach it should follow and the period it should set for coming into compliance under the hierarchy of controls. OSHA is not requesting comment in this rulemaking on what the hierarchy of controls should be.

For some substances OSHA is tentatively using the 10-hour TWA given in the NIOSH-RELs as a proposed PEL. It should be noted that NIOSH generally refers in its criteria document for airborne concentration of a substance as a "time-weighted average (TWA) exposure for up to a 10-hour work shift in a 40-hour work week." OSHA preliminarily concludes that this is equivalent to the OSHA definition of an 8-hour work shift for a 40-hour work week. OSHA requests comments on this approach.

NIOSH REL ceiling values are based on time intervals which range from instantaneous to 120 minutes. Most of these REL ceilings have been established for a 15-minute period. OSHA proposes that PELs based on REL ceilings of 10, 15, and 20 minutes all be considered as 15-minute PELs in order to achieve greater uniformity and simplicity in the standards. OSHA is also considering treating the 30-minute, 60-minute and 120-minute ceilings in the same way. OSHA invites comments on these two approaches.

OSHA also recognizes that ceiling limits as defined by the ACGIH-TLV committee may represent a permissible exposure based on instantaneous measurement, or an exposure over a 15-minute period, if instantaneous monitoring is not feasible. The ACGIH-TLV committee defined a STEL as a 15-minute measurement. Therefore, some of the ceiling limits can be equivalent to STELs. OSHA will consider adopting the 15-minute period for many of the proposed PELs based on TLV ceiling values in order to achieve greater uniformity and simplicity in the standard. OSHA invites comments on this modification of the definition of a TLV ceiling, and the possible use of two alternate monitoring procedures (instantaneous and 15-minute) for substances having a PEL ceiling.

It should be noted that OSHA is not proposing to change exposure limits for the 24 substances regulated in §§ 1910.1000 to 1910.1047. These limits have previously been issued in section 6(b) rulemakings where their health effects and feasibility have been fully considered. Table VII-A lists those substances. Some of those substances remain listed unchanged in Tables Z-1, Z-2 and Z-3 as well. Those listings apply in limited particular circumstances specified by footnotes.

OSHA is also not proposing to change exposure limits for 9 other substances on Tables Z-1, Z-2 and Z-3 for which ACGIH or NIOSH have recommended different exposure limits. OSHA plans to regulate those substances (such as cadmium) in the near future in individual section 6(b) rulemakings because of the importance of the substance, or the need to fully evaluate the substance individually in determining the level to be set. Those substances are listed in Section VII, Table VII-B.

OSHA is also *not* proposing to change the limits for 160 substances for which the OSHA PEL's and the 1987-88 ACGIH TLV's are identical. Table VII-D lists these substances.

To summarize other sections of the preamble, OSHA reviewed some fourteen (14) data bases in developing an approach to updating the permissible exposure limits (PELs). These data bases included those developed by professional organizations, private-sector corporations, international bodies, governments and government agencies. In making a preliminary selection, the sources of standards were evaluated for the following criteria: Comprehensiveness, currentness, process setting procedures, feasibility, review process, applicability and documentation for each substance.

OSHA has preliminarily concluded that ACGIH-TLV is the most extensive source when compared to a number of other sources, and that it satisfies all the additional criteria established for this effort. OSHA has also preliminarily concluded that NIOSH's recommended exposure limits, while less extensive, should also be considered in the proposal. Thus, the ACGIH-TLVs and NIOSH-RELs will be discussed in order to present the OSHA basis for setting the new proposed PELs.

The ACGIH-TLV's are the most comprehensive of all the examined lists. Currently, over 600 substances are covered and TWA's, STELs, ceilings and skin notations are included where appropriate. The limits developed by the ACGIH TLV committee are applicable to U.S. industry conditions, and feasibility is generally considered.

The ACGIH-TLV process includes multiple professional review, and documentation is included for every recommendation. This documentation includes a discussion of the toxicological data underlying the limit, a description of the exposure limits set for the chemical by NIOSH and other sources, and a statement of the rationale for selecting a particular limit. In some cases, the ACGIH-TLV documentation lacks optimal depth of detail, but in all cases it is possible to determine what AGCIH judges to be the most directly relevant toxicological data. While some documentation is anecdotal or contained in personal communication, this is generally only one component of the total basis for recommending the TLVs. Recently, Castleman and Ziem (1987-1988) and Samuels (1987) have been critical of the TLV's committee's procedures and documentation because a number of references have been based on personal communication and they believe industry representatives on the TLV Committee have had too much influence. It should be noted that voting members of ACGIH must be employed by governments or educational institutions. Industry employees do not vote.

On the basis of all evidence, OSHA makes a preliminary conclusion that the TLVs established by the ACGIH constitute the best available *starting point* for revisions of existing PEL's. This establishes the *bounds* of the substances

to be considered in this proposal as those substances where the 1987–88 TLVs differ from the existing OSHA PELs.

OSHA will also consider the NIOSH–REL's in setting new PEL's in this rulemaking. The NIOSH–RELs are well documented and their RELs are set with U.S. workplaces in mind. NIOSH explains the basis for its limits in criteria documents or in Current Intgelligence Bulletins.

OSHA has considered more than 160 NIOSH–RELs and classified the RELs according to the following preliminary assumptions:

1. OSHA has excluded RELs for substances for which the OSHA comprehensive standards exist. The comprehensive standards had been previously reviewed and analyzed under 6(b) rulemaking process (Tab1e VII–A.).

2. OSHA has excluded RELs for substances which are in various stages of OSHA rulemaking (Table VII–B).

3. OSHA has identified 9 substances for which the existing OSHA–PELs, NIOSH RELs, and ACGIH TLVs are identical. These substances are exempted from the new proposal and are included in Tables Z–1, Z–2, and Z–3 without the asterisk. The 9 substances are: Antimony and compounds, benzoyl peroxide, carbaryl, carbon black, diacetone alcohol, dinitrocresol, fluoride, nitrioc oxide and sulfuric acid.

4. OSHA has identified 11 substances for which the RELs and the TLVs are different, but the TLV and PEL are the same. OSHA has also identified 19 substances which have RELs, but have no corresponding TLVs or PELs. OSHA has preliminarily decided to exclude these 30 substances from this standard. This is in line with OSHA's discussion in Section I–D which limits this proposal to those substances where 1987–88 ACGIH TLVs exist and differ from the existing PEL.

5. OSHA has identified 8 substances for which the RELs equal the TLVs. They are listed in Table Z–4 as proposed PELs and are identified by footnote C.

6. OSHA has identified 44 substances for which significant differences between the RELs and the TLVs exist. Table VII–C lists 44 substances in which two alternate permissible exposure limits are proposed, based on the NIOSH–RELs and the ACGIH–TLVs. OSHA identified 35 substances for which the RELs are lower than the TLVs (Table I–F–A) and 9 substances in which the RELs are higher than TLVs (Table I–F–B). These were evaluated on an individual substance basis and the proposed PEL is listed in Table Z–4. The OSHA proposed PEL is also underlined in Table VII–C.

7. OSHA has identified 15 substances for which the TWA for the RELs and the TLVs are identical, but differences exist in the STEL or Ceiling limit. OSHA has preliminarily concluded that this is a minor difference and therefore is using the TLV limits which are included in Table Z–4. This preliminary approach is based on the fact that the existing PEL's are based on 1967–68 TLV's, and the approach used in this proposal should follow that baseline unless significant differences exist.

8. OSHA has identified 16 substances for which the TWA TLV or TWA REL equals the STEL/Ceiling; the TWA, TLV or REL equals ½ STEL; or the TWA, TLV or REL are within 10%. OSHA has preliminarily concluded that these are minor differences and has selected the available TWA limit. The 16 substances in this group are included in Table Z–4.

OSHA has also identified a number of substances which require special attention because of differences in the allowable exposure guidelines compared to the other sets of limits reviewed or other special circumstances. OSHA has identified several alternatives for dealing with these situations.

For its discussion of health effects OSHA has preliminarily grouped each substance on the basis of the TLV documentation. The substances are divided into 15 generic groups. These are: Neurophatic effects, narcotic effects, sensory irritants, liver and kidney effects, occular effects, adverse respiratory effects, cardiovascular effects, systemic effects, no observed effects, nuisance potential, odor and taste effects, analogy, biochemical and metabolic effects, sensitizers, and carcinogenic effects. The OSHA analysis also considered three special categories concerned with: Change only to the STEL; change regarding skin designation in the TLV; and situations where the TLV is greater than the existing PEL.

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TABLE VII A. Substances Regulated by OSHA Under Section 6(b)

CHEMICAL NAME	STANDARD
2-Acetylaminofluorine	1910.1014
Acrylonitrile	1910.1045
4-Aminodiphenyl	1910.1011
Arsenic (Inorganic)	1910.1018
Asbestos	1910.1001
Benzene	1910.1028
Benzidine	1910.1010
Bis-Chloromethyl Ether	1910.1008
Coke Oven Emissions	1910.1029
Cotton Dust	1910.1043
1,2 Dibromo 3 Dichloropropane	1910.1049
3,3' Dichlorobenzidine	1910.1007

TABLE VII A. Substances Regulated by OSHA Under Section 6(b)

CHEMICAL NAME	STANDARD
4 Dimethylaminoazobenzene	1910.1015
Ethylene Oxide	1910.1047
Ethyleneimine	1910.1012
Formaldehyde	1910.1046
Lead	1910.1025
Methyl Chloromethyl Ether	1910.1006
2 Naphthylamine	1910.1004
3 Naphthylamine	1910 1009
4 Nitrobiphenyl	1910.1003
n Nitrosodimethylamine	1910.1016
b Propiolactone	1910.1013
Vinyl Chloride	1910 1017

TABLE VII B. Substances for Which OSHA Has Initiated 6(b) Rulemaking

CHEMICAL NAME	STANDARD
1,3 Butadiene	
Cadmium Dust and Fume	
2 Ethoxyethanol (Cellosolve)	
2 Ethoxyethyl Acetate	
Ethylene Dibromide	
Methyl Cellosolve	
Methyl Cellosolve Acetate	
Methylene Chloride	
4,4' Methylenedianiline	

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit*

H.S. No.	Chemical Name	CAS No.	ACGIH TLV[R]** TWA	ACGIH TLV[R]** STEL	ACGIH TLV[R]** Ceiling	NIOSH REL*** TWA	NIOSH REL*** Ceiling
1004	Acetone	67-64-1	750 ppm	1000 ppm	--	250 ppm	--
1005	Acetonitrile	75-05-8	40 ppm	60 ppm	--	20 ppm	--
1008	Acrylamide	79-06-1	0.03 mg/m^3, Skin	--	--	0.3 mg/m^3	--
1021	Ammonia	7664-41-7	25 ppm	35 ppm	--	--	50 ppm (5 min)
1033	Beryllium and Compounds[+]	7440-41-7	0.002 mg/m^3	--	--	--	0.0005 mg/m^3
1052	n-Butyl Glycidyl Ether	2426-08-6	25 ppm	-	--	--	5.6 ppm (15 min)
1069	Carbon Dioxide	124-38-9	5000 ppm	30,000 ppm	--	10,000 ppm	30,000 ppm (10 min)
1070	Carbon Disulfide	75-15-0	10 ppm	--	--	1 ppm	10 ppm (15 min)

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit* (Continued)

H.S. No.	Chemical Name	CAS No.	ACGIH TLV[R]** TWA	ACGIH TLV[R]** STEL	ACGIH TLV[R]** Ceiling	NIOSH REL*** TWA	NIOSH REL*** Ceiling
1071	Carbon Monoxide	630-08-0	50 ppm	400 ppm	—	35 ppm	200 ppm (no defined time)
1073	Carbon Tetrachloride	56-23-5	5 ppm, Skin	--		--	2 ppm (60 min)
1079	Chlorine	7782-50-5	1 ppm	3 ppm	--	--	0.5 ppm (15 min)
1086	Chloroform	67-66-3	10 ppm	--	--	—	2 ppm (60 min)
1088	Chloroprene	126-099-8	10 ppm, Skin	--	--	--	1 ppm (15 min)
1192	Chromic Acid and Chromates+ (Non-carcinogenic)	7738-94-5	0.05 mg/m^3	--	—	0.025 mg/m^3	—
1192	Chromic Acid and Chromates+ (Carcinogenic)	7738-94-5	0.05 mg/m^3	—	--	0.001 mg/m^3	—

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit* (Continued)

H.S. No.	Chemical Name	CAS No.	ACGIH TLV[R]** TWA	ACGIH TLV[R]** STEL	ACGIH TLV[R]** Ceiling	NIOSH REL*** TWA	NIOSH REL*** Ceiling
1145	Dioxane	123-91-1	25 ppm, Skin	--	--	--	1 ppm (30 min)
1168	Ethylene Dichloride	107-06-2	10 ppm	--	--	1 ppm	2 ppm (15 min)
1170	Ethylene Glycol Dinitrate	628-96-6	0.05 ppm, Skin	--	--	--	$0.1\ mg/m^3$ (20 min)
1178	Fibrous Glass Dust	--	$10\ mg/m^3$	--	--	$5\ mg/m^3$	--
1184	Furfuryl Alcohol	98-00-0	10 ppm, Skin	15 ppm	--	50 ppm	--
1194	n-Heptane	142-82-5	400 ppm	500 ppm	--	85 ppm	440 ppm (15 min)
1200	n-Hexane	110-54-3	50 ppm	--	--	100 ppm	510 ppm (15 min)
1201	Hexane Isomers	--	500 ppm	1000 ppm	--	100 ppm	510 ppm (15 min)

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit* (Continued)

H.S. No.	Chemical Name	CAS No.	ACGIH TLV[R]** TWA	ACGIH TLV[R]** STEL	ACGIH TLV[R]** Ceiling	NIOSH REL*** TWA	NIOSH REL*** Ceiling
1202	2-Hexanone	591-78-6	5 ppm	--	--	1 ppm	--
1205	Hydrazine	302-01-2	0.1 ppm, Skin	-	--	--	0.03 ppm (120 min)
1207	Hydrogen Cyanide	74-90-8	--	--	10 ppm, Skin	--	4.7 ppm (10 min)
1222	Isophorone Diisocyanate	4098-71-9	0.09 mg/m^3	--	--	0.045 mg/m^3	0.18 mg/m^3 (10 min)
1235	Malathion	121-75-5	10 mg/m^3, Skin	--	--	15 mg/m^3	--
1240	Mercury (Aryl and Inorganic Compounds)+	7439-97-6	0.1 mg/m^3, Skin	--	--	0.05 mg/m^3	--
1243	Mesityl Oxide	141-79-7	15 ppm	25 ppm	--	10 ppm	--

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit* (Continued)

H.S. No.	Chemical Name	CAS No.	ACGIH TLV[R]** TWA	ACGIH TLV[R]** STEL	ACGIH TLV[R]** Ceiling	NIOSH REL*** TWA	NIOSH REL*** Ceiling
1264	Methyl n-Amyl Ketone[+]	110-43-0	50 ppm	--	--	100 ppm	—
1283	Nickel (Soluble Compounds)	7440-02-0	0.1 mg/m^3	--	--	0.015 mg/m^3	—
1289	Nitrogen Dioxide	10102-44-0	3 ppm	5 ppm	--	—	1 ppm (15 min)
1290	Nitroglycerin	55-63-0	0.5 mg/m^3, Skin	--	--	—	0.1 mg/m^3 (20 min)
1296	Octane	111-65-9	300 ppm	375 ppm	—	75 ppm	385 ppm (15 min)
1306	Pentane	109-66-0	600 ppm	750 ppm	--	120 ppm	610 ppm (15 min)
1307	2-Pentanone (Methylpropyl ketone)	107-89-9	200 ppm	250 ppm	--	150 ppm	--

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit* (Continued)

H.S. No.	Chemical Name	CAS No.	ACGIH TLV[R]** TWA	ACGIH TLV[R]** STEL	ACGIH TLV[R]** Ceiling	NIOSH REL*** TWA	NIOSH REL*** Ceiling
1312	Petroleum Distillates (Naphtha)	--	1600 mg/m^3	--	--	350 mg/m^3	1800 mg/m^3 (15 min)
1317	Phenylhydrazine	100-63-0	5 ppm, Skin	10 ppm	--	--	0.14 ppm (120 min)
1355	Silica, Crystalline Quartz, Respirable	14808-60-7	0.1 mg/m^3	--	--	0.05 mg/m^3	--
1371	Stoddard Solvent	8052-41-3	100 ppm (525 mg/m^3)	--	--	350 mg/m^3	1800 mg/m^3 (15 min)
1375	Sulfur Dioxide	7446-09-5	2 ppm	5 ppm	--	0.5 ppm	--

TABLE VII-C. Substances for Which OSHA Considered Proposing Either the ACGIH or NIOSH Limit* (Continued)

H.S. No.	Chemical Name	CAS No.	ACGIH TLV^{R}**			NIOSH REL***	
			TWA	STEL	Ceiling	TWA	Ceiling
1406	Trichloroethylene	79-01-6	50 ppm	200 ppm	--	<u>25 ppm</u>	—
1424	Vinyl Acetate	108-05-4	<u>10 ppm</u>	<u>20 ppm</u>	--	—	4 ppm (15 min)
1436	Zinc Chromates (CrVI)+	13530-65-9	0.05 mg/m^3	--	—	0.001 mg/m^3	—

* Underlined values indicate the limits being proposed by OSHA.

** The ACGIH TWA-TLV is for an 8-hour exposure; its STELs are 15-minute limits not to be exceeded more than 4 times per day with a minimum of 60 minutes between successive STEL exposures; and its ceilings are peaks not to be exceeded for any period of time.

*** NIOSH TWA limits are for 10-hour exposures unless otherwise specified, and its ceilings are peaks not to be exceeded for any period of time unless a duration is specified in parentheses.

+ OSHA is not proposing to revise its current limit at the present time.

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
ACETYLENE TETRABROMIDE	1	-	-	-	-	-	-
ALDRIN	-	0.25	-	-	-	-	S
2-AMINOPYRIDINE	0.5	-	-	-	-	-	-
N-AMYL ACETATE	100	-	-	-	-	-	-
SEC-AMYL ACETATE	125	-	-	-	-	-	-
ANISIDINE (O,P ISOMERS)	-	0.5	-	-	-	-	S
ANTIMONY & COMPOUNDS	-	0.5	-	-	-	-	-
ANTU	-	0.3	-	-	-	-	-
ARSINE	0.05	-	-	-	-	-	-
ARSENIC, ORGANIC COMPOUNDS	0.5	-	-	-	-	-	-
AZINPHOS-METHYL	-	0.2	-	-	-	-	S
BARIUM (SOLUBLE COMPOUNDS)	-	0.5	-	-	-	-	-
BENZOYL PEROXIDE	-	5	-	-	-	-	-
BENZYL CHLORIDE	1	-	-	-	-	-	-
BIPHENYL (DIPHENYL)	0.2	-	-	-	-	-	-
BORON TRIFLUORIDE	-	-	-	-	1	-	-
BROMOFORM	0.5	-	-	-	-	-	S
SEC-BUTYL ACETATE	200	-	-	-	-	-	-
TERT-BUTYL ACETATE	200	-	-	-	-	-	-
TERT-BUTYL CHROMATE	-	-	-	-	-	0.1	S
BUTYLAMINE	-	-	-	-	5	-	S

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
CARBARYL (SEVIN)	-	5	-	-	-	-	-
CARBON BLACK	-	3.5	-	-	-	-	-
CHLORDANE	-	0.5	-	-	-	-	S
CHLORINATED DIPHENYL OXIDE	-	0.5	-	-	-	-	-
CHLORINE TRIFLUORIDE	-	-	-	-	0.1	-	-
CHLOROACETALDEHYDE	-	-	-	-	1	-	-
ALPHA-CHLOROACETOPHENONE	0.05	-	-	-	-	-	-
CHLOROBENZENE	75	-	-	-	-	-	-
CHLOROBROMOMETHANE	200	-	-	-	-	-	-
CHLORODIPHENYL 42% (AROCLOR 1242)	-	1	-	-	-	-	S
CHLORODIPHENYL 54% (AROCLOR 1254)	-	0.5	-	-	-	-	S
CHLOROPICRIN	0.1	-	-	-	-	-	-
CHROMIUM, SOL.CHROMIC, CHROMOUS	-	0.5	-	-	-	-	-
COAL TAR PITCH VOLATILES	-	0.2	-	-	-	-	-
COPPER (DUSTS & MISTS)	-	1	-	-	-	-	-
CRESOL (ALL ISOMERS)	5	-	-	-	-	-	S
CROTONALDEHYDE	2	-	-	-	-	-	-
CUMENE	50	-	-	-	-	-	S
CYANIDES	-	5	-	-	-	-	S
CYCLOHEXANE	300	-	-	-	-	-	-
CYCLOHEXENE	300	-	-	-	-	-	-

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
CYCLOPENTADIENE	75	-	-	-	-	-	-
DEMETON	-	0.1	-	-	-	-	S
2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)	-	10	-	-	-	-	-
DDVP (DICHLORVOS)	-	1	-	-	-	-	S
DIACETONE ALCOHOL	50	-	-	-	-	-	-
DIAZOMETHANE	0.2	-	-	-	-	-	-
DIBORANE	0.1	-	-	-	-	-	-
DIBUTYLPHTHALATE	-	5	-	-	-	-	-
O-DICHLOROBENZENE	-	-	-	-	50	300	-
DICHLORODIFLUOROMETHANE	1000	-	-	-	-	-	-
1,2-DICHLOROETHYLENE	200	-	-	-	-	-	-
DICHLOROTETRAFLUOROETHANE	1000	-	-	-	-	-	-
DIELDRIN	-	0.25	-	-	-	-	S
DIETHYLAMINOETHANOL	10	-	-	-	-	-	S
DIFLUORODIBROMOMETHANE	100	-	-	-	-	-	-
DIISOPROPYLAMINE	5	-	-	-	-	-	S
DIMETHYL ACETAMIDE	10	-	-	-	-	-	S
DIMETHYLAMINE	10	-	-	-	-	-	-
DIMETHYLFORMAMIDE	10	-	-	-	-	-	S
1,1-DIMETHYLHYDRAZINE	0.5	-	-	-	-	-	S

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
DIMETHYLPHTHALATE	-	5	-	-	-	-	-
DINITRO-O-CRESOL	-	0.2	-	-	-	-	S
DINITROBENZENE (ALL ISOMERS)	-	1	-	-	-	-	S
DINITROTOLUENE	-	1.5	-	-	-	-	S
ENDRIN	-	0.1	-	-	-	-	S
EPN	-	0.5	-	-	-	-	S
ETHYL ACETATE	400	-	-	-	-	-	-
ETHYL ALCOHOL	1000	-	-	-	-	-	-
ETHYL BUTYL KETONE	50	-	-	-	-	-	-
ETHYL CHLORIDE	1000	-	-	-	-	-	-
ETHYL FORMATE	100	-	-	-	-	-	-
ETHYL SEC-AMYL KETONE	25	-	-	-	-	-	-
ETHYLAMINE	10	-	-	-	-	-	-
ETHYLENEDIAMINE	10	-	-	-	-	-	-
FLUORIDE (AS F)	-	2.5	-	-	-	-	-
FORMIC ACID	5	-	-	-	-	-	-
HAFNIUM	-	0.5	-	-	-	-	-
HEPTACHLOR	-	0.5	-	-	-	-	S
HEXACHLORONAPHTHALENE	-	0.2	-	-	-	-	S
SEC-HEXYL ACETATE	50	-	-	-	-	-	-
HYDROGEN CHLORIDE	-	-	-	-	5	-	-

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
HYDROGEN PEROXIDE (90%)	1	-	-	-	-	-	-
HYDROGEN SELENIDE	0.05	-	-	-	-	-	-
HYDROQUINONE	-	2	-	-	-	-	-
IODINE	-	-	-	-	0.1	-	-
ISOAMYL ACETATE	100	-	-	-	-	-	-
ISOBUTYL ACETATE	150	-	-	-	-	-	-
L.P.G.	1000	-	-	-	-	-	-
LINDANE	-	0.5	-	-	-	-	S
LITHIUM HYDRIDE	-	0.025	-	-	-	-	-
MALEIC ANHYDRIDE	0.25	-	-	-	-	-	-
MANGANESE DUST AND COMPOUNDS	-	-	-	-	-	5	-
METHYL ACETYLENE (PROPYNE)	1000	-	-	-	-	-	-
METHYL ACRYLATE	10	-	-	-	-	-	S
METHYL ISOCYANATE	0.02	-	-	-	-	-	S
METHYL METHACRYLATE	100	-	-	-	-	-	-
METHYLAL(DIMETHOXYMETHANE)	1000	-	-	-	-	-	-
METHYLENE BISPHENYL ISOCYANATE (MDI)	-	-	-	-	0.02	0.2	-
METHYLAMINE	10	-	-	-	-	-	-
MOLYBDENUM (SOLUBLE COMPOUNDS)	-	5	-	-	-	-	-
MONOMETHYL HYDRAZINE	-	-	-	-	0.2	-	S

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
NAPHTHA (COAL TAR)	100	-	-	-	-	-	-
NICKEL (METAL)	-	1	-	-	-	-	-
NICOTINE	-	0.5	-	-	-	-	S
NITRIC OXIDE	25	-	-	-	-	-	-
NITROBENZENE	1	-	-	-	-	-	S
NITROETHANE	100	-	-	-	-	-	-
NITROGEN TRIFLUORIDE	10	-	-	-	-	-	-
NITROMETHANE	100	-	-	-	-	-	-
1-NITROPROPANE	25	-	-	-	-	-	-
NUISANCE DUST, RESPIRABLE	-	5	-	-	-	-	-
PARATHION	-	0.1	-	-	-	-	S
PENTACHLORONAPHTHALENE	-	0.5	-	-	-	-	S
PENTACHLOROPHENOL	-	0.5	-	-	-	-	S
PERCHLOROMETHYL MERCAPTAN	0.1	-	-	-	-	-	-
PHENOL	5	-	-	-	-	-	S
PHENYL ETHER, BIPHENYL MIXTURE	1	-	-	-	-	-	-
P-PHENYLENE DIAMINE	-	0.1	-	-	-	-	S
PHOSGENE	0.1	-	-	-	-	-	-
PHOSPHORUS (YELLOW)	-	0.1	-	-	-	-	-
PHOSPHORUS PENTACHLORIDE	-	1	-	-	-	-	-
PINDONE	-	0.1	-	-	-	-	-

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
PLATINUM (SOLUBLE SALTS)	-	0.002	-	-	-	-	-
PROPANE	1000	-	-	-	-	-	-
PROPYLENEIMINE	2	-	-	-	-	-	S
PYRETHRUM	-	5	-	-	-	-	-
PYRIDINE	5	15	-	-	-	-	-
QUINONE (P-BENZOQUINONE)	0.1	-	-	-	-	-	-
ROTENONE (COMMERCIAL)	-	5	-	-	-	-	-
SELENIUM AND COMPOUNDS	-	0.2	-	-	-	-	-
SELENIUM HEXAFLUORIDE	0.05	-	-	-	-	-	-
SILICA, CRYSTALLINE QUARTZ, TOTAL DUST	-	4.3	-	-	-	-	
SILVER, SOLUBLE COMPOUNDS	-	0.01	-	-	-	-	-
STIBINE	0.1	-	-	-	-	-	-
STRYCHNINE	-	0.15	-	-	-	-	-
SULFUR HEXAFLUORIDE	1000	-	-	-	-	-	-
SULFURIC ACID	-	1	-	-	-	-	-
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	-	10	-	-	-	-	-
TEDP (SULFOTEP)	-	0.2	-	-	-	-	S
TELLURIUM	-	0.1	-	-	-	-	-
TELLURIUM HEXAFLUORIDE	0.02	-	-	-	-	-	-

TABLE VII-D. Substances for Which OSHA Did Not Consider Changing Its Current Limits (Continued)

CHEMICAL NAME	8-HOUR TWA		15-MINUTE STEL		CEILING		SKIN
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
TEPP	-	0.05	-	-	-	-	S
1,1,2,2-TETRACHLORO-1, 2-DIFLUOROETHANE	500	-	-	-	-	-	-
1,1,1,2-TETRACHLORO-2, 2-DIFLUOROETHANE	500	-	-	-	-	-	-
TETRACHLORONAPHTHALENE	-	2	-	-	-	-	S
TETRAMETHYL SUCCINONITRILE	0.5	-	-	-	-	-	S
TETRANITROMETHANE	1	-	-	-	-	-	-
TETRYL	-	1.5	-	-	-	-	S
THALLIUM (SOLUBLE COMPOUNDS)	-	0.1	-	-	-	-	S
THIRAM	-	5	-	-	-	-	-
TIN (METAL AND INORGANIC COMPOUND)	-	2	-	-	-	-	-
1,1,2-TRICHLOROETHANE	10	-	-	-	-	-	S
TRICHLORONAPHTHALENE	-	5	-	-	-	-	S
TRIFLUOROMONOBROMOMETHANE	1000	-	-	-	-	-	-
TRIPHENYL PHOSPHATE	-	3	-	-	-	-	-
TURPENTINE	100	-	-	-	-	-	-
WARFARIN	-	0.1	-	-	-	-	-
YTTRIUM	-	1	-	-	-	-	-

BILLING CODE 4510-26-C

VIII. Public Participation—Public Hearings

Interested persons are invited to submit written data, views, and arguments with respect to OSHA'S proposed rule. These comments must be postmarked on or before July 8, 1988, and submitted in quadruplicate to the Docket Officer, Docket H–020, Room N–3670, U.S. Department of Labor, Washington, DC 20210, Tel. (202) 523–7894.

This rulemaking covers a large number of substances and industries. Therefore, to permit the public and OSHA to efficiently review the comments, it is necessary to specify the format of the comments in greater detail than normally required for OSHA rulemakings.

Comments on the general concept of the proposal shall be first and shall begin on a new page with the heading "General Comments"; the name of the commenter, and the commenter's SIC code or codes if a business.

Comments on individual substances shall follow. The comment on each substance shall start on a new page with a heading identifying the substance with the name and code number used in proposed Amended Table Z (Table I–E of the preamble; the HS code number, not the CAS number) and a second line identifying the comment as on "Health Issues" or on "Feasibility Issues." If there are comments on both they shall begin on separate pages with headings that identify the substances, and its code number and area of the comment. For feasibility comments, the heading should contain a third line identifying the SIC codes (preferably 4 digit) that the comment covers.

In addition the first or second page of each comment is to have a table of contents indicating the page number that the general comments begin and the page number that Health and Feasibility comments for each chemical individually discussed begin. Finally, one of the four sets of each comment received should not be stapled or bound, so that it can be easily copied. Written submissions must clearly identify the specific provisions of the proposal which are addressed and the position taken with respect to each issue.

The data, views and arguments that are submitted will be available for public inspection and copying at the above address. All timely submissions received will be made a part of the record of this proceeding. The preliminary regulatory impact assessment, regulatory flexibility assessment, and the exhibits cited in this document will be available for public inspection and copying at the above address.

In addition, the record currently contains many data bases of economic and health information identified in the bibliography. That information is also available for inspection and copying at the Docket Office. (Much of the information is on computer tape. OSHA will supply duplicate tapes for the copying charge).

Notice of Intention To Appear at the Informal Hearings

Pursuant to section 6(b)(3) of the OSHA Act, informal public hearings will be held on this proposal in Washington, DC commencing July 20, 1988, and continuing through August 5, 1988, or until such earlier date as oral presentations are completed. The hearing will commence at 9:30 a.m. in the auditorium of the Frances Perkins Building, U.S. Department of Labor, 3rd Street and Constitution Avenue NW., Washington, DC 20210.

Persons desiring to participate at the informal public hearing must file a notice of intention to appear by July 1, 1988. The notice of intention to appear must contain the following information:

1. The name, address, and telephone number of each person to appear;
2. The capacity in which the person will appear;
3. The approximate amount of time required for the presentation;
4. The issues and substances that will be addressed;
5. A brief statement of the position that will be taken with respect to each issue and substance addressed, and
6. Whether the party intends to submit documentary evidence and, if so, a brief summary of it.

The Notice of Intention to Appear shall be mailed to Mr. Thomas Hall, OSHA Division of Consumer Affairs, Docket No. H–020, U.S. Department of Labor, Room N–3647, 200 Constitution Avenue, NW., Washington, DC 20210, tel. (202) 523–8615, and shall be post-marked no later than July 1 1988.

Note.—This is a different address than that previously listed for docket submissions.

Filing of Testimony and Evidence Before the Hearing

Any party requesting more than ten (10) minutes for presentation at the informal public hearing, or who intends to submit documentary evidence, must provide in quadruplicate the testimony and evidence to be presented at the informal public hearing. The documentary evidence and testimony shall follow the format and include the headings and index required for comments. One copy shall not be stapled or bound and be suitable for copying. These materials must be provided to Mr. Thomas Hall, OSHA Division of Consumer Affairs at the address above and be post-marked no later than July 8, 1988.

Each submission will be reviewed in light of the amount of time requested in the Notice of Intention to Appear. In instances where the information contained in the submission does not justify the amount of time requested, a more appropriate amount of time will be allocated and the participant will be notified of that fact prior to the informal public hearings.

Any party who has not substantially complied with the above requirement may be limited to a ten-minute presentation and may be requested to return for questioning at a later time.

Any party who has not filed a notice of intention to appear may be allowed to testify for no more than 10 minutes as time permits, at the discretion of the Administrative Law Judge, but will not be allowed to question witnesses.

Notices of intention to appear, testimony and evidence will be available for inspection and copying at the Docket Office at the address above.

Conduct of Hearing

The informal public hearing will commence at 9:30 a.m. at the scheduled location with the resolution of any procedural matters relating to the hearing. The informal public hearing will be presided over by an Administrative Law Judge who will have the power necessary and appropriate to conduct a full and fair informal public hearing as provided in 29 CFR Part 1911, including the power to:

1. Regulate the course of the proceedings;
2. To dispose of procedural requests, objections and comparable matters;
3. To confine the presentation to the matters pertinent to the issues raised;
4. To regulate the conduct of those present at the informal public hearing by appropriate means;
5. In the Judge's discretion, to question and permit questioning of any witness; and
6. In the Judge's discretion, to keep the record open for a brief additional period to receive written information and additional data, views, and arguments from any person who has participated in the oral proceedings. It is intended that August 12, 1988 be the deadline for post hearing evidence and August 26, 1988 be the deadline for post hearing briefs.

Following the close of the informal public hearing, the presiding Administrative Law Judge will certify

the record of the informal public hearing to the Assistant Secretary of Labor for Occupational Safety and Health. The notice of proposed rulemaking will be reviewed in light of all testimony and written submissions received as part of the record, and the proposed standard will be modified or a determination will be made not to modify the proposed standard based on the entire record of the proceeding.

State Plan Applicability

The 25 states with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within six months of the publication date of a final standard. These States include: Alaska, Arizona, California, Connecticut (for State and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York (for State and local government employees only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, Wyoming. Until such time as a State standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate.

List of Subjects in 29 CFR Part 1910

Air contaminants, Occupational safety and health, Permissible exposure limits, Health, Risk assessment.

IX. Authority

This document has been prepared under the direction of John A. Pendergrass, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210. Pursuant to section 6 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655), section 4 of the Administrative Procedures Act (5 U.S.C. 551), 29 CFR Part 1911 and Secretary of Labor's Order 9-83 (48 FR 35736), it is proposed to amend 29 CFR Part 1910 as set forth below.

Signed at Washington, DC, this 26th day of May 1988.

John A. Pendergrass,

Assistant Secretary of Labor.

X. Standard

OSHA propose to amend 29 CFR Part 1910 as follows:

PART 1910—[AMENDED]

1. The authority citation for Subpart Z of Part 1910 would be amended by revising the third paragraph, and the first and second paragraphs are republished to read as follows:

Authority: Secs. 6, 8. Occupational Safety and Health Act, 29 U.S.C. 655, 657; Secretary of Labor's Orders 12-71 (36 FR 8754), 8-76 (41 FR 25059), or 9-83 (48 FR 35736) as applicable; and 29 CFR 1911.

Section 1910.1000 Tables Z-1, Z-2, and Z-3 also issued under 5 U.S.C. 553.

Section 1910.1000 paragraphs (a) through (c), (e), (f) and Tables Z-1, Z-2, Z-3, not issued under 29 CFR 1911 except for the arsenic, cotton dust, benzene and formaldehyde listings.

* * * * *

2. It is proposed to amend § 1910.1000 by revising the introductory text, redesignating paragraph (d) as paragraph (f) and revising introductory text of paragraph (f) and the last sentence of paragraph (f)(1)(i); adding a new paragraph (d); republishing Tables Z-1, Z-2 and Z-3 with an asterisk indicating the materials proposed to be removed and adding a new Table Z-4.

§ 1910.1000 [Amended]

An employee's exposure to any material listed in Tables Z-1, Z-2, Z-3 or Z-4 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

* * * * *

(d) Table Z-4 lists the proposed permissible exposure limits for 428 materials.

(1) An employee's exposure to any material listed in Table Z-4 shall not exceed the Time Weighted Average (TWA), Short Term Exposure Limit (STEL) or Ceiling specified in Table Z-4 for that material.

(2) An employee's skin exposure to materials listed in table Z-4 with an "S" Notation shall be limited through the use of gloves, coveralls, goggles, or other appropriate personal protection equipment necessary to prevent possible skin absorption.

(3) The following definitions apply to paragraph (d) of this section and Table Z-4:

(i) Time weighted average (TWA) is the average airborne exposure of an employee in any 8-hour work shift of a 40-hour work week which shall not be exceeded.

(ii) Short term exposure limit (STEL) is the employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a work day.

(iii) Ceiling is the employee's exposure which shall not be exceeded during any part of the work day. If instantaneous monitoring is not feasible, then the ceiling shall be assessed by sampling over a 15-minute period as would be done for a STEL, unless a different time period is specifically indicated.

* * * * *

(f) Computational formula. The computation formula which shall apply to employee exposure to more than 1 material for which 8 hour time weighted averages are listed in Subpart Z of 29 CFR Part 1910 in order to determine whether an employee is exposed over the regulatory limit is as follows:

(1)(i) * * * *

The value of E shall not exceed the 8-hour time weighted average specified in Subpart Z of 29 CFR Part 1910 for the material involved.

* * * * *

BILLING CODE 4510-26-M

TABLE Z-1

Substance	ppm[a]	mg/m^3[b]
ACETALDEHYDE*	200	360
ACETIC ACID*	10	25
ACETIC ANHYDRIDE*	5	20
ACETONE*	1000	2400
ACETONITRILE*	40	70
ACETYLENE DICHLORIDE, see 1,2-DICHLOROETHYLENE		
ACETYLENE TETRABROMIDE	1	14
ACROLEIN*	0.1	0.25
ACRYLAMIDE-Skin*		0.3
ALDRIN-Skin		0.25
ALLYL ALCOHOL-Skin*	2	5
ALLYL CHLORIDE*	1	3
C ALLYLGLYCIDYL ETHER (AGE)*	10	45
ALLYL PROPYL DISULFIDE*	2	12
2-AMINOETHANOL, see ETHANOLAMINE		
2-AMINOPYRIDINE	0.5	2
AMMONIA*	50	35
AMMONIUM SULFAMATE (AMMATE)*		15
N-AMYL ACETATE	100	525
SEC-AMYL ACETATE	125	650
ANILINE-Skin*	5	19
ANISIDINE (O,P-ISOMERS)-Skin		0.5
ANTIMONY AND COMPOUNDS(as Sb)		0.5
ANTU (ALPHA NAPTHYL THIOUREA)*		0.3
ARSENIC ORGANIC COMPOUNDS (as As)		0.5
ARSINE	0.05	0.2

TABLE Z-1

Substance	ppm[a]	mg/m^3[b]
AZINPHOS-METHYL-Skin*		0.2
BARIUM (SOLUBLE COMPOUNDS)		0.5
p-BENZOQUINONE, see QUINONE		
BENZOYL PEROXIDE		5
BENZYL CHLORIDE	1	5
BIPHENYL, see DIPHENYL		
BORON OXIDE*		15
C BORON TRIFLUORIDE	1	3
BROMINE*	0.1	0.7
BROMOFORM-Skin	0.5	5
BUTADIENE (1,3-BUTADIENE)	1000	2200
BUTANETHIOL, see BUTYL MERCAPTAN		
2-BUTANONE*	200	590
2-BUTOXY ETHANOL(BUTYL CELLOSOLVE)-Skin*	50	240
BUTYL ACETATE (N-BUTYL ACETATE)*	150	710
SEC-BUTYL ACETATE	200	950
TERT-BUTYL ACETATE	200	950
BUTYL ALCOHOL*	100	300
SEC-BUTYL ALCOHOL*	150	450
TERT-BUTYL ALCOHOL*	100	300
C BUTYLAMINE-Skin	5	15
C TERT-BUTYL CHROMATE (as CrO_3)-Skin		0.1
N-BUTYL GLYCIDYL ETHER*	50	270
BUTYL MERCAPTAN*	10	35
P-TERT-BUTYLTOLUENE*	10	60
CALCIUM OXIDE*		5
CAMPHOR*		2

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
CARBARYL (SEVIN)		5
CARBON BLACK		3.5
CARBON DIOXIDE*	5000	9000
CARBON MONOXIDE*	50	55
CHLORDANE-Skin		0.5
CHLORINATED CAMPHENE-Skin*		0.5
CHLORINATED DIPHENYL OXIDE		0.5
C CHLORINE*	1	3
CHLORINE DIOXIDE*	0.1	0.3
C CHLORINE TRIFLUORIDE	0.1	0.4
C CHLOROACETALDEHYDE	1	3
A-CHLOROACETOPHENONE (PHENACYLCHLORIDE)	0.05	0.3
CHLOROBENZENE (MONOCHLOROBENZENE)	75	350
O-CHLOROBENZYLIDENE MALONONITRILE (OCBM)*	0.05	0.4
CHLOROBROMOMETHANE	200	1050
2-CHLORO-1,3-BUTADIENE, see CHLOROPRENE		
CHLORODIPHENYL (42 PERCENT CHLORINE)-Skin		1
CHLORODIPHENYL (54 PERCENT CHLORINE)-Skin		0.5
1-CHLORO, 2,3-EPOXYPROPANE, see EPICHLORHYDRIN		
2-CHLOROETHANOL, see ETHYLENE CHLOROHYDRIN		
CHLOROETHYLENE, see VINYL CHLORIDE		
C CHLOROFORM (TRICHLOROMETHANE)*	50	240
1-CHLORO-1-NITROPROPANE*	20	100
CHLOROPICRIN	0.1	0.7
CHLOROPRENE(2-CHLORO-1,3-BUTADIENE)-Skin*	25	90
CHROMIUM, SOL.CHROMIC, CHROMOUS SALTS AS Cr		0.5
CHROMIUM, METAL AND INSOLUBLE SALTS		1

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
COAL TAR PITCH VOLATILES (BENZENE SOLUBLE FRACTION) ANTHRACENE, BaP, PHENANTHRENE, ACRIDINE, CHRYSENE, PYRENE)		0.2
COBALT, METAL FUME AND DUST*		0.1
COPPER FUME		0.1
COPPER DUSTS AND MISTS		1
COTTON DUST (RAW)		1[e]
CRAG HERBICIDE*		15
CRESOL (ALL ISOMERS)-Skin	5	22
CROTONALDEHYDE	2	6
CUMENE-Skin	50	245
CYANIDE (as Cn)-Skin		5
CYCLOHEXANE	300	1050
CYCLOHEXANOL*	50	200
CYCLOHEXANONE*	50	200
CYCLOHEXENE	300	1015
CYCLOPENTADIENE	75	200
2,4-D		10
DDT-Skin*		1
DDVP -Skin		1
DECABORANE-Skin*	0.05	0.3
DEMETON -Skin		0.1
DIACETONE ALCOHOL (4-HYDROXY-4-METHYL-2-PENTANONE)	50	240
1,2-DIAMINOETHANE, see ETHYLENEDIAMINE		
DIAZOMETHANE	0.2	0.4
DIBORANE	0.1	0.1
DIBUTYL PHOSPHATE*	1	5

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
DIBUTYLPHTHALATE		5
C O-DICHLOROBENZENE*	50	300
P-DICHLOROBENZENE*	75	450
DICHLORODIFLUOROMETHANE	1000	4950
1,3-DICHLORO-5,5-DIMETHYL HYDANTOIN*		0.2
1,1-DICHLOROETHANE*	100	400
1,2-DICHLOROETHYLENE	200	790
C DICHLOROETHYL ETHER-Skin*	15	90
DICHLOROMETHANE, see METHYLENECHLORIDE		
DICHLOROMONOFLUOROMETHANE*	1000	4200
C 1,1-DICHLORO-1-NITROETHANE*	10	60
1,2-DICHLOROPROPANE, see PROPYLENEDICHLORIDE		
DICHLOROTETRAFLUOROETHANE	1000	7000
DIELDRIN-Skin		0.25
DIETHYLAMINE*	25	75
DIETHYLAMINO ETHANOL-Skin	10	50
DIETHYLETHER, see ETHYL ETHER		
DIFLUORODIBROMOMETHANE	100	860
C DIGLYCIDYL ETHER (DGE)*	0.5	2.8
DIHYDROXYBENZENE, see HYDROQUINONE		
DIISOBUTYL KETONE*	50	290
DIISOPROPYLAMINE-Skin	5	20
DIMETHOXYMETHANE, see METHYLAL		
DIMETHYL ACETAMIDE-Skin	10	35
DIMETHYLAMINE	10	18
DIMETHYLAMINOBENZENE, see XYLIDENE		
DIMETHYLANILINE (N-DIMETHYL-ANILINE)-Skin*	5	25

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
DIMETHYLBENZENE, see XYLENE		
DIMETHYL 1,2-DIBROMO-2,2-DICHLOROETHYL PHOSPHATE (DIBROM)		3
DIMETHYLFORMAMIDE-Skin	10	30
2,6-DIMETHYLHEPTANONE, see DIISOBUTYL KETONE		
1,1-DIMETHYLHYDRAZINE-Skin	0.5	1
DIMETHYLPHTHALATE		5
DIMETHYLSULFATE-Skin*	1	5
DINITROBENZENE (ALL ISOMERS)-Skin		1
DINITRO-O-CRESOL-Skin		0.2
DINITROTOLUENE-Skin		1.5
DIOXANE (DIETHYLENE DIOXIDE)-Skin*	100	360
DIPHENYL	0.2	1
DIPHENYLMETHANE DIISOCYANATE (see METHYLENE BIS-PHENYL ISOCYANATE (MDI))		
DIPROPYLENE GLYCOL METHYL ETHER-Skin*	100	600
DI-SEC. OCTYL-PHTHALATE (DI-2-ETHYLHEXYLPHTHALATE)*		5
ENDRIN-Skin		0.1
EPICHLOROHYDRIN-Skin*	5	19
EPN-Skin		0.5
1,2-EPOXYPROPANE, see PROPYLENEOXIDE		
2,3-EXPOXY-1-PROPANOL, see GLYCIDOL		
ETHANETHIOL, see ETHYLMERCAPTAN		
ETHANOLAMINE*	3	6
2-ETHOXYETHANOL -Skin	200	740
2-ETHOXYETHYLACETATE-(CELLO-SOLVE ACETATE)-Skin	100	540
ETHYL ACETATE	400	1400

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
ETHYL ACRYLATE-Skin*	25	100
ETHYL ALCOHOL (ETHANOL)	1000	1900
ETHYLAMINE	10	18
ETHYL SEC-AMYL KETONE (5-METHYL-3-HEPTANONE)	25	130
ETHYL BENZENE*	100	435
ETHYL BROMIDE*	200	890
ETHYL BUTYL KETONE (3-HEPTANONE)	50	230
ETHYL CHLORIDE	1000	2600
ETHYL ETHER*	400	1200
ETHYL FORMATE	100	300
C ETHYL MERCAPTAN*	10	25
ETHYL SILICATE*	100	850
ETHYLENE CHLOROHYDRIN-Skin*	5	16
ETHYLENEDIAMINE	10	25
C ETHYLENE GLYCOL DINITRATE AND/OR NITROGLYCERIN -Skin*	0.2[d]	1
ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE, see METHYL CELLOSOLVE ACETATE		
ETHYLENE IMINE-Skin	0.5	1
N-ETHYLMORPHOLINE-Skin*	20	94
FERBAM*		15
FERROVANADIUM DUST*		1
FLUORIDE (AS F)		2.5
FLUORINE*	0.1	0.2
FLUOROTRICHLOROMETHANE*	1000	5600
FORMIC ACID	5	9
FURFURAL-Skin*	5	20

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
FURFURYL ALCOHOL*	50	200
GLYCIDOL (2,3-EPOXY-1-PROPANOL)*	50	150
GLYCOL MONOMETHYL ETHER, see 2-ETHOXYETHANOL		
GLUTHION , see AZINPHOSMETHYL		
HAFNIUM		0.5
HEPTACHLOR-Skin		0.5
HEPTANE (N-HEPTANE)*	500	2000
HEXACHLOROETHANE-Skin*	1	10
HEXACHLORONAPHTHALENE-Skin		0.2
HEXANE (N-HEXANE)*	500	1800
2-HEXANONE*	100	410
HEXONE (METHYL ISOBUTYL KETONE)*	100	410
SEC-HEXYL ACETATE	50	300
HYDRAZINE-Skin*	1	1.3
HYDROGEN BROMIDE*	3	10
C HYDROGEN CHLORIDE	5	7
HYDROGEN CYANIDE-Skin*	10	11
HYDROGEN PEROXIDE (90%)	1	1.4
HYDROGEN SELENIDE	0.05	0.2
HYDROQUINONE		2
C IODINE	0.1	1
IRON OXIDE FUME*		10
ISOAMYL ACETATE	100	525
ISOAMYL ALCOHOL*	100	360
ISOBUTYL ACETATE	150	700
ISOBUTYL ALCOHOL*	100	300

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
ISOPHORONE*	25	140
ISOPROPYL ACETATE*	250	950
ISOPROPYL ALCOHOL*	400	980
ISOPROPYLAMINE*	5	12
ISOPROPYLETHER*	500	2100
ISOPROPYL GLYCIDYL ETHER (IGE)*	50	240
KETENE*	0.5	0.9
LINDANE-Skin		0.5
LITHIUM HYDRIDE		0.025
L.P.G. (LIQIFIED PETROLEUM GAS)	1000	1800
MAGNESIUM OXIDE FUME*		15
MALATHION-Skin*		15
MALEIC ANHYDRIDE	0.25	1
C MANGANESE		5
MESITYL OXIDE*	25	100
METHANETHIOL, see METHYL MERCAPTAN		
METHOXYCHLOR*		15
2-METHOXYETHANOL, see METHYL CELLOSOLVE		
METHYL ACETATE*	200	610
METHYL ACETYLENE (PROPYNE)	1000	1650
METHYL ACETYLENE-PROPADIENE MIXTURE (MAPP)*	1000	1800
METHYL ACRYLATE-Skin	10	35
METHYLAL(DIMETHOXYMETHANE)	1000	3100
METHYL ALCOHOL (METHANOL)*	200	260
METHYLAMINE	10	12
METHYL AMYL ALCOHOL, see ISOBUTYL CARBONOL		
METHYL (N-AMYL) KETONE (2-HEPTANONE)*	100	465

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
C METHYL BROMIDE-Skin*	20	80
METHYL BUTYL KETONE, see 2-HEXANONE		
METHYL CELLOSOLVE-Skin	25	80
METHYL CELLOSOLVE ACETATE-Skin	25	120
METHYL CHLOROFORM*	350	1900
METHYLCYCLOHEXANE*	500	2000
METHYLCYCLOHEXANOL*	100	470
O-METHYLCYCLOHEXANONE-Skin*	100	460
METHYL ETHYL KETONE (MEK), see 2-BUTANONE		
METHYL FORMATE*	100	250
METHYL IODIDE-Skin*	5	28
METHYL ISOBUTYL CARBINOL-Skin*	25	100
METHYL ISOBUTYL KETONE, see HEXONE		
METHYL ISOCYANATE-Skin	0.02	0.05
C METHYL MERCAPTAN*	10	20
METHYL METHACRYLATE	100	410
METHYL PROPYL KETONE, see 2-PENTANONE		
C A-METHYL STYRENE*	100	480
C METHYLENE BISPHENYL ISOCYANATE (MDI)	0.02	0.2
MOLYBDENUM (INSOLUBLE COMPOUNDS)		15
MOLYBDENUM (SOLUBLE COMPOUNDS)		5
MONOMETHYL ANILINE-Skin*	2	9
C MONOMETHYL HYDRAZINE-Skin	0.2	0.35
MORPHOLINE-Skin*	20	70
NAPHTHA (COAL TAR)	100	400
NAPHTHALENE*	10	50
NICKEL CARBONYL*	0.001	0.007

TABLE Z-1

Substance	ppm[a]	mg/m[3b]
NICKEL, (METAL AND SOLUBLE COMPOUNDS AS Ni)		1
NICOTINE-Skin		0.5
NITRIC ACID*	2	5
NITRIC OXIDE	25	30
P-NITROANILINE-Skin*	1	6
NITROBENZENE-Skin	1	5
P-NITROCHLOROBENZENE-Skin*		1
NITROETHANE	100	310
C NITROGEN DIOXIDE*	5	9
NITROGEN TRIFLUORIDE	10	29
C NITROGLYCERIN-Skin*	0.2	2
NITROMETHANE	100	250
1-NITROPROPANE	25	90
2-NITROPROPANE*	25	90
NITRO TOLUENE-Skin*	5	30
NITROTRICHLOROMETHANE, see CHLOROPICRINE		
OCTACHLORONAPHTHALENE-Skin*		0.1
OCTANE*	500	2350
OIL MIST, MINERAL*		5
OSMIUM TETROXIDE*		0.002
OXALIC ACID*		1
OXYGEN DIFLUORIDE*	0.05	0.1
OZONE*	0.1	0.2
PARAQUAT-Skin*		0.5
PARATHION-Skin		0.1
PENTABORANE*	0.005	0.01
PENTACHLORONAPHTHALENE-Skin		0.5

TABLE Z-1

Substance	ppm[a]	mg/m[3b]
PENTACHLOROPHENOL-Skin		0.5
PENTANE*	1000	2950
2-PENTANONE*	200	700
PERCHLOROMETHYL MERCAPTAN	0.1	0.8
PERCHLORYL FLUORIDE*	3	13.5
PETROLEUM DISTILLATES (NAPHTHA)*	500	2000
PHENOL-Skin	5	19
P-PHENYLENE DIAMINE-Skin		0.1
PHENYL ETHER (VAPOR)*	1	7
PHENYL ETHER- BIPHENYL MIXTURE (VAPOR)	1	7
PHENYLETHYLENE, see STYRENE		
PHENYL GLYCIDYL ETHER (PGE)*	10	60
PHENYLHYDRAZINE-Skin*	5	22
PHOSDRIN (MEVINPHOS)-Skin*		0.1
PHOSGENE (CARBONYL CHLORIDE)	0.1	0.4
PHOSPHINE*	0.3	0.4
PHOSPHORIC ACID*		1
PHOSPHORUS (YELLOW)		0.1
PHOSPHORUS PENTACHLORIDE		1
PHOSPHORUS PENTASULFIDE*		1
PHOSPHORUS TRICHLORIDE*	0.5	3
PHTHALIC ANHYDRIDE*	2	12
PICRIC ACID-Skin*		0.1
PIVAL (2-PIVALYL-1,3-INDANDIONE)		0.1
PLATINUM (SOLUBLE SALTS) AS Pt		0.002
PROPANE	1000	1800
N-PROPYL ACETATE*	200	840

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
PROPYL ALCOHOL*	200	500
N-PROPYL NITRATE*	25	110
PROPYLENE DICHLORIDE*	75	350
PROPYLENE IMINE-Skin	2	5
PROPYLENE OXIDE*	100	240
PROPYNE, see METHYLACETYLENE		
PYRETHRUM		5
PYRIDINE	5	15
QUINONE	0.1	0.4
RHODIUM, METAL FUME AND DUST, AS Rh*		0.1
RHODIUM (SOLUBLE SALTS)*		0.001
RONNEL*		15
ROTENONE (COMMERCIAL)		5
SELENIUM COMPOUNDS (AS Se)		0.2
SELENIUM HEXAFLUORIDE	0.05	0.4
SILVER, METAL AND SOLUBLE COMPOUNDS*		0.01
SODIUM FLUOROACETATE (1080) -Skin*		0.05
SODIUM HYDROXIDE*		2
STIBINE	0.1	0.5
STODDARD SOLVENT*	500	2900
STRYCHNINE		0.15
SULFUR DIOXIDE	5	13
SULFUR HEXAFLUORIDE	1000	6000
SULFURIC ACID		1
SULFUR MONOCHLORIDE*	1	6
SULFUR PENTAFLUORIDE*	0.025	0.25
SULFURYL FLUORIDE*	5	20

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
SYSTOX, see DEMETON		
2,4,5T		10
TANTALUM*		5
TEDP-Skin		0.2
TELLURIUM		0.1
TELLURIUM HEXAFLUORIDE	0.02	0.2
TEPP-Skin		0.05
C TERPHENYLS*	1	9
1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE	500	4170
1,1,1,2-TETRACHLORO-2,2-DIFLUOROETHANE	500	4170
1,1,2,2-TETRACHLOROETHANE-Skin*	5	35
TETRACHLOROMETHANE, see CARBON TETRACHLORIDE		
TETRACHLORONAPHTHALENE-Skin		2
TETRAETHYL LEAD (AS Pb)-Skin*		0.075
TETRAHYDROFURAN*	200	590
TETRAMETHYL LEAD (AS Pb)-Skin*		0.075
TETRAMETHYL SUCCINONITRILE-Skin	0.5	3
TETRANITROMETHANE	1	8
TETRYL (2,4,6-TRINITROPHENOL-METHYL-NITRAMINE)-Skin		1.5
THALLIUM (SOLUBLE COMPOUNDS)-Skin AS Tl*		0.1
THIRAM		5
TIN (INORGANIC COMPOUNDS EXCEPT OXIDES)		2
TIN (ORGANIC COMPOUNDS) *		0.1
C TOLUENE-2,4-DIISOCYANATE*	0.02	0.14
O-TOLUIDINE-Skin*	5	22
TOXAPHENE, see CHLORINATED CAMPHENE		

Substance	ppm[a]	mg/m3[b]
TRIBUTYL PHOSPHATE*		5
1,1,1-TRICHLOROETHANE, see METHYL CHLOROFORM		
1,1,2-TRICHLOROETHANE-Skin*	10	45
TITANIUM DIOXIDE		15
TRICHLOROMETHANE, see CHLOROFORM		
TRICHLORONAPHTHALENE-Skin		5
1,2,3-TRICHLOROPROPANE*	50	300
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE*	1000	7600
TRIETHYLAMINE*	25	100
TRIFLUOROMONOBROMOMETHANE	1000	6100
2,4,6 - TRINITROPHENOL, see PICRIC ACID		
2,4,6 - TRINITROPHENOLMETHYL-NITRAMINE, see TETRYL		
TRINITROTOLUENE-Skin*		1.5
TRIORTHOCRESYL PHOSPHATE*		0.1
TRIPHENYL PHOSPHATE		3
TURPENTINE	100	560
URANIUM (SOLUBLE COMPOUNDS)*		0.05
URANIUM (INSOLUBLE COMPOUNDS)*		0.25
C VANADIUM (V205, DUST)*		0.5
C VANADIUM (V205, FUME)*		0.1
VINYL BENZENE, see STYRENE		
VINYL CYANIDE, see ACRYLONITRILE		
VINYL TOLUENE*	100	480
WARFARIN		0.1
XYLENE (XYLOL)*	100	435
XYLIDINE-Skin	5	25
YTTRIUM		1

TABLE Z-1

Substance	ppm[a]	mg/m3[b]
ZINC CHLORIDE FUME*		1
ZINC OXIDE (FUME)*		5
ZIRCONIUM COMPOUNDS (AS Zr)*		5

[a]Parts of vapor or gas per million parts of contaminated air by volume at 25° C and 760 mm. Hg pressure.

[b]Approximate milligrams of particulate per cubic meter of air.

(No footnote "c" is used to avoid confusion with ceiling value notations.)

[d]An atmospheric concentration of not more than 0.02 p.p.m. or personal protection may be necessary to avoid headache.

[e]This 8-hour time weighted average is for respirable dust as measured by a verticle elutriator cotton dust sampler or equivalent instrument. This time weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garnetting.

*Substances that are in Table Z-4 in this proposal.

TABLE Z-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptance ceiling concentration for an 8-hour shift	
			Concentration	Maximum duration
BENZENE (Z37.40-1969)	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes
BERYLLIUM AND BERYLLIUM COMPOUNDS (Z37.29-1970)*	2 ug/M^3	5 ug/M^3	25 ug/M^3	30 minutes
CADMIUM FUME (Z37.5-1970)	0.1 mg/M^3	0.3 mg/M^3		
CADMIUM DUST (Z37.5-1970)	0.2 mg/M^3	0.6 mg/M^3		
CARBON DISULFIDE (Z37.3-1968)*	20 p.p.m.	30 p.p.m.	100 p.p.m.	30 minutes
CARBON TETRACHLORIDE (Z37.17-1967)*	10 p.p.m.	25 p.p.m.	200 p.p.m.	5 minutes in any 4 hours
CHROMIC ACID AND CHROMATES (Z37.7-1971)*		1 mg/10M^3		
ETHYLENE DIBROMIDE (Z37.31-1970)	20 p.p.m.	30 p.p.m.	50 p.p.m.	5 minutes
ETHYLENE DICHLORIDE (Z37.21 1969)*	50 p.p.m.	100 p.p.m.	200 p.p.m.	5 minutes in any 3 hours

TABLE Z-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptance ceiling concentration for an 8-hour shift	
			Concentration	Maximum duration
FORMALDEHYDE (Z37.16-1967)	3 p.p.m.	5 p.p.m.	10 p.p.m.	30 minutes
HYDROGEN FLUORIDE (Z37.28-1969)*	3 p.p.m.			
HYDROGEN SULFIDE (Z37.2-1966)*		20 p.p.m.	50 p.p.m.	10 minutes once only if no other measurable exposure occurs
FLUORIDE AS DUST (Z37.28-1969)	2.5 mg/M^3			
MERCURY (Z37.8-1971)*		0.1 mg/10M^3		
METHYL CHLORIDE(Z37.18-1969)*	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 2 hours
METHYLENE CHLORIDE (Z37.23-1969)	500 p.p.m.	1,000 p.p.m.	2,000 p.p.m.	5 minutes in any 2 hours
ORGANO (ALKYL) MERCURY (Z37.30-1969)*	0.01 mg/M^3	0.04 mg/M^3		

TABLE Z-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptance ceiling concentration for an 8-hour shift	
			Concentration	Maximum duration
STYRENE (Z37.15-1969)*	100 p.p.m.	200 p.p.m.	600 p.p.m.	5 minutes in any 3 hours
TETRACHLOROETHYLENE (Z37.22-1967)*	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 3 hours
TOLUENE (Z37.12-1967)*	200 p.p.m.	300 p.p.m.	500 p.p.m.	10 minutes
TRICHLOROETHYLENE (Z37.19-1967)*	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 2 hours

*Substances that are on Table Z-4 in this proposal.

TABLE Z-3

Substance	Mppcf[e]	Mg/M^3
SILICA:		
CRYSTALINE		
QUARTZ (RESPIRABLE)*	$\frac{250}{\%SiO_2+5}$[f]	$\frac{10\ mg/M^3}{\%SiO_2+2}$ [m]
QUARTZ (TOTAL)		$\frac{30\ mg/M^3}{\%SiO_2+2}$
CRISTOBALITE*: Use 1/2 the value calculated from the count or mass formulae for quartz		
TRIDYMITE*: Use 1/2 the value calculated from the formulae for quartz		
AMORPHOUS, including natural diatomaceous earth*	20	$\frac{80\ mg/M^3}{\%SiO_2}$
SILICATES (less than 1% crystalline silica):		
Mica*	20	
Soapstone*	20	
Talc (non-asbestos-form)*	20[n]	

TABLE Z-3

Substance	Mppcf[e]	Mg/M^3
Talc (fibrous). Use asbestos limit		
Tremolite (see talc, fibrous)		
Portland cement*	50	
GRAPHITE (NATURAL)*	15	
COAL DUST (respirable fraction less than 5% SiO_2)*		2.4 mg/M^3 or $\frac{10 \text{ mg/M}^3}{\%SiO_2+2}$
For more than 5% SiO_2*		
INERT OR NUISANCE DUST:		
Respirable fraction*	15	5 mg/M^3
Total dust	50	15 mg/M^3

NOTE: Conversion factors--mppcf X 35.3 = million particles per cubic meter = particles per c.c.

[e]Millions of particles per cubic foot of air, based on impinger samples counted by light field techniques.

[f]The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

[m]Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size selector with the following characteristics:

[n]Containing less than 1% quartz; if 1% quartz, use quartz limit.

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
10	0

The measurements under this note refer to the use of an AEC instrument. The respirable fraction of coal dust is determined with a MRE; the figure corresponding to that of 2.4 Mg/M^3 in the table for coal dust is 4.5 Mg/M^3.

* Substances that are in Table Z-4 in this proposal.

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1001 ACETALDEHYDE	180	100	270	150	—	—	
1002 ACETIC ACID	25	10	37	15	—	—	
1003 ACETIC ANHYDRIDE	—	—	—	—	20	5	
1004 ACETONE[d]	590	250	—	—	—	—	
1005 ACETONITRILE[d]	34	20	—	—	—	—	
1006 ACETYLSALICYLIC ACID (ASPIRIN)	5	—	—	—	—	—	
1007 ACROLEIN	0.25	0.1	0.8	0.3	—	—	
1008 ACRYLAMIDE	0.03	—	—	—	—	—	YES
1009 ACRYLIC ACID	30	10	—	—	—	—	
1010 ALLYL ALCOHOL	5	2	10	4	—	—	YES
1011 ALLYL CHLORIDE	3	1	6	2	—	—	
1012 ALLYL GLYCIDYL ETHER (AGE)	22	5	44	10	—	—	YES
1013 ALLYL PROPYL DISULFIDE	12	2	18	3	—	—	
1014 ALPHA-ALUMINA	10	—	—	—	—	—	
1015 ALUMINUM (ALKYLS)	2	—	—	—	—	—	
1016 ALUMINUM (METAL)	10	—	—	—	—	—	
1017 ALUMINUM (PYRO POWDERS)	5	—	—	—	—	—	
1018 ALUMINUM (SOLUBLE SALTS)	2	—	—	—	—	—	
1019 ALUMINUM (WELDING FUMES)	5	—	—	—	—	—	
1020 AMITROLE (3-AMINO-1,2,4-TRIAZOLE)	0.2	—	—	—	—	—	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1021 AMMONIA	18	25	27	35	—	—	
1022 AMMONIUM CHLORIDE (FUME)	10	—	20	—	—	—	
1024 AMMONIUM SULFAMATE (AMMATE)	10	—	—	—	—	—	
1025 ANILINE	8	2	—	—	—	—	YES
1028 ASPHALT FUMES[b]	5	—	—	—	—	—	
1029 ATRAZINE	5	—	—	—	—	—	
1031 BARIUM SULFATE	10	—	—	—	—	—	
1032 BENOMYL	10	0.8	—	—	—	—	
1033 BERYLLIUM AND BERYLLIUM COMPOUNDS[e]	0.002	—	0.005 (30 min)	—	0.025	—	
1034 BISMUTH TELLURIDE (SE-DOPED)	5	—	—	—	—	—	
1035 BISMUTH TELLURIDE (UNDOPED)	10	—	—	—	—	—	
1036 BORATES, TETRA, SODIUM (ANHYDROUS)	1	—	—	—	—	—	
1037 BORATES, TETRA, SODIUM (DECAHYDRATE)	5	—	—	—	—	—	
1038 BORATES, TETRA, SODIUM (PENTAHYDRATE)	1	—	—	—	—	—	
1039 BORON OXIDE	10	—	—	—	—	—	
1040 BORON TRIBROMIDE	—	—	—	—	10	1	
1041 BROMACIL	10	1	—	—	—	—	
1042 BROMINE	0.7	0.1	2	0.3	—	—	
1043 BROMINE PENTAFLUORIDE	0.7	0.1	—	—	—	—	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1044 BUTANE	1900	800	—	—	—	—	
1045 2-BUTANONE (MEK)	590	200	885	300	—	—	
1046 2-BUTOXY ETHANOL	120	25	—	—	—	—	YES
1047 N-BUTYL ACETATE	710	150	950	200	—	—	
1048 BUTYL ACRYLATE	55	10	—	—	—	—	
1049 SEC-BUTYL ALCOHOL	305	100	455	150	—	—	
1050 TERT-BUTYL ALCOHOL	300	100	450	150	—	—	
1051 N-BUTYL ALCOHOL	—	—	—	—	150	50	YES
1052 N-BUTYL GLYCIDYL ETHER	135	25	—	—	—	—	
1053 N-BUTYL LACTATE	25	5	—	—	—	—	
1054 BUTYL MERCAPTAN	1.5	0.5	—	—	—	—	
1055 O-SEC-BUTYLPHENOL	30	5	—	—	—	—	YES
1056 P-TERT-BUTYLTOLUENE	60	10	120	20	—	—	
1057 CALCIUM CARBONATE	10	—	—	—	—	—	
1058 CALCIUM CYANAMIDE	0.5	—	—	—	—	—	
1059 CALCIUM HYDROXIDE	5	—	—	—	—	—	
1060 CALCIUM OXIDE	2	—	—	—	—	—	
1061 CALCIUM SILICATE, TOTAL DUST	10	—	—	—	—	—	
1062 CALCIUM SULFATE	10	—	—	—	—	—	
1063 CAMPHOR (SYNTHETIC)	12	2	18	3	—	—	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1064 CAPROLACTAM (DUST)	1	--	3	--	--	--	
1065 CAPROLACTAM (VAPOR)	20	5	40	10	--	--	
1066 CAPTAFOL (DIFOLATAN)	0.1	--	--	--	--	--	YES
1067 CAPTAN	5	--	--	--	--	--	
1068 CARBOFURAN (FURADAN)	0.1	--	--	--	--	--	
1069 CARBON DIOXIDE	9000	5000	54,000	30,000	--	--	
1070 CARBON DISULFIDE[d]	3	1	30	10	--	--	
1071 CARBON MONOXIDE[d]	40	35	--	--	229	200(NDT)	
1072 CARBON TETRABROMIDE	1.4	0.1	4.0	0.3	--	--	
1073 CARBON TETRACHLORIDE[d]	--	--	12.6	2 (60 min)	--	--	
1074 CARBONYL FLUORIDE	5	2	15	5	--	--	
1075 CATECHOL (PYROCATECHOL)	20	5	--	--	--	--	
1076 CELLULOSE	10	--	--	--	--	--	
1077 CESIUM HYDROXIDE	2	--	--	--	--	--	
1078 CHLORINATED CAMPHENE	0.5	--	1	--	--	--	YES
1079 CHLORINE[d]	--	--	1.45	0.5	--	--	
1080 CHLORINE DIOXIDE	0.3	0.1	0.9	0.3	--	--	
1081 1-CHLORO-1-NITROPROPANE	10	2	--	--	--	--	
1082 2-CHLORO-6-TRICHLOROMETHYL PYRIDINE (NITRAPYRIN)	10	--	20	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1083 CHLOROACETYL CHLORIDE	0.2	0.05	--	--	--	--	
1084 O-CHLOROBENZYLIDENE MALONONITRILE	--	--	--	--	0.4	0.05	YES
1085 CHLORODIFLUOROMETHANE	3500	1000	4375	1250	--	--	
1086 CHLOROFORM[d]	--	--	9.78 (60 min)	2 (60 min)	--	--	
1087 CHLOROPENTAFLUOROETHANE	6320	1000	--	--	--	--	
1088 CHLOROPRENE	35	10	--	--	--	--	YES
1089 O-CHLOROSTYRENE	285	50	430	75	--	--	
1090 O-CHLOROTOLUENE	250	50	375	75	--	--	
1091 CHLORPYRIFOS	0.2	--	0.6	--	--	--	YES
1092 CHROMIC ACID AND CHROMATES[e]	--	--	--	--	0.1	--	
1093 CHROMIUM, METAL	0.5	--	--	--	--	--	
1094 CHROMYL CHLORIDE	0.15	0.025	--	--	--	--	
1095 CLOPIDOL(COYDEN)	10	--	20	--	--	--	
1096 COAL DUST, < 5% QUARTZ, RESPIRABLE FRACTION	2	--	--	--	--	--	
1097 COAL DUST, > 5% QUARTZ, RESPIRABLE QUARTZ FRACTION	0.1	--	--	--	--	--	
1098 COBALT CARBONYL	0.1	--	--	--	--	--	
1099 COBALT HYDROCARBONYL	0.1	--	--	--	--	--	
1100 COBALT, METAL, FUME, DUST	0.05	--	--	--	--	--	
1101 COPPER (FUME)[e]	0.1	--	--	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1102 CRAG HERBICIDE (SESONE)	10	--	--	--	--	--	
1103 CRUFOMATE	5	--	20	--	--	--	
1104 CYANAMIDE	2	--	--	--	--	--	
1105 CYANOGEN	20	10	--	--	--	--	
1106 CYANOGEN CHLORIDE	--	--	--	--	0.6	0.3	
1107 CYCLOHEXANOL	200	50	--	--	--	--	YES
1108 CYCLOHEXANONE[c]	100	25	--	--	--	--	YES
1109 CYCLOHEXYLAMINE	40	10	--	--	--	--	
1110 CYCLONITE	1.5	--	3	--	--	--	YES
1111 CYCLOPENTANE	1720	600	--	--	--	--	
1112 CYHEXATIN	5	--	--	--	--	--	
1113 DDT[e]	1	--	--	--	--	--	YES
1114 DECABORANE	0.3	0.05	0.9	0.15	--	--	YES
1116 DI-SEC-OCTYL-PHTHALATE	5	--	10	--	--	--	
1117 2,6-DI-TERT-BUTYL-P-CRESOL	10	--	--	--	--	--	
1118 DIAZINON	0.1	--	--	--	--	--	YES
1119 DIBUTYL PHOSPHATE	5	1	10	2	--	--	
1120 2-N-DIBUTYLAMINOETHANOL	14	2	--	--	--	--	YES
1121 1,1-DICHLORO-1-NITROETHANE	10	2	--	--	--	--	
1122 1,3-DICHLORO-5,5-DIMETHYLHYDANTOIN	0.2	--	0.4	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1123 DICHLOROACETYLENE	--	--	--	--	0.4	0.1	
1125 P-DICHLOROBENZENE	450	75	665	110	--	--	
1126 1,1-DICHLOROETHANE[e]	400	100	--	--	--	--	
1127 DICHLOROETHYL ETHER	30	5	60	10	--	--	YES
1128 DICHLOROMONOFLUOROMETHANE	40	10	--	--	--	--	
1129 1,3-DICHLOROPROPENE	5	1	--	--	--	--	YES
1130 2,2-DICHLOROPROPIONIC ACID	6	1	--	--	--	--	
1131 DICROTOPHOS (BIDRIN)	0.25	--	--	--	--	--	YES
1132 DICYCLOPENTADIENE	30	5	--	--	--	--	
1133 DICYCLOPENTADIENYL IRON	10	--	--	--	--	--	
1134 DIETHANOLAMINE	15	3	--	--	--	--	
1135 DIETHYL KETONE	705	200	--	--	--	--	
1136 DIETHYL PHTHALATE	5	--	--	--	--	--	
1137 DIETHYLAMINE	30	10	75	25	--	--	
1138 DIETHYLENE TRIAMINE	4	1	--	--	--	--	YES
1139 DIGLYCIDYL ETHER (DGE)[b]	0.5	0.1	--	--	--	--	
1140 DIISOBUTYL KETONE[c]	150	25	--	--	--	--	
1141 DIMETHYL 1,2-DIBROMO-2,2-DICHLOROETHYL PHOSPHATE	3	--	--	--	--	--	YES
1142 DIMETHYL SULFATE	0.5	0.1	--	--	--	--	YES
1143 DIMETHYLANILINE	25	5	50	10	--	--	YES

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1144 DINITOLMIDE (3,5-DINITRO-O-TOLUAMIDE)	5	--	--	--	--	--	
1145 DIOXANE (DIETHYLENE DIOXIDE)	90	25	--	--	--	--	YES
1146 DIOXATHION (DELNAV)	0.2	--	--	--	--	--	YES
1147 DIPHENYLAMINE	10	--	--	--	--	--	
1148 DIPROPYL KETONE	235	50	--	--	--	--	
1149 DIPROPYLENE GLYCOL METHYL ETHER	600	100	900	150	--	--	YES
1150 DIQUAT	0.5	--	--	--	--	--	
1151 DISULFIRAM	2	--	--	--	--	--	
1152 DISULFOTON	0.1	--	--	--	--	--	
1153 DIURON	10	--	--	--	--	--	
1154 DIVINYL BENZENE	50	10	--	--	--	--	
1155 EMERY	10	--	--	--	--	--	
1156 ENDOSULFAN	0.1	--	--	--	--	--	YES
1158 EPICHLOROHYDRIN	8	2	--	--	--	--	YES
1159 ETHANOLAMINE	8	3	15	6	--	--	
1160 ETHION (NIALATE)	0.4	--	--	--	--	--	YES
1161 ETHYL ACRYLATE	20	5	100	25	--	--	YES
1162 ETHYL BENZENE	435	100	545	125	--	--	
1163 ETHYL BROMIDE	890	200	1110	250	--	--	
1164 ETHYL ETHER	1200	400	1500	500	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1165 ETHYL MERCAPTAN	1	0.5	—	—	—	—	
1166 ETHYL SILICATE	85	10	—	—	—	—	
1167 ETHYLENE CHLOROHYDRIN	—	—	—	—	3	1	YES
1168 ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE)[d]	4	1	8	2	—	—	
1169 ETHYLENE GLYCOL	—	—	—	—	125	50	
1170 ETHYLENE GLYCOL DINITRATE[d]	—	—	0.1 (20 min)	—	—	—	YES
1171 ETHYLIDENE NORBORNENE	—	—	—	—	25	5	
1172 N-ETHYLMORPHOLINE	23	5	—	—	—	—	YES
1173 FENAMIPHOS	0.1	—	—	—	—	—	YES
1174 FENSULFOTHION (DASANIT)	0.1	—	—	—	—	—	
1175 FENTHION	0.2	—	—	—	—	—	YES
1176 FERBAM	10	—	—	—	—	—	
1177 FERROVANADIUM DUST	1	—	3	—	—	—	
1178 FIBROUS GLASS DUST[d]	5	—	—	—	—	—	
1179 FLUORINE	2	1	4	2	—	—	
1180 FLUOROTRICHLOROMETHANE	—	—	—	—	5600	1000	
1181 FONOFOS	0.1	—	—	—	—	—	YES
1182 FORMAMIDE	30	20	45	30	—	—	
1183 FURFURAL	8	2	—	—	—	—	YES

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1184 FURFURYL ALCOHOL	40	10	60	15	--	--	YES
1185 GASOLINE	900	300	1500	500	--	--	
1186 GERMANIUM TETRAHYDRIDE	0.6	0.2	--	--	--	--	
1187 GLUTARALDEHYDE	--	--	--	--	0.8	0.2	
1188 GLYCERIN (MIST)	10	--	--	--	--	--	
1189 GLYCIDOL (2,3-EPOXY-1-PROPANOL)	75	25	--	--	--	--	
1190 GRAIN DUST (OAT, WHEAT, BARLEY)	4	--	--	--	--	--	
1191 GRAPHITE, NATURAL, RESPIRABLE	2.5	--	--	--	--	--	
1191A GRAPHITE, SYNTHETIC	10	--	--	--	--	--	
1192 GYPSUM, TOTAL DUST	10	--	--	--	--	--	
1194 N-HEPTANE	1600	400	2000	500	--	--	
1195 HEXACHLOROBUTADIENE	0.24	0.02	--	--	--	--	YES
1196 HEXACHLOROCYCLOPENTADIENE	0.1	0.01	--	--	--	--	
1197 HEXACHLOROETHANE[e]	10	1	--	--	--	--	YES
1198 HEXAFLUOROACETONE	0.7	0.1	--	--	--	--	YES
1200 N-HEXANE	180	50	--	--	--	--	
1201 HEXANE ISOMERS	1800	500	3600	1000	--	--	
1202 2-HEXANONE	20	5	--	--	--	--	
1203 HEXONE (METHYL ISOBUTYL KETONE)	205	50	300	75	--	--	
1204 HEXYLENE GLYCOL	--	--	--	--	125	25	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1205 HYDRAZINE	0.1	0.1	—	—	—	—	YES
1206 HYDROGEN BROMIDE	—	—	—	—	10	3	
1207 HYDROGEN CYANIDE[d]	—	—	—	—	5 (10 min)	4.7 (10 min)	YES
1208 HYDROGEN FLUORIDE[d]	—	3	—	6	—	—	
1209 HYDROGEN SULFIDE[b]	14	10	21	15	—	—	
1210 HYDROGENATED TERPHENYLS	5	0.5	—	—	—	—	
1211 2-HYDROXYPROPYL ACRYLATE	3	0.5	—	—	—	—	YES
1212 INDENE	45	10	—	—	—	—	
1213 INDIUM & COMPOUNDS	0.1	—	—	—	—	—	
1214 IODOFORM	10	0.6	—	—	—	—	
1215 IRON OXIDE (DUST AND FUME)	5	—	—	—	—	—	
1216 IRON PENTACARBONYL	0.8	0.1	1.6	0.2	—	—	
1217 IRON SALTS (SOLUBLE)	1	—	—	—	—	—	
1218 ISOAMYL ALCOHOL	360	100	450	125	—	—	
1219 ISOBUTYL ALCOHOL	150	50	—	—	—	—	
1220 ISOOCTYL ALCOHOL	270	50	—	—	—	—	YES
1221 ISOPHORONE[d]	23	4	—	—	—	—	
1222 ISOPHORONE DIISOCYANATE[d]	—	0.005	—	—	—	0.02 (10 min)	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1223 2-ISOPROPOXYETHANOL	105	25	--	--	--	--	
1224 ISOPROPYL ACETATE	950	250	1185	310	--	--	
1225 ISOPROPYL ALCOHOL	980	400	1225	500	--	--	
1226 ISOPROPYL ETHER[e]	2100	500	--	--	--	--	
1227 ISOPROPYL GLYCIDYL ETHER[b]	240	50	360	75	--	--	
1228 ISOPROPYLAMINE	12	5	24	10	--	--	
1229 N-ISOPROPYLANILINE	10	2	--	--	--	--	YES
1230 KAOLIN, TOTAL DUST	10	--	--	--	--	--	
1231 KETENE	0.9	0.5	3	1.5	--	--	
1232 LIMESTONE, TOTAL DUST	10	--	--	--	--	--	
1233 MAGNESITE, TOTAL DUST	10	--	--	--	--	--	
1234 MAGNESIUM OXIDE FUME	10	--	--	--	--	--	
1235 MALATHION	10	--	--	--	--	--	YES
1236A MANGANESE, FUME	1	--	3	--	--	--	
1237 MANGANESE CYCLOPENTADIENYL TRICARBONYL	0.1	--	--	--	--	--	YES
1238 MANGANESE TETROXIDE	1	--	--	--	--	--	
1239 MARBLE, TOTAL DUST	10	--	--	--	--	--	
1240 MERCURY (ARYL AND INORGANIC COMPOUNDS)[e]	--	--	--	--	0.1	--	
1241 MERCURY (VAPOR)	0.05	--	--	--	--	--	YES
1242 MERCURY, (ORGANO) ALKYL COMPOUNDS	0.01	--	0.03	--	--	--	YES

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1243 MESITYL OXIDE	60	15	100	25	—	—	
1244 METHACRYLIC ACID	70	20	—	—	—	—	
1245 METHOMYL (LANNATE)	2.5	—	—	—	—	—	
1246 METHOXYCHLOR	10	—	—	—	—	—	
1247 4-METHOXYPHENOL	5	—	—	—	—	—	
1248 METHYL 2-CYANOACRYLATE	8	2	16	4	—	—	
1249 METHYL ACETATE	610	200	760	250	—	—	
1250 METHYL ACETYLENE/PROPADIENE MIXTURE	1800	1000	2250	1250	—	—	
1251 METHYL ACRYLONITRILE	3	1	—	—	—	—	YES
1252 METHYL ALCOHOL	260	200	310	250	—	—	YES
1253 METHYL BROMIDE	20	5	—	—	—	—	YES
1254 METHYL CHLORIDE	105	50	205	100	—	—	
1255 METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE)	1900	350	2450	450	—	—	
1256 METHYL DEMETON	0.5	—	—	—	—	—	YES
1257 METHYL ETHYL KETONE PEROXIDE	—	—	—	—	1.5	0.2	
1258 METHYL FORMATE	250	100	375	150	—	—	
1259 METHYL IODIDE	10	2	—	—	—	—	YES
1260 METHYL ISOAMYL KETONE	240	50	—	—	—	—	
1261 METHYL ISOBUTYL CARBINOL	100	25	165	40	—	—	YES
1262 METHYL ISOPROPYL KETONE	705	200	—	—	—	—	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1263 METHYL MERCAPTAN[b]	1	0.5	—	—	—	—	
1264 METHYL N-AMYL KETONE[e]	465	100	—	—	—	—	
1265 METHYL PARATHION[c]	0.2	—	—	—	—	—	YES
1266 METHYL SILICATE	6	1	—	—	—	—	
1267 ALPHA-METHYL STYRENE	240	50	485	100	—	—	
1268 METHYLCYCLOHEXANE	1600	400	—	—	—	—	
1269 METHYLCYCLOHEXANOL	235	50	—	—	—	—	
1270 O-METHYLCYCLOHEXANONE	230	50	345	75	—	—	YES
1271 METHYLCYCLOPENTADIENYL MN TRICARBONYL	0.2	—	—	—	—	—	YES
1272 METHYLENE BIS (4-CYCLOHEXYLISOCYANATE)	—	—	—	—	0.11	0.01	
1273 4,4'-METHYLENE BIS(2-CHLOROANILINE)	0.22	0.02	—	—	—	—	YES
1275 METRIBUZIN	5	—	—	—	—	—	
1276 MICA	3	—	—	—	—	—	
1277 MINERAL WOOL FIBER	10	—	—	—	—	—	
1278 MOLYBDENUM (INSOLUBLE COMPOUNDS)	10	—	—	—	—	—	
1279 MONOCROTOPHOS (AZODRIN)	0.25	—	—	—	—	—	
1280 MONOMETHYL ANILINE	2	0.5	—	—	—	—	YES
1281 MORPHOLINE	70	20	105	30	—	—	YES
1282 NAPHTHALENE	50	10	75	15	—	—	
1283 NICKEL (SOLUBLE COMPOUNDS)	0.1	—	—	—	—	—	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1284 NICKEL CARBONYL[e]	0.007	0.001	—	—	—	—	
1286 NITRIC ACID	5	2	10	4	—	—	
1287 P-NITROANILINE	3	—	—	—	—	—	YES
1288 P-NITROCHLOROBENZENE[e]	1	—	—	—	—	—	YES
1289 NITROGEN DIOXIDE[d]	—	—	1.8	1	—	—	
1290 NITROGLYCERIN[d]	—	—	0.1 (20 min)	—	—	—	YES
1291 2-NITROPROPANE	35	10	—	—	—	—	
1292 NITROTOLUENE	11	2	—	—	—	—	YES
1293 NONANE	1050	200	—	—	—	—	
1294 NUISANCE PARTICULATES, TOTAL DUST	10	—	—	—	—	—	
1295 OCTACHLORONAPHTHALENE	0.1	—	0.3	—	—	—	YES
1296 OCTANE	1450	300	1800	375	—	—	
1297 OIL MIST (MINERAL)	5	—	10	—	—	—	
1298 OSMIUM TETROXIDE	0.002	0.0002	0.006	0.0006	—	—	
1299 OXALIC ACID	1	—	2	—	—	—	
1300 OXYGEN DIFLUORIDE	—	—	—	—	0.1	0.05	
1301 OZONE	0.2	0.1	0.6	0.3	—	—	
1302 PARAFFIN WAX FUME	2	—	—	—	—	—	
1303 PARAQUAT, RESPIRABLE DUST	0.1	—	—	—	—	—	YES

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1304 PENTABORANE	0.01	0.005	0.03	0.015	--	--	
1305 PENTAERYTHRITOL, TOTAL DUST	10	--	--	--	--	--	
1306 PENTANE	1800	600	2250	750	--	--	
1307 2-PENTANONE (METHYL PROPYL KETONE)	700	200	875	250	--	--	
1308 PERCHLOROETHYLENE	340	50	1340	200	--	--	
1309 PERCHLORYL FLUORIDE	14	3	28	6	--	--	
1310 PERLITE	10	--	--	--	--	--	
1312 PETROLEUM DISTILLATES (NAPHTHA)	1600	400	--	--	--	--	
1313 PHENOTHIAZINE	5	--	--	--	--	--	YES
1314 PHENYL ETHER (VAPOR)[e]	7	1	--	--	--	--	
1315 PHENYL GLYCIDYL ETHER	6	1	--	--	--	--	
1316 PHENYL MERCAPTAN	2	0.5	--	--	--	--	
1317 PHENYLHYDRAZINE	20	5	45	10	--	--	YES
1318 PHENYLPHOSPHINE	--	--	--	--	0.25	0.05	
1319 PHORATE (THIMET)	0.05	--	0.2	--	--	--	YES
1320 PHOSDRIN (MEVINPHOS)	0.1	0.01	0.3	0.03	--	--	YES
1321 PHOSPHINE	0.4	0.3	1	1	--	--	
1322 PHOSPHORIC ACID	1	--	3	--	--	--	
1323 PHOSPHORUS OXYCHLORIDE	0.6	0.1	3	0.5	--	--	
1324 PHOSPHORUS PENTASULFIDE	1	--	3	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1325 PHOSPHORUS TRICHLORIDE	1.5	0.2	3	0.5	—	—	
1326 PHTHALIC ANHYDRIDE	6	1	—	—	—	—	
1327 M-PHTHALODINITRILE	5	—	—	—	—	—	
1328 PICLORAM	10	—	20	—	—	—	
1329 PICRIC ACID	0.1	—	0.3	—	—	—	YES
1330 PIPERAZINE DIHYDROCHLORIDE	5	—	—	—	—	—	
1331 PLASTER OF PARIS, TOTAL DUST	10	—	—	—	—	—	
1332 PLATINUM, METAL	1	—	—	—	—	—	
1333 PORTLAND CEMENT	10	—	—	—	—	—	
1334 POTASSIUM HYDROXIDE	—	—	—	—	2	—	
1335 PROPARGYL ALCOHOL	2	1	—	—	—	—	YES
1336 PROPIONIC ACID	30	10	45	15	—	—	
1337 PROPOXUR (BAYGON)	0.5	—	—	—	—	—	
1338 N-PROPYL ACETATE	840	200	1050	250	—	—	
1339 PROPYL ALCOHOL	500	200	625	250	—	—	YES
1340 N-PROPYL NITRATE	105	25	170	40	—	—	
1341 PROPYLENE DICHLORIDE	350	75	510	110	—	—	
1342 PROPYLENE GLYCOL DINITRATE	0.3	0.05	—	—	—	—	YES
1343 PROPYLENE GLYCOL MONOMETHYL ETHER	360	100	540	150	—	—	
1344 PROPYLENE OXIDE	50	20	—	—	—	—	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1346 RESORCINOL	45	10	90	20	--	--	
1347 RHODIUM (METAL FUME & INSOLUBLE COMPOUNDS)[e]	0.1	--	--	--	--	--	
1348 RHODIUM (SOLUBLE SALTS)[e]	0.001	--	--	--	--	--	
1349 RONNEL	10	--	--	--	--	--	
1350 ROSIN CORE SOLDER PYROLYSIS PRODUCT (AS HCHO)	0.1	--	--	--	--	--	
1351 ROUGE, TOTAL DUST	10	--	--	--	--	--	
1352 SILICA, AMORPHOUS, DIATOMACEOUS EARTH	6	--	--	--	--	--	
1353 SILICA, AMORPHOUS, PRECIPITATED OR GEL	6	--	--	--	--	--	
1354 SILICA, CRYSTALLINE - CRISTOBALITE	0.05	--	--	--	--	--	
1355 SILICA, CRYSTALLINE QUARTZ, RESPIRABLE	0.1	--	--	--	--	--	
1356 SILICA, CRYSTALLINE TRIDYMITE	0.05	--	--	--	--	--	
1357 SILICA, CRYSTALLINE TRIPOLI (AS QUARTZ DUST)	0.1	--	--	--	--	--	
1358 SILICA, FUSED	0.1	--	--	--	--	--	
1359 SILICON	10	--	--	--	--	--	
1360 SILICON CARBIDE	10	--	--	--	--	--	
1361 SILICON TETRAHYDRIDE	7	5	--	--	--	--	
1362 SILVER (METAL DUST AND FUME)[e]	0.01	--	--	--	--	--	
1363 SOAPSTONE, TOTAL DUST	6	--	--	--	--	--	
1363A SOAPSTONE, RESPIRABLE DUST	3	--	--	--	--	--	
1364 SODIUM AZIDE	--	--	--	--	0.3	0.1	
1365 SODIUM BISULFITE	5	--	--	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1366 SODIUM FLUOROACETATE	0.05	--	0.15	--	--	--	YES
1367 SODIUM HYDROXIDE	--	--	--	--	2	--	
1368 SODIUM METABISULFITE	5	--	--	--	--	--	
1369 STARCH, TOTAL DUST	10	--	--	--	--	--	
1371 STODDARD SOLVENT	525	100	--	--	--	--	
1372 STYRENE (PHENYLETHYLENE)[c]	215	50	425	100	--	--	
1373 SUBTILISINS (PROTEOLITIC ENZYMES)	--	--	--	--	0.00006	--	
1374 SUCROSE, TOTAL DUST	10	--	--	--	--	--	
1375 SULFUR DIOXIDE	5	2	10	5	--	--	
1376 SULFUR MONOCHLORIDE	--	--	--	--	6	1	
1377 SULFUR PENTAFLUORIDE	--	--	--	--	0.1	0.01	
1378 SULFUR TETRAFLUORIDE	--	--	--	--	0.4	0.1	
1379 SULFURYL FLUORIDE	20	5	40	10	--	--	
1380 SULPROFOS	1	--	--	--	--	--	
1381 TALC (NON-ASBESTIFORM)	2	--	--	--	--	--	
1382 TANTALUM (METAL AND OXIDE DUSTS)	5	--	10	--	--	--	
1383 TEMEPHOS	10	--	--	--	--	--	
1384 TERPHENYLS	--	--	--	--	5	0.5	
1385 1,1,2,2-TETRACHLOROETHANE	7	1	--	--	--	--	YES
1386 TETRAETHYL LEAD[e]	0.075	--	--	--	--	--	YES
1387 TETRAHYDROFURAN	590	200	735	250	--	--	
1388 TETRAMETHYL LEAD[e]	0.075	--	--	--	--	--	YES

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1389 TETRASODIUM PYROPHOSPHATE	5	--	--	--	--	--	
1391 4,4'-THIOBIS (6-TERT-BUTYL-M-CRESOL)	10	--	--	--	--	--	
1392 THIOGLYCOLIC ACID	4	1	--	--	--	--	YES
1393 THIONYL CHLORIDE	--	--	--	--	5	1	
1394 TIN (ORGANIC COMPOUNDS)	0.1	--	--	--	--	--	YES
1395 TIN OXIDE	2	--	--	--	--	--	
1396 TITANIUM DIOXIDE	10	--	--	--	--	--	
1397 TOLUENE	375	100	560	150	--	--	
1398 TOLUENE 2,4-DIISOCYANATE	0.04	0.005	0.15	0.02	--	--	
1399 O-TOLUIDINE	9	2	--	--	--	--	YES
1400 P-TOLUIDINE	9	2	--	--	--	--	YES
1401 M-TOLUIDINE	9	2	--	--	--	--	YES
1402 TRIBUTYL PHOSPHATE	2.5	0.2	--	--	--	--	
1403 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	7600	1000	9500	1250	--	--	
1404 TRICHLOROACETIC ACID	7	1	--	--	--	--	
1405 1,2,4-TRICHLOROBENZENE	--	--	--	--	40	5	
1406 TRICHLOROETHYLENE[d]	--	25	--	--	--	--	
1407 1,2,3-TRICHLOROPROPANE	60	10	--	--	--	--	YES
1408 TRIETHYLAMINE	40	10	60	15	--	--	
1409 TRIMELLITIC ANHYDRIDE	0.04	0.005	--	--	--	--	
1410 TRIMETHYL PHOSPHITE	10	2	--	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA		SHORT-TERM LIMIT*		CEILING**		SKIN NOTATION
	MG/M3	PPM	MG/M3	PPM	MG/M3	PPM	
1411 TRIMETHYLAMINE	24	10	36	15	--	--	
1412 TRIMETHYLBENZENE	125	25	--	--	--	--	
1413 2,4,6-TRINITROTOLUENE (TNT)	0.5	--	--	--	--	--	YES
1414 TRIORTHOCRESYL PHOSPHATE	0.1	--	--	--	--	--	YES
1415 TRIPHENYL AMINE	5	--	--	--	--	--	
1416 TUNGSTEN & COMPOUNDS (INSOLUBLE)	5	--	10	--	--	--	
1417 TUNGSTEN & COMPOUNDS (SOLUBLE)	1	--	3	--	--	--	
1418 URANIUM (INSOLUBLE COMPOUNDS)	0.2	--	0.6	--	--	--	
1419 URANIUM (SOLUBLE COMPOUNDS)[e]	0.05	--	--	--	--	--	
1420 N-VALERALDEHYDE	175	50	--	--	--	--	
1421 VANADIUM (V2O5, DUST)[b]	0.05	--	--	--	--	--	
1422 VANADIUM (V2O5, FUME)[b]	0.05	--	--	--	--	--	
1423 VEGETABLE OIL MIST	10	--	--	--	--	--	
1424 VINYL ACETATE	30	10	60	20	--	--	
1425 VINYL BROMIDE	20	5	--	--	--	--	
1426 VINYL CYCLOHEXENE DIOXIDE	60	10	--	--	--	--	YES
1427 VINYL TOLUENE[e]	480	100	--	--	--	--	
1428 VINYLIDENE CHLORIDE	20	5	80	20	--	--	
1429 VM & P NAPHTHA	1350	300	--	--	--	--	
1430 WELDING FUMES (TOTAL PARTICULATE)	5	--	--	--	--	--	
1430a WOOD DUST, HARD WOOD	1	--	--	--	--	--	

TABLE Z-4. All Substances Considered by OSHA for Proposed Revision or Addition of Limits[a]

H.S. NO./ CHEMICAL NAME	8-HOUR TWA MG/M3	8-HOUR TWA PPM	SHORT-TERM LIMIT* MG/M3	SHORT-TERM LIMIT* PPM	CEILING** MG/M3	CEILING** PPM	SKIN NOTATION
1430b WOOD DUST, SOFT WOOD	5	—	10	—	—	—	
1431 XYLENE (O,M,P-ISOMERS)	435	100	655	150	—	—	
1432 M-XYLENE-ALPHA,ALPHA'-DIAMINE	—	—	—	—	0.1	—	YES
1433 XYLIDINE	10	2	—	—	—	—	YES
1434 ZINC STEARATE	10	—	20	—	—	—	
1435 ZINC CHLORIDE FUME	1	—	2	—	—	—	
1436 ZINC CHROMATES (CrVI)[e]	—	—	—	—	0.1	—	
1437 ZINC OXIDE (FUME)	5	—	10	—	—	—	
1438 ZINC OXIDE, TOTAL DUST	10	—	—	—	—	—	
1439 ZIRCONIUM COMPOUNDS	5	—	10	—	—	—	

[a] All proposed limits derive from the 1987-88 ACGIH TLVs, unless otherwise noted.

[b] Proposed limit is based on 1987-88 ACGIH TLV because NIOSH REL for this substance was judged to be essentially equivalent to the TLV.

[c] Proposed limit is based both on 1987-88 ACGIH TLV and the current NIOSH REL, which are identical.

[d] Proposed limit is based on NIOSH REL.

[e] Proposal retains existing PEL.

* Duration is 15 minutes, unless otherwise noted.

** Ceiling is a peak not to be exceeded at any time during the working day.

BILLING CODE 4510-26-C

XI. Appendices

Note.—These appendices will not appear in the Code of Federal Regulations.

Appendix A—Sampling and Analytical Methods

The sampling and analytical methods for the substances listed in Section I–E of this preamble are categorized into three groups: (1) Fully Validated Methods, (2) Other Methods, and (3) No Methods. These methods are indicated in the Table in this Appendix. The first Table details fully validated methods, other methods, substances for which there are no identified methods, and detection limits. The second Table identifies the most recent NIOSH Analytical methods.

A. Fully Validated Methods

Fully Validated methods were developed by either NIOSH or OSHA. The criteria used in validating these procedures were developed independently by each agency. There are some differences in validation protocol, but in general similar testing procedures were followed. These methods are widely accepted by the scientific community.

B. Other Methods

Methods in this category have not been subjected to all of the testing procedures required of fully validated methods. Some of these procedures have been taken directly from the scientific literature and may not have been used by OSHA. Some are methods that were validated for a specific analyte and assumed to be applicable to a similar one.

While the precision and accuracy of these methods has not been determined and may not meet the OSHA accuracy requirement (+25% at the 95% confidence level), they are the best procedures currently available at this time. Work at evaluating these procedures is progressing.

C. No Methods

These analytes to not have an adequate sampling method available at OSHA, nor has an appropriate method been found in the available scientific literature.

D. Detection Limits

The values listed under Detection Limits are the lowest air concentrations that can be monitored, based on recommended sample air volumes. Detection limits for the OSHA validated methods are determined during the evaluation. Detection limits are not routinely determined for OSHA in-house methods, nor were they determined in the validated methods of the NIOSH Standards Completion Program. Therefore, the detection limits listed for these methods are estimated.

SAMPLING AND ANALYTICAL METHODS

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
1. Acetaldehyde	OSHA 68			0.58	
2. Acetic Acid		In-house[2]		6 ppb	DL based on 240 L air vol.
3. Acetic Anhydride	NIOSH 3506			5 mg/M³	DL based on 100 L air vol.
4. Acetone	NIOSH 1300			0.3 ppm	
5. Acetonitrile	NIOSH 1606			1 ppm	
6. Acetylsalicylic Acid (Aspirin)		In-house		2 µg/M³	DL based on 120 L air vol.
7. Acrolein	OSHA 52			2.7 ppb	
8. Acrylamide	OSHA 21			1.3 ppb	
9. Acrylic Acid	OSHA 28			0.014 ppb	
10. Allyl Alcohol	NIOSH 1402			0.5 ppm	
11. Allyl Chloride	NIOSH 1000			0.2 ppm	
12. Allyl Glycidyl Ether (AGE)	NIOSH S346			0.1 ppm	
13. Allyl Propyl Disulfide		In-house		0.16 ppm	
14. alpha-Alumina	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
15. Aluminum					
Metal & oxide—					
Pyro powders					DL based on 480 L air vol.
Welding fumes	GRAV & In-house			0.1 mg/M³	Method does not differentiate different forms of Al.
Soluble Salts—					
Alkyls			XXXX		
16. Amitrole (3-Amino-1,2,4-triazole).		In-house		0.004 mg/M³	DL based on 60 L air vol.
17. Ammonia		In-house		1 ppm	DL based on 24 L air vol.
18. Ammonium Chloride (fume)	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
19. Ammonium Perfluorooctanoate.			XXXX		
20. Ammonium Sulfamate (Ammate).	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
21. Aniline	NIOSH 2002			0.05 ppm	
22. ANTU (alpha-Naphthyl Thiourea).	NIOSH S276			0.01 mg/M³	DL based on 480 L air vol.
23. Arsenic	OSHA ID105			0.0005 mg/M³	DL based on 480 L air vol.
24. Asphalt (Petroleum) Fumes		OSHA 58		0.006 mg/M	Benzene soluble portion.
25. Atrazine		In-house		0.05 mg/M³	DL based on 300 L air vol.
26. Azinphos-methyl		In-house		0.014 mg/M³	DL based on 300 L air vol.
27. Barium Sulfate	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
28. Benomyl		In-house		0.03 mg/M³	DL based on 60 L air vol.
29. Beryllium & compounds	OSHA ID125			0.04 µg/M³	DL based on 480 L air vol.
30. Bismuth Telluride (Se-doped).		In-house		0.02 mg/M³	DL based on 480 L air vol.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
31. Bismuth Telluride (Undoped).	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
32. Borates, Tetra, Sodium Salts.					
Anhydrous					DL based on 480 L air vol. Method is for total Boron and does not differentiate different forms of Boron.
Decahydrate		In-house		0.01 mg/M³	
Pentahydrate					
33. Boron Oxide	GRAVIMETRIC			0.02 mg/sample	Same as nuisance particulate TLV.
34. Boron Tribromide		In-house		0.013 mg/M³	Based on total Br & 15 L air vol.
35. Bromacil		In-house		0.1 mg/M³	DL based on 50 L air vol.
36. Bromine	OSHA ID108			0.09 ppm	DL based on 30 L air vol.
37. Bromine Pentafluoride		In-house		0.009 mg/M³	Based on total Br & 48 L air vol.
38. Butane		In-house		1 ppm	DL based on 10 L air vol.
39. 2-Butanone (MEK)	OSHA 16			1.5 ppm	
40. 2-Butoxy Ethanol	NIOSH 1403			0.02 ppm	DL based on 10 L air vol.
41. n-Butyl Acetate	NIOSH 1450			0.04 ppm	DL based on 10 L air vol.
42. Butyl Acrylate		In-house		0.3 ppm	DL based on 3 L air vol.
43. sec-Butyl Alcohol	NIOSH 1401			0.5 ppm	DL based on 10 L air vol.
44. tert-Butyl Alcohol	NIOSH 1400			0.5 ppm	DL based on 10 L air vol
45. n-Butyl Alcohol	NIOSH 1401			0.5 ppm	DL based on 10 L air vol.
46. n-Butyl Glycidyl ether (BGE)	NIOSH S81			0.5 ppm	DL based on 10 L air vol.
47. n-Butyl Lactate		OSHA 7		0.2 ppm	Use method for Organic Solvents.
48. Butyl Mercaptan	NIOSH S350			0.2 ppm	DL based on 10 L air vol.
49. o-sec-Butylphenol		In-house		0.1 ppm	DL based on 10 L air vol.
50. p-tert-Butyltoluene	NIOSH 1501			0.1 ppm	DL based on 10 L air vol.
51. Calcium Carbonate (Limestone, Marble).	GRAVIMETRIC			0.02 mg/Sample	Same as nuisance particulate TLV.
52. Calcium Cyanamide		In-house		0.02 mg/M³	DL based on sol. Ca & 480 L air vol.
53. Calcium Hydroxide		OSHA ID121		0.002 mg/M³	DL based on total Ca.
54. Calcium Oxide		OSHA ID121		0.002 mg/M³	DL based on total Ca.
55. Calcium Silicate, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
56. Calcium Sulfate (Plaster of Paris).	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
57. Camphor, Synthetic	NIOSH 1301			0.5 ppm	DL based on 10 L air vol.
58. Caprolactam Vapor & Aerosol.		In-house		0.007 mg/M³	DL based on 100 L air vol.
59. Caprolactam Vapor only		In-house		0.007 mg/M³	DL based on 100 L air vol.
60. Captafol (Difolatan)		In-house		0.025 mg/M³	DL based on 120 L air vol.
61. Captan		In-house		0.02 mg/M³	DL based on 60 L air vol.
62. Carbofuran (Furadan)		In-house		0.02 mg/M³	DL based on 300 L air vol.
63. Carbon Dioxide	OSHA ID172			500 ppm	
64. Carbon Disulfide	OSHA-NIOSH 1600			0.1 ppm	DL based on 5 L air vol.
65. Carbon Monoxide		Field Test		0.5 ppm	Use direct reading instrument.
66. Carbon Tetrabromide		In-house		0.01 ppm	DL based on 10 L air vol.
67. Carbon Tetrachloride (Tetrachloromethane).	NIOSH 1003			0.1 ppm	DL based on 15 L air vol.
68. Carbonyl Fluoride		In-house		0.2 mg/M³	Based on total F & 240 L air vol.
69. Catechol (Pyrocatechol)		OSHA 32		0.5 ppm	Use OSHA method of Cresol.
70. Cellulose (paper fiber)	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
71. Cesium Hydroxide		In-house		0.02 mg/M³	DL based on Total Cs & 480 L air vol.
72. Chlorinated Camphene (Toxaphene).	NIOSH S67			0.05 mg/M³	DL based on 15 L air vol.
73. Chlorine	OSHA ID101			0.13 ppm	
74. Chlorine Dioxide		In-house		0.05 ppm	DL based on 29 L air vol.
75. 1-Chloro-1-nitropropane	NIOSH S211			0.5 ppm	
76. 2-Chloro-6-trichloro-methyl Pyridine (Nitrapyrin).		In-house		0.08 mg/M³	DL based on 60 L air vol.
77. Chloroacetyl Chloride		In-house		0.05 ppm	DL based on 10 L air vol.
78. o-Chlorobenzylidene Malonitrile.		NIOSH 304		0.003 mg/M³	DL based on 90 L air vol.
79. Chlorodifluoromethane		NIOSH 1020		1 ppm	Use NIOSH method for 1,1,2-Trichloro-1,2,2-trifluoroethane.
80. Chloroform	OSHA 5			0.11 ppm	
81. Chloropentafluoroethane		NIOSH 1020		1 ppm	Use NIOSH method for 1,1,2-Trichloro-1,2,2-trifluoroethane.
82. beta-Chloroprene	NIOSH 1002			0.5 ppm	
83. o-Chlorostyrene		NIOSH 1003		0.5 ppm	Use NIOSH method for Chlorobenzene.
84 o-Chorotoluene		NIOSH 1003		0.5 ppm	Use NIOSH method for Chlorobenzene.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
85. Chlorpyrifos (Dursban)	OSHA 62			0.23 ppb	DL based on 480 L air vol.
86. Chromic Acid & Chromates	OSHA ID103			<0.4 µg/M³ as CR^{+6}.	DL based on 480 L air vol.
87. Chromium, metal	ID121, ID125			2 µg/M³	DL based on 480 L air vol.
88. Chromyl Chloride		In-house		0.009 mg/M³	Based on Cr^{+6} & 240 L air vol.
89. Clopidol (Coyden)		In-house		0.08 mg/M³	DL based on 60 L air vol.
90. Coal Dust (<5% Quartz)	GRAV & ID142			0.02 mg/M³	Quartz analysis using 400 L air vol.
91. Coal Dust (>5% Quartz)	GRAV & ID142			0.02 mg/M³	Quartz analysis using 400 L air vol.
92. Cobalt as Co Metal Dust & Fume.	ID121, ID125			2 µg/M³	DL based on 480 L air vol.
93. Cobalt Carbonyl as Co		In-house		0.002 mg/M³	Based on total Co & 480 L air vol.
94. Cobalt Hydrocarbonyl as Co		In-house		0.002 mg/M³	Based on total Co & 480 L air vol.
95. Copper, Fume	ID121, ID125			2 µg/M³	DL based on 480 L air vol.
96. Crag Herbicide (Sesone)	NIOSH S356			1.5 mg/M³	DL based on 90 L air vol.
97. Crufomate		In-house		0.03 mg/M³	DL based on 60 L air vol.
98. Cyanamide			XXXX		
99. Cyanogen		In-house		0.08 ppm	DL based on 10 L air vol.
100. Cyanogen Chloride		In-house		0.05 ppm	DL based on 10 L air vol.
101. Cyclohexanol	NIOSH 1402			0.5 ppm	DL based on 10 L air vol.
102. Cyclohexanone	OSHA 1			0.05 ppm	
103. Cyclohexylamine		In-house		0.5 ppm	DL based on 10 L air vol.
104. Cyclonite (RDX)		In-house		0.08 mg/M³	DL based on 80 L air vol.
105. Cyclopentane		NIOSH 1500		0.5 ppm	Use NIOSH method for pentane.
106. Cyhexatin		In-house		0.008 mg/M³	Solvent extract, Sn anal & 480 L air vol.
107. DDT (Dichlorodiphenyl-trichlorcethane).	NIOSH S274			0.01 mg/M³	DL based on 90 L air vol.
108. Decaborane		In-house		0.002 mg/M³	Hot H_20 extract, B anal & 480 L air vol.
109. Demeton (Systox)	NIOSH 5514			0.006 mg/M³	DL based on 480 L air vol.
110. Di-Sec-Octyl Phthalate		In-house		0.01 mg/M³	DL based on 100 L air vol.
111. 2,6-Di-tert-Butyl-p-cresol		NIOSH 226		0.5 ppm	
112. Diazinon	OSHA 62			0.24 ppb	DL based on 480 L air vol.
113. Dibutyl Phosphate		NIOSH 5017		0.3 mg/M³	DL based on 250 L air vol.
114. 2-N-Dibutylaminoethanol		OSHA-NIOSH 2007.		0.5 ppm	
115. 1,1-Dichloro-1-nitroethane	NIOSH 1601			0.5 ppm	
116. 1,3-Dichloro-5,5-dimethyl-hydantoin.		in-house		0.2 mg/mL	Field anal by Chemiluminescence.
117. Dichloroacetylene		NIOSH 1003		0.05 ppm	Use NIOSH method for 1,1-Dichloroethane.
118. o-Dichlorobenzene	NIOSH 1003			0.5 ppm	
119. p-Dichlorobenzene	NIOSH 1003			0.5 ppm	
120. 1,1-Dichloroethane	NIOSH 1003			0.5 ppm	
121. Dichloroethyl Ether	NIOSH 1004			1 ppm	
122. Dichlorofluoromethane	NIOSH 2516			1 ppm	
123. 1, 3-Dichloropropene		NIOSH 1003		0.5 ppm	Use NIOSH method for 1,1-Dichloroethane.
124. 2,2-Dichloropropionic Acid		In-house		0.5 ppm	DL based on 10 L air vol.
125. Dicrotophos (Bidrin)		In-house		0.008 mg/M³	DL based on 240 L air vol.
126. Dicyclopentadiene		In-house		0.04 ppm	DL based on 10 L air vol.
127. Dicyclopentadienyl Iron		ID121, ID125			
128. Diethanolamine		In-house		0.05 ppm	DL based on 10 L air vol.
129. Diethyl Ketone		In-house		0.5 ppm	DL based on 10 L air vol.
130. Diethyl Phthalate		In-house		0.07 mg/M³	DL based on 180 L air vol.
131. Diethylamine	OSHA 41			0.053 ppm	
132. Diethylenetriamine	OSHA 60			4 ppb	
133. Diglycidyl Ether (DGE)					Not present-Sample for Epichlorohydrin & Bisphenol A.
134. Diisobutyl Ketone	NIOSH 1300			0.5 mg/M³	
135. Dimethyl-1,2-dibromo-2,2-dichloroethyl Phosphate.		In-house		0.01 mg/M³	DL based on 480 L air vol.
136. Dimethyl Sulfate		OSHA-NIOSH 301		0.1 mg/M³	DL based on 20 L air vol.
137. Dimethylaniline (N,N-Dimethylaniline).	NIOSH 2002			0.003 ppm	DL based on 20 L air vol.
138. Dinitolmide (3,5-Dinitro-o-Toluamine).		In-house		0.05 mg/M³	DL based on 240 L air vol.
139. Dioxane (Diethylene Dioxide).	NIOSH 1602			0.5 ppm	
140. Dioxathion (Delnav)		In-house		0.03 mg/M³	DL based on 10 L air vol.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
141. Diphenylamine	OSHA 22			1 ug/M³	
142. Dipropyl Ketone		OSHA 7		0.5 ppm	Use OSHA method for Organic Solvents.
143. Dipropylene Glycol Methyl Ether.	NIOSH S69			0.5 ppm	DL based on 10 L air vol.
144. Diquat		In-house		2.8 mg/M³	DL based on 100 L air vol.
145. Disulfiram		In-house		0.02 mg/M³	DL based on 25 L air vol.
146. Disulfoton (Disyston)		In-house		0.002 mg/M³	DL based on 480 L air vol.
147. Diuron		In-house		0.03 mg/M³	DL based on 60 L air vol.
148. Divinyl Benzene		OSHA 9		0.5 ppm	Use OSHA method for Styrene.
149. Emery	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV
150. Enflurane (Ethrane)	OSHA 29			0.04 ppm	DL based on 10 L air vol.
151. Epichlorohydrin	NIOSH 1010			0.1 ppm	DL based on 20 L air vol.
152. Ethanolamine		In-house		0.08 ppm	DL based on 10 L air vol.
153. Ethion (Nialate)		In-house		0.008 mg/M³	DL based on 240 L air vol.
154. Ethrane (Enflurane)	OSHA 29			0.04 ppm	DL based on 10 L air vol.
155. Ethyl Acrylate	NIOSH 1450			0.5 ppm	
156. Ethyl Benzene	NIOSH 1501			0.05 ppm	DL based on 10 L air vol.
157. Ethyl Bromide	NIOSH 1011			0.5 ppm	
158. Ethyl Ether	NIOSH 1610			0.5 ppm	
159. Ethyl Mercaptan		In-house		0.1 ppm	DL based on 20 L air vol.
160. Ethyl Silicate	NIOSH S264			0.5 ppm	
161. Ethylene Chlorohydrin	NIOSH 2513			0.1 ppm	
162. Ethylene Dichloride (1,2-Dichloroethane).	OSHA 3			0.05 ppm	
163. Ethylene Glycol		NIOSH 5500		0.8 ppm	
164. Ethylene Glycol Dinitrate	OSHA 43			0.043 ppm	DL based on 15 L air vol.
165. Ethylidene Norbornene			XXXX		
166. N-Ethylmorpholine	NIOSH S146			0.1 ppm	
167. Fenamiphos		In-house		0.004 mg/M³	DL based on 480 L air vol.
168. Fensulfothion (Dasanit)		In-house		0.025 mg/M³	DL based on 200 L air vol.
169. Fenthion (Tiguvon)		In-house		0.004 mg/M³	DL based on 480 L air vol.
170. Ferbam		In-house		0.08 mg/M³	DL based on 60 L air vol.
171. Ferrovanadium Dust	ID121, ID125			2 μg/M³	DL based on Fe or V & 480 L air vol.
172. Fibrous Glass Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV
173. Fluorine		In-house		0.1 mg/M³	As F^-, DL based on 240 L air vol.
174. Fluorotrichloromethane	NIOSH 1006			1 pm	DL based on 3 L air vol.
175. Fonofos		In-house		0.004 mg/M³	DL based on 480 L air vol.
176. Formamide		In-house		0.5 ppm	DL based on 10 L air vol.
177. Furfural		In-house		0.1 ppm	DL based on 10 L air vol.
178. Furfuryl Alcohol	NIOSH S365			0.5 ppm	
179. Gasoline		In-house		0.9 mg/M³	DL based on 10 L air vol.
180. Germanium Tetrahydride		In-house		0.0008 mg/M³	As Ge by (HGA AAS) & 240 L air vol.
181. Glutaraldehyde	OSHA 64			4.4 ppb	
182. Glycerin (Mist)	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
183. Glycidol (2,3-Epoxy-1-propanol).	NIOSH 1608			1 ppm	DL based on 10 L air vol.
184. Grain Dust (oat, wheat, barley).	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
185. Graphite (natural, respirable).	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
186. Gypsum, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
187. Halothane	OSHA 29			0.023 ppm	
188. n-Heptane	NIOSH 1500			0.2 ppm	
189. Hexachlorobutadiene	NIOSH 307			0.2 ppm	DL based on 100 L air vol.
190. Hexachlorocyclopentadiene.		NIOSH 2518		1 ppb	
191. Hexachloroethane	NIOSH 1003			0.5 ppm	DL based on 10 L air vol.
192. Hexafluoroacetone			XXXX		
193. Hexamethylene Diisocyanate.	OSHA 42			0.43 ppb	DL based on 15 L air vol.
194. n-Hexane	NIOSH 1500			0.05 ppm	
195. Hexane Isomers		NIOSH 1500		0.5 ppm	Use NIOSH method for Hexane.
196. 2-Hexanone	NIOSH 1300			0.5 ppm	
197. Hexone (Methyl Isobutyl Ketone).	NIOSH 1300			0.05 ppm	DL based on 10 L air vol.
198. Hexylene Glycol		In-house		0.5 ppm	DL based on 10 L air vol.
199. Hydrazine	OSHA 20			1.2 ppb	
200. Hydrogen Bromide		In-house		0.6 ppb	DL based on 96 L air vol.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
201. Hydrogen Cyanide	OSHA ID120			0.03 ppm	DL based on 90 L air vol.
202. Hydrogen Fluoride		In-house		0.1 ppm	DL based on 240 L air vol.
203. Hydrogen Sulfide	OSHA ID141			0.9 ppm	DL based on 2 L air vol.
204. Hydrogenated Terphenyls		NIOSH 5021		0.1 mg/M³	Use NIOSH method of Terphenyls.
205. 2-Hydroxypropyl Acrylate		NIOSH S43		1 ppm	Use NIOSH method for Methyl Methacrylate.
206. Indene		In-house		0.01 ppm	DL based on 10 L air vol.
207. Indium & Compounds		In-house		0.025 mg/M³	As In. DL based on 480 L air vol.
208. Iodoform		In-house		0.005 ppm	DL based on 10 L air vol.
209. Iron Oxide, (Dust & Fume)	ID121, ID125			3 µg/M³	As Fe_2O_3. DL based on 480 L air vol.
210. Iron Pentacarbonyl (as Fe)		COLORIMETRIC		0.04 mg/M³	DL based on 240 L air vol.
211. Iron Salts, Soluble, as Fe	OSHA ID121			2 µg/M³	As Fe water solubie. DL based on 480 L.
212. Isoamyl Alcohol	NIOSH 1402			0.5 ppm	
213. Isobutyl Alcohol	NIOSH 1401			0.03 ppm	
214. Isooctyl Alcohol		NIOSH 1400		0.5 ppm	Use NIOSH method for Isopropanol.
215. Isophorone	NIOSH 2508			0.07 ppm	DL based on 12 L air vol.
216. Isophorone Diisocyanate		OSHA 42		0.02 mg/M³	DL based on 15 L air vol.
217. 2-Isopropoxyethanol		OSHA 53		0.5 ppm	Use OSHA method for Cellosolve.
218. Isopropyl Acetate	NIOSH S50			0.5 ppm	
219. Isopropyl Alcohol	NIOSH 1400			0.2 ppm	
220. Isopropyl Ether	NIOSH S368			0.5 ppm	
221. Isopropyl Glycidyl Ether (IGE).	NIOSH S77			0.5 ppm	
222. Isopropylamine	NIOSH S147			0.5 ppm	
223. N-Isopropylaniline		NIOSH 2002		0.5 ppm	Use NIOSH method for Dimethylaniline.
224. Kaolin, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
225. Ketene	NIOSH S92			0.2 mg/M³	DL based on 50 L air vol.
226. Limestone, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
227. Magnesite, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
228. Magnesium Oxide fume	OSHA ID121			4 ug/M³	As total Mg, DL based on 480 L air vol.
229. Malathion	OSHA 62			2.2 ppb	DL based on 60 L air vol.
230. Manganese as Mn Dust & Compounds Fume.	ID121, ID125			0.07 mg/M³	As Mn, Method does not distinguish fume from dust.
	ID121, ID125			0.004 mg/M³	
231. Manganese Cyclopentadienyl Tricarbonyl as Mn.		In-house		0.004 mg/M³	Total Mn by AAS, 240 L air vol.
232. Manganese Tetroxide	ID121, ID125			0.004 mg/M³	DL based on total Mn & 30 L air vol.
233. Marble, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
234. Mercury as Hg Alkyl Compounds.			XXXX		
All forms except alkyl vapor	In-house			0.001mg/M³	DL based on 15 L air vol.
Aryl & inorganic compounds.	In-house			0.001 mg/M³	DL based on 15 L air vol.
235. Mesityl Oxide	NIOSH 1301			0.5 ppm	
236. Methacrylic Acid		In-house		0.03 ppm	DL based on 20 L air vol.
237. Methomyl (Lannate)		In-house		0.03 mg/M³	DL based on 60 L air vol & OVS-2 Sampler.
238. Methoxychlor		OSHA-NIOSH S371.		0.5 mg/M³	DL based on 100 L air vol.
239. 4-Methoxyphenol		OSHA 32		0.5 ppm	Use OSHA method for Cresol.
240. Methyl-2-cyanoacrylate	OSHA 55			0.01 ppm	
241. Methyl Acetate	NIOSH S42			0.5 ppm	
242. Methyl Acetylene/Propadiene Mixture (MAPP).		In-house		2.5 ppm	DL based on 5 L air vol.
243. Methyl Acrylonitrile		OSHA 37		0.1 ppm	Use OSHA method for Acrylonitrile.
244. Methyl Alcohol	OSHA-NIOSH 2000			1.5 ppm	
245. Methyl Bromide	NIOSH 2520			0.5 ppm	
246. Methyl Chloride	NIOSH 1001			0.5 ppm	DL based on 10 L air vol.
247. Methyl Chloroform (1,1,1-Trichloroethane).	OSHA 14			0.07 ppm	
248. Methyl Demeton		In-house		0.03 mg/M³	DL based on 60 L air vol.
249. Methyl Ethyl Ketone Peroxide.		In-house		0.05 mg/M³	DL based on 15 L air vol.
250. Methyl Formate	NIOSH S291			1 ppm	DL based on 10 L air vol.
251. Methyl Iodide	NIOSH 1014			0.5 ppm	
252. Methyl Isoamyl Ketone		In-house		0.5 ppm	DL based on 10 L air vol.
253. Methyl Isobutyl Carbinol (Methyl Amyl Alcohol).	NIOSH 1402			0.5 ppm	
254. Methyl Isopropyl Ketone		OSHA 7		0.5 ppm	Use OSHA method for Organic Solvents.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
255. Methyl Mercaptan (Methanethiol).	OSHA 26			0.027 ppm	
256. Methyl-(N-amyl) Ketone	NIOSH 1301			0.5 ppm	
257. Methyl Parathion		In-house		0.002 mg/M³	DL based on 480 L air vol.
258. Methyl Silicate		NIOSH S264		0.5 ppm	Use NIOSH method for Ethyl Silicate.
259. alpha-Methyl Styrene	NIOSH 1501			1 ppm	
260. Methylcyclohexane	NIOSH 1500			0.5 ppm	
261. Methylcyclohexanol	NIOSH S374			0.5 ppm	
262. o-Methylcyclohexanone	NIOSH 2521			0.5 ppm	
263. Methylcyclopentadienyl-Mn-Tricarbonyl as Mn.		In-house		0.004 mg/M³	Total Mn by AAS, & 240 L air vol.
264. Methylene Bis (4-cyclohexylisocyanate).		In-house		0.02 mg/M³	DL based on 15 L air vol.
265. 4,4'-Methylene-Bis-(2-chloroaniline).	OSHA 24			3.6 μg/M³	DL based on 100 L air vol.
266. Methylene Bisphenyl Isocyanate (MDI).	OSHA 47			2.6 μg/M³	DL based on 15 L air vol.
267. Metribuzin		In-house		0.1 mg/M³	DL based on 120 L air vol.
268. Mica	GRAV & ID142	In-house		0.02 mg/M³	Regulated as Quartz if >1% Quartz, 400 L.
269. Mineral Wool Fiber	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
270. Molybdenum Insoluble Compounds, as Mo-.	ID121, ID125			4 μg/M³	as Mo, DL based on 480 L air vol.
271. Monocrotophos		In-house		0.008 mg/M³	DL based on 240 L air vol.
272. Monomethyl Aniline	NIOSH S153			0.1 ppm	
273. Morpholine	NIOSH S150			0.5 ppm	
274. Naphthalene	OSHA 35			80 ppb	
275. Nickel Soluble Compounds as Ni-.	ID121, ID125			4 μg/M³	As Ni, DL based on 480 L air vol.
276. Nickel Carbonyl		In-house		0.002 mg/M³	Based on total Ni & 240 L air vol.
277. Nickel Sulfide Roasting, Fume & Dust, as Ni-.		OSHA ID121		4 μg/M³	As Ni, DL based on 480 L air vol.
278. Nitric Acid		ID127		0.5 ppb	DL based on 96 L air vol.
279. p-Nitroaniline	NIOSH S7			0.5 ppm	
280. p-Nitrochlorobenzene	NIOSH 2005			0.1 ppm	
281. Nitrogen Dioxide		ID109, ID182		0.2 ppm	DL based on 3 L air vol.
282. Nitroglycerin (NG)	OSHA 43			2 ppb	DL based on 15 L air vol.
283. 2-Nitropropane	OSHA 46			0.025 ppm	
284. Nitrotoluene	NIOSH 2005			0.1 ppm	
285. Nonane		NIOSH 1500		0.2 ppm	Use NIOSH method for Heptane.
286. Nuisance Particulates, Total Dust-.	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
287. Octachloronaphthalene	NIOSH S97			0.05 mg/M³	
288. Octane	NIOSH 1500			0.5 ppm	
289. Oil Mist, (Mineral)	GRAV & In-house			0.1 mg/M³	DL varies based on oil & 480 L air vol.
290. Osmium Tetroxide		In-house		0.002 mg/M³	Neutron Activation Analysis, Total Os.
291. Oxalic Acid		In-house		0.02 mg/M³	DL based on 480 L air vol.
292. Oxygen Difluoride			XXXX		
293. Ozone		In-house		0.01 ppm	Chemiluminescence, direct read.
294. Paraffin Wax fume		In-house		0.5 mg/M³	DL based on 120 L air vol.
295. Paraquat respirable dust-	NIOSH 5003			0.1 mg/M³	DL based on 90 L air vol.
296. Pentaborane		In-house		0.005 mg/M³	Based on B & 240 L air vol.
297. Pentaerythritol, Total Dust-	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
298. Pentane	NIOSH 1500			0.5 ppm	DL based on 10 L air vol.
299. 2-Pentanone (Methyl Propyl Ketone).	NIOSH 1300			0.5 ppm	DL based on 10 L air vol.
300. Perchloroethylene (Tetrachloroethylene).	NIOSH 1003			0.05 ppm	DL based on 10 L air vol.
301. Perchloryl Fluoride		In-house		0.6 mg/M³	Based on F & 240 L air vol.
302. Perlite	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
303. Persulfates			XXXX		
304. Petroleum Distillates (Naphtha).	OSHA 48			<260 mg/M³	DL based on 3 L air vol.
305. Phenothiazine		In-house		0.1 mg/M³	DL based on 240 L air vol.
306. Phenyl Ether (Vapor)	NIOSH S72			0.1 ppm	
307. Phenyl Glycidyl Ether (PGE)-.	NIOSH S74			0.1 ppm	
308. Phenylmercaptan		OSHA 26		0.1 ppm	Use OSHA method for Methyl Mercaptan.
309. Phenylhydrazine	NIOSH S160			5 mg/M³	DL based on 120 L air vol.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
310. Phenylphosphine			XXXX		
311. Phorate (Thimet)		In-house		0.003 mg/M³	DL based on 480 L air vol.
312. Phosdrin (Mevinphos)	NIOSH 2503			0.001 mg/M³	DL based on 240 L air vol.
313. Phosphine	OSHA ID180			0.015 ppm	DL based on 36 L air vol.
314. Phosphoric Acid		OSHA ID111		0.01 mg/M³	DL based on 480 L air vol.
315. Phosphorus Oxychloride		In-house		0.002 mg/M³	DL based on PO_4^{-3} & 240 L air vol.
316. Phosphorus Pentasulfide		In-house		0.025mg/M³	DL based on 60 L air vol.
317. Phosphorus Trichloride		NIOSH 6402		1.1mg/M³	DL based on 24 L air vol.
318. Phthalic Anhydride		In-house		0.38mg/M³	DL based on 27 L air vol.
319. m-Phthalodinitrile		OSHA 37		0.5 mg/M³	Use OSHA method for Acrylonitrile.
320. Picloram (Tordom)		In-house		0.03 mg/M³	DL based on 60 L air vol.
321. Picric Acid (2,4,6-Trinitrophenol).	NIOSH S228			0.04 mg/M³	DL based on 180 L air vol.
322. Piperazine Dihydrochloride		In-house		1 ppm	DL based on 10 L air vol.
323. Plaster of Paris Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
324. Platinum Metal		In-house		0.2 μ/M³	DL based on 480 L air vol.
325. Portland Cement	GRAV & ID142			0.02 mg/M³	Use Quartz std if >1% Quartz.
326. Potassium Hydroxide		OSHA ID121		0.03 mg/M³	Bases on water soluble K^+ & 480 L air.
327. Propargyl Alcohol		NIOSH 1400		0.1 ppm	Use NIOSH method for Isopropanol.
328. Propionic Acid		In-house		0.03 ppm	DL based on 10 L air vol.
329. Propoxur (Baygon)		In-house		0.003 mg/M³	DL based on 60 L air vol.
330. n-Propyl Acetate	NIOSH 1450			0.5 ppm	DL based on 10 L air vol.
331. Propyl Alcohol	NIOSH 1401			0.5 ppm	
332. n-Propyl Nitrate	NIOSH S227			1 ppm	
333. Propylene Dichloride	NIOSH 1003			0.5 ppm	
334. 1,2-Propylene Glycol Dinitrate.		OSHA 43		0.2 mg/M³	Use OSHA 43 for EGDN, & 15 L air vol.
335. Propylene Glycol Monomethyl Ether.		OSHA 53		0.5 ppm	Use OSHA method for Cellosolve.
336. Propylene Oxide	NIOSH 1612			0.1 ppm	
337. Pyridine	NIOSH 1613			0.5 ppm	
338. Resorcinol		In-house		0.02 mg/M³	DL based on 120 L air vol.
339. Rhodium Metal		In-house		0.1 μ/M³	DL based on 480 L air vol.
Insoluble Compounds as Rh.		In-house		0.1 μ/M³	DL based on 480 L air vol.
Soluble Compounds as Rh		In-house		0.1 μ/M³	DL based on 480 L air vol.
340. Ronnel		In-house		0.002 mg/M³	DL based on 120 L air vol.
341. Rosin Core Solder Pyrolysis Products, as Formaldehyde.	OSHA 53	In-house			Sample for Formaldehyde (OSHA 53) and Abietic Acid (OSHA In-house) as per Chemical Information File.
342. Rouge, (Total dust)	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
343. Silica—Amorphous Diatomaceous Earth (uncalcined).	GRAV & ID142			0.02 mg/M³	If >1% Quartz, use Quartz standard.
Percipitated Silica-Silica Gel.					
344. Silica—Crystalline Cristobalite.	OSHA ID142			0.05 mg/M³	DL based on 816 L air vol.
Quartz	OSHA ID142			0.02 mg/M³	DL based on 480 L air vol.
Silica, Fused	GRAVIMETRIC			0.02 mg/M³	If >1% Quartz, use Quartz standard.
Tridymite	OSHA ID142			0.05 mg/M³	
Tripoli	OSHA ID142			0.02 mg/M³	Quartz analysis.
345. Silicon	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
346. Silicon Carbide	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
347. Silicon Tetrahydride (Silane).		In-house		0.002 mg/M³	DL based on Si anal & 240 L air vol.
348. Silver Metal	OSHA ID121			0.5 mg/M³	DL based on 480 L air vol.
Soluble Compounds as Ag	OSHA ID121			0.5 μ/M³	DL based on 480 L air vol.
349. Soapstone, Total	GRAV. & ID142			0.02 mg/M³	If >1% Quartz, use Quartz standard.
350. Sodium Azide		In-house		0.06 mg/M³	DL based on 15 L air vol.
351. Sodium Bisulfite		In-house		0.04 mg/M³	Based on Na & 480 L air vol.
352. Sodium Fluoroacetate		In-house		0.04 mg/M³	Based on Na & 480 L air vol.
353. Sodium Hydroxide		OSHA ID121		0.04 mg/M³	Based on Na & 480 L air vol.
354. Sodium Metabisulfite		In-house		0.04 mg/M³	Based on Na & 480 L air vol.
355. Starch, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
356. Stearates	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
357. Stoddard Solvent	OSHA 48			<260 mg/M³	DL based on 3 L air vol.
358. Styrene Monomer (Phenylethylene, Vinyl Benzene).	OSHA 9			3.1 ppm	
359. Subtilisins (Proteolitic Enzymes).			XXXX		

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
360. Sucrose, Total Dust	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
361. Sulfur Dioxide	OSHA ID107			0.07 mg/M³	DL based on 24 L air vol.
362. Sulfur Monochloride		In-house		0.01 mg/M³	Based on Cl^- & 15 L air vol.
363. Sulfur Pentafluoride			XXX		
364. Sulfur Tetrafluoride		In-house		0.05 mg/M³	Based on F^- & 15 L air vol.
365. Sulfuryl Fluoride		Field test		0.1 ppm	Miran 1A & 1B: MIN. Detectable Conc.=0.1 ppm at 11.5 um.
366. Sulprofos		In-house		0.03 mg/M³	DL based on 60 L air vol.
367. Talc (Non-Asbestiform)	GRAVIMETRIC	Particle count		0.02 mg/M³	Same as nuisance particulate TLV.
368. Tantalum, Metal & Oxide Dust.	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV
369. Temephos		In-house		0.02 mg/M³	DL based on 60 L air vol.
370. Terphenyls	NIOSH 5021			0.1 ppm	
371. 1,1,2,2-Tetrachloroethane	NIOSH 1019			0.1 ppm	
372. Tetraethyl Lead (as Pb)		In-house		0.004 mg/M³	DL based on 240 L air vol & total Pb.
373. Tetrahydrofuran	NIOSH 1609			1 ppm	
374. Tetramethyl Lead (as Pb)		In-house		0.004 mg/M³	DL based on 240 L air vol & total Pb.
375. Tetrasodium Pyrophosphate.		In-house		0.015 mg/M³	Based on Na & 480 L air vol.
376. Thallium (Soluble Compounds).		OSHA ID121		0.03 mg/M³	DL based on 480 L air vol.
377 4,4'-Thio-bis(6-tertbutyl-m-cresol).		In-house		0.04 mg/M³	DL based on 120 L air vol.
378. Thioglycolic Acid		In-house		0.07 ppm	DL based on 10 L air vol.
379. Thionyl Chloride		In-house		0.01 mg/M³	Based on Cl^- & 15 L air vol.
380. Tin Oxide		In-house		0.03 mg/M³	DL based on 480 L air vol.
Organic compounds, as Sn		In-house		0.01 mg/M³	Only Org-Sn's listed in Chem Info File.
381. Titanium Dioxide	GRAVIMETRIC			0.02 mg/M³	Same as nuisance particulate TLV.
382. Toluene	NIOSH 4000			0.02 ppm	DL based on 10 L air vol.
383. Toluene-2,4-diisocyanate (TDI).	OSHA 42			0.36 ppb	DL based on 15 L air vol.
384. o-Toluidine	NIOSH 2002			0.1 ppm	
385. p-Toluidine		NIOSH 2002		0.1 ppm	Use NIOSH method for o-Toluidine.
386. m-Toluidine		NIOSH 2002		0.1 ppm	Use NIOSH method for o-Toluidine.
387. Tributyl Phosphate	OSHA-NIOSH S208			0.5 mg/M³	DL based on 100 L air vol.
388. 1,1,2-Trichloro-1,2,2,-trifluoroethane.	NIOSH 1020			1.4 ppm	DL based on 1.5 L air vol.
389. Trichloroacetic Acid		NIOSH 1603		0.1 ppm	Use NIOSH method for Acetic Acid.
390. 1,2,4-Trichlorobenzene		NIOSH 5517		0.5 ppm	DL based on 10 L air vol.
391. Trichloroethylene	NIOSH 1022,3701			0.2 ppm	DL based on 3 L air vol.
392. 1,2,3-Trichloropropane	NIOSH 1003			0.5 ppm	DL based on 10 L air vol.
393. Triethylamine	NIOSH S152			0.5 ppm	
394. Trimellitic Anhydride		In-house		0.001 mg/M³	DL based on 480 L air vol.
395. Trimethyl Phosphate		In-house		0.5 ppm	DL based on 120 L air vol.
396. Trimethylamine		In-house		0.5 ppm	DL based on 10 L air vol.
397. Trimethylbenzene		In-house		0.02 ppm	DL based on 10 L air vol.
398. 2,4,6-Trinitrotoluene (TNT)	OSHA 44			0.021 mg/M³	
399. Triorthocresyl Phosphate	OSHA-NIOSH S209			0.01 mg/M³	DL based on 100 L air vol.
400. Triphenylamine		In-house		0.5 ppm	DL based on 10 L air vol.
401. Tungsten, as W Insoluble Compounds.		In-hosue		0.002 mg/M³	480 L & Neutron Activation Analysis.
Soluble Compounds		In-house		0.002 mg/M³	480 L & Neutron Activation Analysis.
402. Uranium Insoluble Compounds.		In-house		0.8 μg/M³	DL based on 480 L air vol.
Soluble Compounds		In-house		0.8 μg/M³	DL based on 480 L air vol.
403. N-Valeraldehyde		OSHA 68		1 ppm	Use OSHA method for Acetaldehyde
404. Vanadium, as (V_2O_5) Respirable Dust.	OSHA ID125			0.004 mg/M³	Based on total V analysis & 480 L
Fume	OSHA ID125			0.004 mg/M³	Based on total V analysis & 480 L
405. Vegetable Oil Mist	GRAVIMETRIC				Same as nuisance particulate TLV.
406. Vinyl Acetate	NIOSH 278			0.01 ppm	
407. Vinyl Bromide	OSHA 8			0.2 ppm	
408. Vinyl Cyclohexene Dioxide		In-house		0.5 ppm	DL based on 10 L air vol.
409. Vinyl Toluene	NIOSH 1501			0.5 ppm	
410. Vinylidene Chloride	OSHA 19			0.05 ppm	
411. VM&P Naphtha	OSHA 48			<260 mg/M³	DL based on 3 L air vol.
412. Welding Fumes (Total Particulate).	GRAV. & ID125				See Det. Lim. for specific metals
413. Xylene (o-,m-,p-isomers)	NIOSH 1501			0.02 ppm	DL based on 12 L air vol.

SAMPLING AND ANALYTICAL METHODS—Continued

Number analyte	Validated method	Other method	No method	Det limit [1]	Comments
414. m-Xylene-alpha,alpha'-diamine.		In-house		0.1 ppm	DL based on 10 L air vol.
415. Xylidine	NIOSH 2002			2.5 mg/M³	DL based on 20 L air vol.
416. Zinc Chloride fume		OSHA ID121		0.006 mg/M³	Based on Zn & 480 L air vol.
417. Zinc Stearate		OSHA ID121		0.003 mg/M³	Based on Zn & 480 L air vol.
418. Zinc Chromates, as (CrVI)	OSHA ID103			0.4 µg/M³	As Cr^{+6}. DL based on 480 L air vol.
419. Zinc Oxide Fume	GRAV & ID121,			0.003 mg/M³	Total Zn. Does not differentiate fume & dust.
Dust	ID125	ID143		0.003 mg/M³	
420. Zirconium Compounds	GRAV & ID121			1 mg/M³	DL based on 480 L air vol.

1. Detection Limits (DL) are approximate values based on the analytical procedures recommended air volume or the air volume cited in the "comments" section.
2. "In-house" refers to analytical methods used by OSHA that have not been fully validated by either NIOSH or OSHA. These procedures have been developed by OSHA or were taken from the literature. Some literature methods may not have been used by OSHA as yet.

NIOSH ANALYTICAL METHODS FOR PEL UPDATE

No.	Analyte	NIOSH Validated Method	Other NIOSH Method
1.	Acetaldehyde	NIOSH 3507	
2.	Acetic acid	NIOSH 1603	
3.	Acetic anhydride	NIOSH 3506	
4.	Acetone	NIOSH 1400	
5.	Acetonitrile	NIOSH 1606	
7.	Acrolein	NIOSH 2501	
10.	Allyl alcohol	NIOSH 1402	
11.	Allyl chloride	NIOSH 1000	
12.	Allyl glycidyl ether (AGE)	NIOSH S346	
17.	Ammonia	NIOSH 6701	
20.	Ammonium Sulfamate (Ammate)	NIOSH 5348	
21.	Aniline	NIOSH 2002	
22.	ANTU (Alpha-Naphthyl Thiourea)	NIOSH S276	
23.	Arsenic	NIOSH 7900	
29.	Beryllium & compounds	NIOSH 7102	
33.	Boron Oxide	NIOSH 500, 600	
39.	2-Butanone (MEK)	NIOSH 2500	
40.	2-Butoxy ethanol	NIOSH 1403	
41.	n-Butyl acetate	NIOSH 1450	
43.	sec-Butyl alcohol	NIOSH 1401	
44.	tert-Butyl alcohol	NIOSH 1400	
45.	n-Butyl alcohol	NIOSH 1401	
46.	n-Butyl glycidyl ether (BGE)	NIOSH S81	
48.	Butyl mercaptan	NIOSH S350	
50.	p-tert-Butyltoluene	NIOSH 1501	
51.	Calcium carbonate (Limestone, Marble)	NIOSH 500, 600	
53.	Calcium hydroxide	NIOSH 7020	
54.	Calcium oxide	NIOSH 7020	
56.	Calcium Sulfate (Plaster of Paris)	NIOSH 500, 600	
57.	Camphor, synthetic	NIOSH 1301	
63.	Carbon Dioxide	NIOSH 5249	
64.	Carbon Disulfide	NIOSH 1600	
65.	Carbon Monoxide	NIOSH S340	
67.	Carbon Tetrachloride (Tetrachloromethane)	NIOSH 1003	
70.	Cellulose (paper fiber)	NIOSH 500, 600	
72.	Chlorinated Camphene (Toxaphene)	NIOSH S67	
75.	1-Chloro-1-nitropropane	NIOSH S211	
78.	o-Chlorobenzylidene malonitrile		NIOSH 304
79.	Chlorodifluoromethane		NIOSH 1020
80.	Chloroform	NIOSH 1003	
81.	Chloropentafluoroethane		NIOSH 1020
82.	beta-Chloroprene	NIOSH 1002	
83.	o-Chlorostyrene		NIOSH 1003
84.	o-Chlorostyrene		NIOSH 1003
84.	Chlorostyrene		NIOSH 1003

NIOSH ANALYTICAL METHODS FOR PEL UPDATE—Continued

No.	Analyte	NIOSH Validated Method	Other NIOSH Method
86.	Chromic Acid & Chromates	NIOSH 7600	
87.	Chromium, metal	NIOSH 7024, 7300	
92.	Cobalt as Co Metal dust & fume	NIOSH 7027, 7300	
95.	Copper, Fume	NIOSH 7029, 7200, 7300	
96.	Crag Herbicide (Sesone)	NIOSH S356	
101.	Cyclohexanol	NIOSH 1402	
102.	Cyclohexanone	NIOSH 1300	
105.	Cyclopentane		NIOSH 1500
107.	DDT (Dichlorodiphenyl-trichloroethane)	NIOSH S274	
109.	Demeton (Systox)	NIOSH 5514	
111.	2,6-Di-tert-Butyl-p-cresol		NIOSH 226
113.	Dibutyl Phosphate		NIOSH 5017
114.	2-N-Dibutylaminoethanol		NIOSH 2007
115.	1,1-Dichloro-1-nitroethane	NIOSH 1601	
117.	Dichloroacetylene		NIOSH 1003
118.	o-Dichlorobenzene	NIOSH 1003	
119.	p-Dichlorobenzene	NIOSH 1003	
120.	1,1-Dichloroethane	NIOSH 1003	
121.	Dichloroethyl Ether	NIOSH 1004	
122.	Dichlorfluoromethane	NIOSH 2516	
123.	1,3-Dichloropropene		NIOSH 1003
134.	Diisobutyl ketone	NIOSH 1300	
136.	Dimethyl Sulfate		NIOSH 301
137.	Dimethylaniline (N,N-Dimethylaniline)	NIOSH 2002	
139.	Dioxane (Diethylene Dioxide)	NIOSH 1602	
143.	Dipropylene Glycol Methyl Ether	NIOSH S69	
151.	Epichlorohydrin	NIOSH 1010	
152.	Ethanolamine	NIOSH 2007	
155.	Ethyl Acrylate	NIOSH 1450	
156.	Ethyl Benzene	NIOSH 1501	
157.	Ethyl Bromide	NIOSH 1011	
158.	Ethyl Ether	NIOSH 1610	
160.	Ethyl Silicate	NIOSH S264	
161.	Ethylene Cholorhydrin	NIOSH 2513	
162.	Ethylene Dichloride (1,2-Dichloroethane)	NIOSH 1003	
163.	Ethylene Glycol	NIOSH 5500	
164.	Ethylene Glycol Dinitrate	NIOSH 2507	
166.	N-Ethylmoropholine	NIOSH S146	
174.	Fluorotrichloromethane	NIOSH 1006	
177.	Furfural	NIOSH 2529	
178.	Furfuryl Alcohol	NIOSH S365	
183.	Glycido (2,3-Epoxy-1-propanol)	NIOSH 1608	
185.	Graphite (natural, respirable)	NIOSH 500, 600	
186.	Gypsum, Total dust-n-Heptane	NIOSH 500, 600	
188.	n-Heptane	NIOSH 1500	
189.	Hexachlorobutadiene	NIOSH 307	
190.	Hexachlorocyclopentadiene		NIOSH 308
191.	Hexachloroethane	NIOSH 1003	
194.	n-Hexane	NIOSH 1500	
195.	Hexane Isomers		NIOSH 1500
196.	2-Hexanone	NIOSH 1300	
197.	Hexone (Methyl Isobutyl Ketone	NIOSH 1300	
199.	Hydrazine	NIOSH 3503	
200.	Hydrogen Bromide	NIOSH 7903	
201.	Hydrogen Cyanide	NIOSH 7904	
202.	Hydrogen Fluoride	NIOSH 7903	
204.	Hydrogenated Terphenyls		NIOSH 5021
205.	2-Hydroxypropyl Acrylate		NIOSH S43
212.	Isoamyl Alcohol	NIOSH 1402	
213.	Isobutyl Alcohol	NIOSH 1401	

NIOSH ANALYTICAL METHODS FOR PEL UPDATE—Continued

No.	Analyte	NIOSH Validated Method	Other NIOSH Method
214.	isoctyl Alcohol		NIOSH 1400
215.	Isophorone	NIOSH 2508	
218.	Isopropyl Acetate	NIOSH S50	
219.	Isopropyl Alcohol	NIOSH 1400	
220.	Isopropyl Ether	NIOSH S368	
221.	Isopropyl Glycidyl Ether (IGE)	NIOSH S77	
222.	Isopropylamine	NIOSH S147	
223.	N-Isopropylaniline		NIOSH 2002
225.	Ketene	NIOSH S92	
226.	Limestone, Total Dust	NIOSH 500, 600	
227.	Magnesite, Total Dust	NIOSH 500, 600	
233.	Marble, Total Dust	NIOSH 500, 600	
235.	Mesityl Oxide	NIOSH 1301	
238.	Methoxychlor		NIOSH S371
241.	Methyl Acetate	NIOSH S42	
242.	Methyl Acetylene/Propadiene Mixture (MAPP)	NIOSH S85	
244.	Methyl Alcohol	NIOSH S59	
245.	Methyl Bromide	NIOSH 2520	
246.	Methyl Chloride	NIOSH 1001	
247.	Methyl Chloroform (1,1,1-Tricholorethane)	NIOSH 1003	
249.	Methyl Ethyl Ketone Peroxide		NIOSH 3508
250.	Methyl Formate	NIOSH S291	
251.	Methyl Iodide	NIOSH 1014	
253.	Methyl Isobutyl Carbinol (Methyl Amyl Alcohol)	NIOSH 1402	
256.	Methyl-(N-Amy)Ketone	NIOSH 1301	
258.	Metthyl Sililicate		NIOSH S264
259.	alpha-Methyl Styrene	NIOSH 1501	
260.	Methylcyclohexane	NIOSH 1500	
261.	Methylcyclohexanol	NIOSH S374	
262.	o-Methylcyclohexanone	NIOSH 2521	
269.	Mineral Wool Fiber	NIOSH 500, 600	
272.	Monomethyl Aniline	NIOSH S153	
273.	Morpholine	NIOSH S150	
274.	Naphthalene	NIOSH 1501	
276.	Nickel Carbonyl		NIOSH 6007
278.	Nitric Acid	NIOSH 7903	
279.	p-Nitroaniline	NIOSH S7	
280.	p-Nitrochlorobenzene	NIOSH 2005	
281.	Nitrogen Dioxide		NIOSH 6700
282.	Nitroglycerin (NG)	NIOSH 2507	
283.	2-Nitropropane	NIOSH 2528	
284.	Nitrotoluene	NIOSH 2005	
285.	Nonane		NIOSH 1500
286.	Nuisance Particulates, Total dust	NIOSH 500, 600	
287.	Octachloronaphthalene	NIOSH S97	
288.	Octane	NIOSH 1500	
295.	Paraquat respirable dust	NIOSH 5003	
298.	Pentane	NIOSH 1500	
299.	2-Pentanone (Methyl propl ketone)	NIOSH 1300	
300.	Perchloroethylene (Tetrachloroethylene)	NIOSH 1003	
302.	Perlite	NIOSH 500, 600	
304.	Petroleum Distillates (Naphtha)	NIOSH 1500	
306.	Phenyl Ether (Vapor)	NIOSH S72	
307.	Phenyl Glycidyl Ether (PGE)	NIOSH S74	
309.	Phenylhydrazine	NIOSH S160	
312.	Phosdrin (Mevinphos)	NIOSH 2503	
314.	Phosphoric Acid	NIOSH 7903	
317.	Phosphorus Trichloride		NIOSH 305
321.	Picric Acid (2,4,6-Trinitrophenol)	NIOSH S228	

NIOSH ANALYTICAL METHODS FOR PEL UPDATE—Continued

No.	Analyte	NIOSH Validated Method	Other NIOSH Method
323.	Plaster of Paris Total Dust	NIOSH 500, 600	
327.	Propargyl Alcohol		NIOSH S65
330.	n-Propyl Acetate	NIOSH 1450	
331.	Propyl Alcohol	NIOSH 1401	
332.	n-Propyl Nitrate	NIOSH S227	
333.	Propylene Dichloride	NIOSH 1003	
336.	Propylene Oxide	NIOSH 1612	
337.	Pyridine	NIOSH 1613	
342.	Rouge, (Total Dust)	NIOSH 500, 600	
343.	Silica—Amorphous Diatomaceous earth (uncalcined)—Percipitated silica-Silica gel-		NIOSH 7501
344.	Silica—Crystalline		
	Cristobalite	NIOSH 7500	
	Quartz	NIOSH 7500	
	Tridymite	NIOSH 7500	
	Tripoli-	NIOSH 7500	
345.	Silicon	NIOSH 500, 600	
346.	Silicon Carbide	NIOSH 500, 600	
353.	Sodium Hydroxide		NIOSH 7401
355.	Starch, Total Dust	NIOSH 500, 600	
357.	Stoddard Solvent	NIOSH 1550	
360.	Sucrose, Total Dust	NIOSH 500, 600	
361.	Sulfur Dioxide		NIOSH 6004
367.	Talc (Non-asbestiform)	NIOSH 500, 600	
370.	Terphenyls	NIOSH 5021	
371.	1,1,2,2-Tetrachloroethane	NIOSH 1019	
372.	Tetraethyl Lead (as Pb)	NIOSH 2533	
373.	Tetrahydrofuran	NIOSH 1609	
374.	Tetramethyl Lead (as Pb)	NIOSH 2534	
380.	Tin as Sn-		NIOSH 5504
382.	Toluene	NIOSH 1500, 1501	
383.	Toluene-2,4-diisocyanate (TDI)	NIOSH 2535	
384.	o-Toluidine	NIOSH 2002	
385.	p-Toluidine		NIOSH 2002
386.	m-Toluidine		NIOSH 2002
387.	Tributyl Phosphate	NIOSH S208	
388.	1,1,2-Trichloro-1,2,2-trifluoroethane	NIOSH 1020	
389.	Trichloroacetic Acid		NIOSH 1603
390.	1,2,4-Trichlorobenzene		NIOSH 5517
391.	Trichloroethylene	NIOSH 1022, 3701	
392.	1,2,3-Trichloropropane	NIOSH 1033	
393.	Triethylamine	NIOSH S152	
399.	Triorthocresyl Phosphate	NIOSH S209	
401.	Tungsten, as W		
	Insoluble compounds	NIOSH 7074	
	Soluble compounds	NIOSH 7074	
404.	Vanadium, as (V_2O_5)		
	Respirable dust		NIOSH 7504
	fume		NIOSH 7504
406.	Vinyl Acetate	NIOSH 278	
407.	Vinyl Bromide	NIOSH 1009	
409.	Vinyl Toluene	NIOSH 1501	
410.	Vinylidene Chloride	NIOSH 1015	
411.	VM&P Naphtha	NIOSH 1550	
412.	Welding fumes (Total particulate)	NIOSH 7200	
413.	Xylene (o-,m-,p-isomers)	NIOSH 1501	
415.	Xylidine	NIOSH 2002	
419.	Zinc Oxide		
	Fume	NIOSH 7502	

NIOSH ANALYTICAL METHODS FOR PEL UPDATE—Continued

No.	Analyte	NIOSH Validated Method	Other NIOSH Method
	Dust	NIOSH 7502	

Appendix B—Preliminary Regulatory Impact, Regulatory Flexibility Analysis, and Feasibility Analysis

Outline

Copies of Supplements 2 through 6 are available upon request by calling or writing: Ms. Regina Flahie, Office of Regulatory Analysis, Room N3627, U.S. Department of Labor-OSHA, 200 Constitution Ave. N.W., Washington, DC 20210 (202) 523-7283.

List of Tables and Figures

I. Introduction and Executive Summary

Introduction

The Occupational Safety and Health Administration (OSHA) is proposing to amend its existing air contaminant standards 29 CFR 1910.1000, Tables Z-1, Z-2, and Z-3. The amendments would lower the 8-hour time weighted average permissible exposure limits (PELS) for about 100 substances now listed on the "Z" tables, raise the limit for one chemical, set exposure limits for about 190 substances currently not regulated by OSHA, set short term exposure limits for 70 substances, and, in some cases, set limits for ceiling and skin exposures.

Background

Congress enacted the Occupational Safety and Health Act of 1970 (the Act) to achieve several goals, one of which was to protect workers from occupational health hazards. Congress

acknowledged the role of occupational exposure in the development of diseases, and addressed in the Act the need to quickly establish minimum health standards to control exposure to hazardous substances. To accomplish Congress' intent, OSHA adopted initial exposure limits for approximately 430 chemicals. Four hundred of these exposure limits were based on the recommendations of the American Conference of Governmental Industrial Hygienists (ACGIH), and 21 were from the American National Standards Institute. The list of exposure limits was to be updated, improved, and expanded as new knowledge and techniques were developed. To date OSHA has promulgated extensive health standards for only 24 individual chemicals. The rulemaking under consideration here would set exposure limits for about 430 chemicals based on the 1987–88 Threshold Limit Values of the ACGIH, and recommendations of the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services.

The OSH Act requires the Agency to consider the feasibility of proposed standards. Executive Order 12291 (46 FR 13197) requires that a regulatory analysis be conducted for any rule having major economic consequences on the national economy, individual industries, geographical regions, or levels of government. The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) similarly requires OSHA to consider the impact of the proposed regulation on small entities. This analysis covers these requirements.

Approach

Because this rulemaking involves about 430 chemicals, OSHA has prepared the regulatory impact analysis in two phases. Phase I involved the use of a number of secondary data bases to collect information on the chemicals to be regulated and the industries in which they are used. These data bases provided information on the toxicity and health effects of exposure to the chemicals, and current information on engineering controls in use and emergency response procedures. Two data bases provided information on employee exposures. The 1982 National Occupational Exposure Survey (NOES) was based on a sample of about 4,500 businesses. The data base developed from this survey contains an estimate of the number of persons occupationally exposed to hazardous substances by Standard Industrial Classification (SIC). The second data base was OSHA's Integrated Management Information System (IMIS). The IMIS contains the results of air samples taken since 1979 by OSHA industrial hygienists in the course of compliance inspections. Both the NOES an IMIS data bases provided valuable information on the nature and extent of employee exposures to the substances to be regulated; however, they did not provide complete information on all substances. Supplementary information was obtained from industrial hygienists and engineers. These experts identified exposure controls in use and the number and size of plants most likely to be affected by this rulemaking. These sources have provided OSHA with a substantial body of information of chemical use, exposures and controls.

Phase II of the data collection effort involved a sampling survey of over 5,300 firms in industries where chemical exposures were believed to pose potential problems. The survey, conducted during the first part of 1988, gathered data on chemicals, processes, exposures and controls currently in use. These additional data have permitted OSHA to refine the Phase I preliminary estimates of technical and economic feasibility. In addition, site visits to over 100 plants are underway to verify the data collected to date on chemicals, processes, controls, and employee exposures. The reports covering these site visits will be submitted to the docket by July 15, 1988.

OSHA has used contractors to assist in these data collection efforts. Three contractors have supplied expert knowledge on the industries affected and the engineering controls needed to reach the proposed exposure levels. These contractors and Kearney/Centaur Division of A.T. Kearney, Meridian Research, and CONSAD. Fu Associates provided datas base management support during all phases of this project. Washington Consulting Group designed the sample for the surveyed firms and KCA Research conducted the telephone interviews of these firms.

Employee Exposure and Benefits

Revising OSHA's Z-Table limits for hazardous substances is expected to result in reduced risk of chemically-related disease among exposed employees. Exposure to substances included in the rulemaking has been associated with a variety of adverse health effects, including impairment of organ system functions, mucous membrane irritation, neuropathy, narcosis, allergic sensitization, respiratory disease, cardiovascular disease, and cancer.

Using data collected from the survey of over 5,300 establishments, OSHA estimates that between 5.8 million and 6.5 million employees are potentially exposed to the 160 hazardous substances identified in the survey. OSHA also estimates over 1.2 million employees are currently exposed above the proposed exposure limits for these substances. Table I–1 summarizes OSHA's estimates of the number of workers currently at risk of adverse health effects. OSHA estimates that promulgation of the proposed exposure limits will result in a potential reduction of over 11,000 work-related illness cases per year, over 8,000 lost-workday illness cases per year, and over 147,000 lost workdays due to illness per year. OSHA's preliminary estimate is that industry compliance with the proposed exposure limits will result in a reduction of 250 fatalities caused by exposure to substances that cause cancer, respiratory disease, cardiovascular disease, or liver or kidney disease.

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TABLE I-1

ESTIMATED NUMBER OF WORKERS POTENTIALLY AT RISK OF EXPERIENCING ADVERSE EFFECTS, BY TYPE OF ADVERSE EFFECT*

ADVERSE HEALTH EFFECT	NO. OF WORKERS POTENTIALLY EXPOSED TO SUBSTANCES ASSOCIATED WITH EFFECT, MINIMUM ESTIMATE	NO. OF WORKERS POTENTIALLY EXPOSED TO SUBSTANCES ASSOCIATED WITH EFFECT, MAXIMUM ESTIMATE	NO. OF WORKERS EXPOSED ABOVE PROPOSED LIMITS FOR SUBSTANCES, MINIMUM ESTIMATE	NO. OF WORKERS EXPOSED ABOVE PROPOSED LIMITS FOR SUBSTANCES, MAXIMUM ESTIMATE
NUISANCE EFFECTS	4,729,417	5,804,846	829,487	892,725
ODOR AND TASTE EFFECTS	718,522	808,537	59,102	59,102
SYSTEMIC TOXICITY	3,233,319	3,818,742	250,282	256,909
MUCOUS MEMBRANE IRRITATION	12,077,315	15,813,663	59,969	1,021,197
METABOLIC INTERFERENCES	2,277,113	2,345,975	746,879	746,879
LIVER/KIDNEY DISEASE	2,321,573	2,488,604	383,581	384,876
OCULAR DISTURBANCES	194	194	0	0
RESPIRATORY DISEASE	3,765,717	4,023,525	639,717	654,319
CARDIOVASCULAR DISEASE	164,576	164,576	44,355	44,355
NEUROPATHY	1,231,744	1,349,421	201,760	210,203
NARCOSIS	4,601,993	6,381,899	526,021	547,731
CANCER	3,663,053	3,784,374	499,716	499,716
ALLERGIC SENSITIZATION	2,710,576	2,903,153	296,444	297,255

*Double counting of employees simultaneously exposed to more than one substance in different adverse health effects categories, prevents the summation of workers exposed to all adverse health effects in this table.

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Nonregulatory Alternatives

OSHA believes that there are no nonregulatory alternatives that adequately protect most workers from the adverse health effects associated with exposure to the chemicals under consideration. OSHA believes that the tort liability laws and Workers' Compensation do not provide adequate worker protection due to market imperfections. Some employers have not complied with the standards recommended by professional organizations. The deleterious health effects resulting from continued high levels of exposure to hazardous substances require a regulatory solution.

Technological Feasibility

Consistent with OSHA regulations and policy, engineering controls and work practices to control employee exposure are preferred over the use of personal protective equipment.

Engineering controls involve the use of local exhaust ventilation, general ventilation, isolation of the worker and enclosure of the source of emissions, process modifications, equipment modifications, and substitution of non-hazardous chemicals. These methods may be used alone or in combination depending upon the industrial processes involved.

These controls are widely used and will effectively control exposures either by themselves, or coupled with changes in work practices.

Perhaps the most widely used technique for controlling chemical exposure is the use of ventilation. General ventilation uses the movement of air within the general work space to displace or dilute the contaminant with fresh outside air. General ventilation may not be the preferred control method, however, due to the large volumes of air movement required. Local exhaust ventilation uses much smaller volumes of air, exhausted from the point or source at which contaminants are generated.

Isolation involves placing a physical barrier between the hazardous operation and the worker. Many modern, automated manufacturing processes are now fully enclosed in ventilated cabinets. The effectiveness of such a control technique depends on the frequency with which the workers have to enter the enclosure during normal operations. In other situations, rather than placing the process or machine in an enclosure, the worker is placed in an enclosure. Many processes which involve potential chemical exposures are operated remotely by operators in air-conditioned booths isolated from the hazardous materials.

Substitution refers to the replacement of a toxic chemical in a particular process or work area with another, less toxic product. Properly applied, substitution can be a very effective control technique. However, care must be taken to ensure that the proposed substitute performs in a similar manner to the product being replaced. In addition, it is essential that the substitute be carefully evaluated to ensure that in controlling one hazard, another different hazard is not inadvertently introduced. The substitute must also be compatible with existing manufacturing equipment and processes.

The success of these techniques will depend on the physical properties of the chemicals and emissions encountered (boiling point, vapor pressure, etc.) and the process operating conditions. In some cases, particularly with cleaning solvents, substitution may provide the quickest and most effective means of reducing exposure. In other situations, a major effort may be required to alter processes or install or expand local or general dilution ventilation.

OSHA believes that existing engineering controls are available to reduce exposure levels to the new proposed levels. Standard controls have been adapted in numerous situations to solve situation-specific problems in all of the industry sectors affected. Detailed industry-specific illustrations of this point are presented in the Technological Feasibility Chapter of this Preliminary Regulatory Impact Analysis.

Costs of Compliance

Costs of compliance with the proposed rulemaking would result from industry actions to lower workers' chemical exposures to the levels proposed. The 1988 sample survey of more than 5,300 firms was drawn from a universe of over one million firms potentially affected by the rule. Table I–5 at the end of this section presents a list of industries included in the analysis.

Survey respondents verified the number of work stations and workers related to each process, the process location and configuration, the controls already in place, and potential chemical exposures above new proposed levels. Process controls in place were compared to a list of control designs needed to limit exposures to new lower levels. Where the required controls were not reported to be in place, a compliance cost per work station was assigned. Process control costs were summed per establishment and certain maintenance workers were assigned a respirator cost. Costs for the surveyed establishments were then weighted (by SIC and size) to represent compliance costs for the universe of affected plants.

The survey found that about 500,000 establishments reported using the chemicals being regulated. Of this number, about 100,500 would incur some costs to comply with the proposed rule. The total estimated annualized capital plus annual operating costs are $927.83 million. Table I–2 presents the annual cost by industry sector, for large and small (fewer than 20 employees) plants.

Among all industry sectors affected by this proposal, about 101,200 establishments are estimated to incur, on average, an annual cost of $9,200.

Economic Impact

OSHA prepared two estimates of the economic effects of the proposal on potentially affected firms. The two estimates were based upon No Cost-Passthrough ("worst case") and Total Cost-Passthrough ("best case") scenarios.

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TABLE I-2

ANNUAL OPERATING AND ANNUALIZED CAPITAL COST OF COMPLIANCE BY INDUSTRIAL SECTOR (a)

SIC (b)	SIC DESCRIPTION	LARGE PLANTS	SMALL PLANTS	ANNUAL COST
20	FOOD PROD. (c)	$21,704,100	$11,789,000	$33,493,100
21	TOBACCO (c)	$19,700	$0	$19,700
22	TEXT. MILL (c)	$23,308,400	$6,170,000	$29,478,400
23	APPAREL PROD. (c)	$23,604,300	$8,139,900	$31,744,200
24	LUMBER & WOOD	$20,534,800	$175,551,300	$196,086,100
25	FURNITURE	$7,915,300	$6,805,300	$14,720,600
26	PAPER PROD.	$30,966,900	$290,800	$31,257,700
27	PRINTING & PUB.	$15,263,300	$60,425,000	$75,688,300
28	CHEMICAL PROD.	$31,745,500	$8,412,100	$40,157,600
29	PETRO. REFINING	$6,800,700	$414,600	$7,215,300
30	RUBBER & PLASTICS	$53,256,200	$22,225,900	$75,482,100
31	LEATHER PROD.	$1,464,400	$1,115,100 (c)	$2,579,500
32	STONE & CLAY	$15,079,300	$7,463,300	$22,542,600
33	PRIM. METAL	$34,721,200	$5,612,400	$40,333,600
34	FAB. METALS	$50,927,100	$5,010,500	$55,937,600
35	MACHINERY	$43,986,300	$13,754,100	$57,740,400
36	ELEC. MACH.	$24,210,900	$7,570,500	$31,781,400
37	TRANS. EQUIP.	$20,884,600	$26,214,500 (c)	$47,099,100
38	INSTRUMENTS	$10,257,300	$3,207,400	$13,464,700
39	MISC. MANUF.	$13,861,200	$4,334,300	$18,195,500
40	R.R. TRANS.	$532,200	$0	$532,200
45	AIR TRANS.	$1,828,900	$0	$1,828,900
47	TRANS. SERV.	$1,853,100	$0	$1,853,100
49	ELEC. GAS. SAN.	$19,373,900	$3,314,500	$22,688,400
50	WHOLESALE TRADE	$1,416,300	$2,638,300	$4,054,600
51	WHOLESALE, NON-DUR	$3,094,200	$5,764,000	$8,858,200
55	AUTO DEALERS (c)	$9,862,500	$2,092,200	$11,954,700
72	PERSONAL SRV. (c)	$15,648,500	$15,639,300	$31,287,800
73	BUSINESS SRV. (c)	$3,701,700	$5,252,100	$8,953,800
75	AUTO REPAIR (c)	$466,800	$1,044,100	$1,510,900
76	MISC. REPAIR SRV.	$669,500	$4,179,000	$4,848,500
80	HEALTH SERV. (c)	$2,413,000	$2,026,400	$4,439,400
TOTAL		$511,372,100	$416,455,900	$927,828,000

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

(a) Costs were calculated by annualizing the capital cost over the projected life of the equipment (10 years) using a 10 percent cost of capital and adding an annual operating and maintenance cost estimated at 10 percent of the capital cost.

(b) Industry sectors not identified in this table include industries with no major cost impact expected, the construction industry, which will be the subject of a separate regulatory analysis, and industries such as mining, over which OSHA has no jurisdiction.

(c) Costs in these sectors were based on expert judgement and secondary data collection. Survey data for SICs 55, 72, 73, 75 and 80 was insufficient to estimate compliance costs.

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In the first scenario it was assumed that all compliance costs would be absorbed by firms in the form of reduced profits. Table I–3 contains a summary of this "worst case" analysis. Under this scenario, the estimated average percent reduction in profits for all affected firms was less than one percent. The estimated reduction in profit of 8 percent for SIC 24, Lumber and Wood Products Manufacturers, was the highest among all industries.

In the second scenario it was assumed that all compliance costs would be passed on to the consumer in the form of higher prices. The potential price increase for an industry sector at the two-digit SIC level was estimated by dividing the sector's compliance cost by its total sales. In this scenario, there would be little impact on market prices; none of the estimated price increases exceeded one-half of one percent (see Table I–4).

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TABLE I-3

ECONOMIC EFFECTS: NO-COST PASSTHROUGH SCENARIO[1]

SIC	Industry	Annual Costs[2] ($ millions)	Total Sales[3] ($ millions)	R.o.R. on Sales (%)[4]	Pre-Reg Profits ($ m)	Post-Reg Profits ($ m)	% Change in Profits
20	FOOD PROD.	33.49	353,780.38	1.9	8,008.04	7,986.29	- 0.2715
21	TOBACCO	0.02	74,030.13	5.3	3,923.60	3,923.59	- 0.0003
22	TEXT. MILL	29.48	60,735.22	2.7	1,765.42	1,747.59	- 1.0100
23	APPAREL PROD.	31.74	74,474.65	2.8	1,813.22	1,793.56	- 1.0845
24	LUMBER & WOOD	196.09	57,994.48	3.9	1,974.51	1,814.21	- 8.1188
25	FURNITURE	14.72	37,648.27	3.5	1,411.02	1,400.96	- 0.7129
26	PAPER PROD.	31.26	103,694.14	3.7	3,778.20	3,761.24	- 0.4489
27	PRINTING & PUB.	75.69	134,830.21	4.8	6,471.85	6,412.25	- 0.9210
28	CHEMICAL PROD.	40.16	272,759.67	3.7	11,738.80	11,714.76	- 0.2048
29	PETRO. REFINING	7.22	196,400.57	2.7	4,964.85	4,960.84	- 0.0808
30	RUBBER & PLASTICS	75.48	86,538.58	4.3	3,423.75	3,376.10	- 1.3918
31	LEATHER PROD.	2.58	15,449.56	2.6	401.69	399.95	- 0.4328
32	STONE & CLAY	22.54	46,094.04	4.1	1,954.99	1,940.73	- 0.7300
33	PRIMARY METALS	40.33	112,564.26	3.3	3,714.62	3,691.27	- 0.6286
34	FAB. METALS	55.94	150,146.41	4.0	6,005.86	5,974.10	- 0.5288
35	MACHINERY	57.74	345,144.89	5.1	17,602.39	17,566.95	- 0.2013
36	ELEC. MACH.	31.78	245,982.70	5.0	12,299.14	12,279.63	- 0.1586
37	TRANS. EQUIP.	47.10	365,427.20	3.9	14,520.25	14,486.69	- 0.2311
38	INSTRUMENTS	13.46	83,359.57	4.9	3,373.26	3,365.00	- 0.2450
39	MISC. MANUF.	18.20	41,870.30	4.4	1,788.56	1,777.39	- 0.6245
40	R.R. TRANS.	.53	43,869.14	10.0	3,969.62	3,969.34	- 0.0072
45	AIR TRANS.	1.83	109,538.08	3.6	3,251.40	3,250.41	- 0.0304
47	TRANS. SERVICES	1.85	12,254.96	2.7	582.18	581.18	- 0.1719
49	ELEC.,GAS & SAN.	22.69	300,254.83	7.0	21,017.84	21,004.06	- 0.0655
50	WHOLESALE TRADE[5]	4.05	13,853.52	2.0	277.07	273.67	- 1.2285
51	WHOLESALE, NON-DUR	8.86	113,848.20	1.5	1,726.26	1,721.48	- 0.2771
55	AUTO DEALERS	11.95	341,574.50	1.9	6,489.92	6,482.81	- 0.1095
72	PERSONAL SERV.	31.29	24,270.74	7.3	1,771.76	1,750.02	- 1.2272
73	BUSINESS SERV.	8.95	22,165.94	6.6	1,462.95	1,455.45	- 0.5126
75	AUTO REPAIR	1.51	45,750.92	5.1	2,492.19	2,491.05	- 0.0457
76	MISC. REPAIR SERV.	4.85	2,665.52	5.5	146.60	142.69	- 2.6696
80	HEALTH SERVICES	4.44	170,234.25	4.5	7,807.72	7,804.54	- 0.0406

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

Notes:
1. All values in 1985 dollars.
2. Reproduced from Table VI-1.
3. Dun and Bradstreet, Dun's Marketing Identifiers (DMI) Database.
4. Rate of Return on Sales, Dun and Bradstreet, Industry Norms Database.
5. Consists of SIC 5093 (scrap and waste materials) only.

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Based on this analysis, OHSA concludes that the proposed standard is economically feasible for each sector. The impact on prices is slight and even in the worst cases, the reductions in profitability are small.

Regulatory Flexibility Analysis

In accordance with the Regulatory Flexibility Act (Pub. L. 96–353, 94 Stat. 1664 (5 U.S.C. 601 *et seq.*), OSHA has made a preliminary assessment of how the proposed rulemaking will affect large and small establishments. The results of this preliminary assessment indicate that some small establishments may experience some adverse impact. The smaller profit margins of some small establishments may make it difficult for them to absorb increases in compliance costs. OSHA requests comments on approaches to reduce the impact on small establishments. An important ameliorating factor for each affected firm will be its ability to pass through additional costs to the consumer. The ability of individual firms to do this will be dependent upon product demand elasticities. It is expected that all impacted firms will be able to pass through some portion of their increased costs.

Environmental Impact

The proposed standard has been reviewed in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality NEPA regulations, and the Department of Labor's NEPA compliance procedures and is not anticipated to have a significant impact on the external environmental.

TABLE I-4.—ECONOMIC EFFECTS: TOTAL-COST PASSTHROUGH

[Dollars in millions]

SIC/industry	Annual costs	Total sales	Costs as a percent of sales
20—Food products	$33.49	$353,780.38	.0095
21—Tobacco	0.02	74,030.13	.0000
22—Text. mill	29.48	60,735.22	.0485
23—Apparel products	31.74	74,474.65	.0426
24—Lumber and wood	196.09	57,994.48	.3381
25—Furniture	14.72	37,648.28	.0391
26—Paper products	31.26	103,694.14	.0301
27—Printing and publishing	75.69	134,830.21	.0561
28—Chemical products	40.16	272,759.67	.0147
29—Petro. refining	7.22	196,400.57	.0037
30—Rubber and plastics	75.48	86,538.58	.0872
31—Leather products	2.58	15,449.56	.0167
32—Stone and clay	22.54	46,094.04	.0489
33—Prim. metals	40.33	112,564.26	.0358
34—Fab. metals	55.94	150,146.41	.0373
35—Machinery	57.74	345,144.89	.0167
36—Elec. mach	31.78	245,982.70	.0129
37—Trans. equip	47.10	365,427.20	.0129
38—Instruments	13.46	83,359.57	.0162
39—Misc. manuf	18.20	41,870.30	.0435
40—R.R. trans	.53	43,869.14	.0012
45—Air trans	1.83	109,538.08	.0017
47—Trans. services	1.85	12,254.96	.0151
49—Elec. gas and san	22.69	300,254.83	.0076
50—Wholesale trade [1]	4.05	13,853.52	.0293
51—Wholesale, non-dur	8.86	113,848.20	.0078
55—Auto dealers	11.95	341,574.50	.0035
72—Personal services	31.29	24,270.74	1289
73—Business services	8.95	22,165.94	.0404
75—Auto repairs	1.51	45,750.92	.0033
76—Misc. repair serv	4.85	2,665.52	1819
80—Health services	4.44	170,234.25	.0026

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

[1] Consists of SIC 5093 (scrap and waste materials) only.

Table I-5.—SIC Groups Covered in the OSHA Analysis

Division D. Manufacturing
- Major Group 20. Food and kindred products
- Major Group 21. Tobacco manufactures
- Major Group 22. Textile mill products
- Major Group 23. Apparel and other finished products, made from fabrics and similar materials
- Major Group 24. Lumber and wood products, except furniture
- Major Group 25. Furniture
- Major Group 26. Paper and allied products
- Major Group 27. Printing, publishing, and allied industries
- Major Group 28. Chemicals and allied products
- Major Group 29. Petroleum refining and related industries
- Major Group 30. Rubber and miscellaneous plastics products
- Major Group 31. Leather and leather products
- Major Group 32. Stone, clay, glass, and concrete products
- Major Group 33. Primary metal industries
- Major Group 34. Fabricated metal products, except machinery and transportation equipment
- Major Group 35. Machinery, except electrical
- Major Group 36. Electrical and electronic machinery, equipment, and supplies
- Major Group 37. Transportation equipment
- Major Group 38. Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks
- Major Group 39. Miscellaneous manufacturing industries

Division E. Transportation, Communications, Electric, Gas, and Sanitary Services
- Major Group 40. Railroad transportation
- Major Group 44. Water transportation
- Major Group 45. Transportation by air
- Major Group 47. Transportation services
- Major Group 49. Electric, gas, and sanitary services

Division F. Wholesale Trade
- Major Group 50. Wholesale trade—durable goods
- Major Group 51. Wholesale trade—nondurable goods

Division G. Retail Trade
- Major Group 55. Automotive dealers and gasoline service stations

Division I. Services
- Major Group 72. Personal services
- Major Group 73. Business services
- Major Group 75. Automotive repair, services, and garages
- Major Group 80. Health services

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, as derived from Standard Industrial Classification Manual 1972, Executive Office of the President—Office of Management and Budget [1, pp. 5–7].

The listing excludes the construction industry (SICs 15, 16, and 17) which will be the subject of a separate regulatory analysis.

Respondents:

II. Survey of Affected Industries

Chemicals and other hazardous substances are present to some degree in all industries. However, some industry sectors use chemicals more extensively than others and have controls in place which do not always reduce workers' exposures below permissible exposure levels. This chapter presents an overview of those industries which OSHA believes may experience costs and benefits as a result of this rulemaking. In order to estimate and quantify the potential impact of the rule, a sample survey of over 5,300 establishments was conducted during the first part of 1988. The results of the survey provided the basis for the cost and benefit estimates presented in this preliminary Regulatory Impact Analysis (PRIA). A technical description of the survey is presented in Supplement 1.

In order to determine which industries to include in the sample survey, OSHA relied primarily on two data sources: (1) The NIOSH National Occupational

Exposure Survey (NOES) of 1982 and supplementary information from the NIOSH 1972 survey; and (2) data in the OSHA Integrated Management Information System (IMIS). The 1982 NOES database contains a sample of the number of persons exposed by substance and industry from almost 4500 businesses in 98 different geographic areas in the United States. OSHA's IMIS contains the results of exposure samples taken since 1979 by industrial hygienists during the course of compliance inspections. Using these two databases, industries which are likely to use the substances in this rulemaking at levels which might exceed the proposed exposure limits were identified.

As a check on this list of industries, OSHA contracted with about one dozen industrial hygienists and chemical engineers to review the list. Based on their professional knowledge, these experts verified the industries with potential exposure problems. The final list of industries selected for the sample survey included over 30 two-digit and three-digit SICs where it is believed that chemical exposure potentially exceed the proposed levels.

Industry sectors not included in the survey are those where OSHA believes there is little potential chemical exposure or where existing exposures are well controlled. Industries which were not surveyed for these reasons included finance, real estate, insurance and most services and retail trade sectors. The construction industry was also excluded and will be the subject of a separate rulemaking action. Industries such as mining and certain transportation sectors were not included since other agencies have safety and health enforcement jurisdiction. Certain industry sectors including textile, apparel, food and tobacco products are expected to incur some costs as a result of this rulemaking, but these were not included in the sample survey. The reasons for not including these sectors were a combination of the limits imposed by the sample size, relatively low hazardous substance exposure levels and the availability of adequate information on the engineering controls currently in use in these industries. (Supplement 1 contains a list of the industry sectors included in the sample survey.)

Industrial hygienists and engineers under contract to OSHA also identified the processes used in the industries surveyed, and the chemicals used in those processes. Expected levels of exposure and the number of employees potentially exposed were estimated. The list of processes and chemicals determined to be in common use in each industry sector was subsequently verified in the sample survey. Supplement 2 identifies the processes and chemicals found at the four-digit level for all industries surveyed.

Establishments to be surveyed were selected based on a statistical sample of all establishments in the surveyed industry sectors. For each SIC, establishments were selected from four size categories:

(a) 0–19 employees
(b) 20–29 employees
(c) 100–249 employees
(d) 250 or more employees

This permitted analysis of the effects of the rulemaking by establishment employment size.

About 5,000 completed responses were required to obtain statistically valid results. The field survey was conducted by KCA Research using Computer-Assisted Telephone Interviewing (CATI). Trained interviewers requested data from each establishment regarding production employment, chemical usage, and exposure guidelines in use. Respondents were asked to verify the presence or absence of chemicals and processes believed to be found in establishments in their industry, and were asked to volunteer information on other chemicals not included on the interviewers' "prompt" list of chemicals in use. For each chemical present, the respondent was asked about amounts used, employee exposure levels, and processes where used. For each process, the respondent was asked questions concerning its configuration, frequency of use, and the types of controls and personal protective equipment in use. This information was used to develop the estimates of costs and benefits presented in this PRIA.

The survey results generally corroborated the preliminary assessments of potential industry exposure and overexposure to chemicals. In the sample of over 5,300 firms, about two-thirds reported chemicals being used in the workplace. Most of the firms which reported no chemical usage were small administrative or distribution units of multi-plant companies. Supplement 2 contains a list of the chemicals and processes found in the survey. Based on the survey, OSHA estimates that over 60 percent of production workers in most of the industries surveyed are potentially exposed to chemicals and about 10–15 percent of these would be overexposed at the levels proposed in this rulemaking. Chapter III presents OSHA's estimates of the benefits occuring from a reduction in the number of employees exposed to these chemicals.

The industry profiles that follows present economic information on industry sectors expected to be affected by the rulemaking. Most but not all of these industries were included in the sample survey. Table II–1 at the end of the chapter, contains employment and establishment data for each industry profiled.

SIC 20—Food and Kindred Products

This major industry group includes establishments that manufacture or process food and beverages for human consumption as well as certain related products such as ice, chewing gum, vegetable and animal fats and oils, and prepared animal feeds [1, pp. 59 to 69]. Increased disposable income, low commodity prices, changing demographics, and the 1986 tax reforms are expected to benefit this industry in the next few years. [2, p. 39–1].

Employment and establishment data are shown in Table II–1. The total 1985 value of SIC 20 shipments ($301.6 billion) was 13 percent of the value of all manufacturing industry shipments; this represented the largest share of any two-digit manufacturing industry. The most important industry within SIC 20 is meat products; accounting for 22 percent of the value of shipments, followed by beverages and dairy products, accounting for 14 percent each [3, Vol 1:8].

In 1985, 1.6 million workers in over 29,000 establishments were employed in SIC 20. About 70 percent of these are production workers [Table II–1]. Employment has declined since 1979. The largest employer is the meat products industry, with 23 percent of the workforce in 1986, followed by preserved fruits and vegetables (15 percent) and beverages (13 percent). Meat and miscellaneous food products both experienced 1986 employment levels slightly above the 1979 peak [4]. The largest number of food products establishments are in the manufacturing or processing of miscellaneous foods and meat products (17 percent and 16 percent, respectively).

Establishments in SIC 20 are similar in size to those in the manufacturing industry as a whole, although there is a smaller concentration of very large establishments. Mean establishment size is 55 workers.

Most recent growth by larger food processors has been through business acquisitions rather than internal expansion. The food and beverage sector is becoming more concentrated

and efficient. In most food industries for which data are available, concentration is moderate, with the largest four firms having a 30 percent share of sales. Exceptions can be found in cereal breakfast foods, where the four-firm concentration ratio is just over 75 percent, and in soft drinks, where it is 88 percent [2, pp. 39–1 to 39–39].

In the next few years, most food and beverage producers will benefit from increases in disposable income, favorable trends in consumer purchasing patterns, and continued low commodity prices. Decreased operating costs and expenses have resulted in a 6 percent increase in income in 1985–86 for large food and beverage processors, despite sales gains of only a little more than 1 percent [2, p. 39–1].

In 1985, the median rate of return on assets in the food and kindred products industry was 5.1 percent; this was the third lowest for the 20 two-digit manufacturing industry group. The highest rates of return were registered by the cookie and cracker industry and the blended and prepared flour industry (11.8 percent and 11.1 percent, respectively), followed by the flavoring extracts industry (9.2 percent). At the other extreme, the wine and brandy industry registered a −0.9 percent rate of return on assets in 1985, with an average rate of under 0.1 percent for the 1984–86 period. The cheese and rice milling industries also have very low rates of return on assets (2.2 percent) [5].

SIC 21—Tobacco Manufactures

Establishments in the tobacco manufactures industry produce cigarettes (SIC 211), cigars (SIC 212), chewing and smoking tobacco, and snuff (SIC 213), or they engage in tobacco stemming and redrying (SIC 214) [1, p. 70]. The major worker exposures in these industries are to nuisance dusts generated during the initial handling of tobacco and to chemicals that have been used to treat the tobacco.

Data on employment and establishments for SIC 21 are shown in Table II–1. In 1985, the value of tobacco manufacturing shipments was $18.5 billion, slightly more than 6 percent of the value of shipments for all manufacturing [3, Vol. 1: 8]. SIC 21 has less than 0.3 percent of the total employment or establishments in manufacturing [6, pp. 10, 15]. Three-quarters of the employees in this industry are production workers. The cigarette industry is the most important component of SIC 21, accounting for more than 80 percent of the value of shipments [3, Vol. 1: 8] and 70 percent of employment for this sector, but only 9 percent of establishments [6, p. 15].

Establishments in SIC 21 are large, with a mean size of 296 employees, compared to 55 for all manufacturing. More than half of the establishments in this two-digit SIC have fewer than 20 employees [Table II–1]; and more than 17 percent have 250 or more employees. These large establishments account for more than 85 percent of all employees. The cigarette industry is especially highly concentrated, with a mean establishment size of 2,430 employees. Eleven establishments in the cigarette industry employ 1,000 or more workers, and 99.8 percent of all cigarette manufacturing employees work in these large establishments. Mean establishment sizes in other tobacco industries range from 80 to 135 employees [6, pp. 10, 15]. Employment in the tobacco products industry has declined every year since 1976 (except in 1981), with a total decline in employment of more than 23 percent over the last decade [4].

Most tobacco firms remain profitable because input costs have been relatively stable and prices have increased faster than consumption has declined. The major tobacco companies are continuing to reduce their vulnerability through mergers and diversification [2, pp. 40–1 to 40–7]. Thus, profitablility in the tobacco manufactures industry is good. The 1985 median rate of return on assets (7.7 percent) was the fifth highest median rate of return on assets among firms in the 20 manufacturing industry groups [5].

SIC 22—Textile Mill Products

SIC 22 includes those establishments that perform any of the following six operations: (1) Preparation of fiber and subsequent manufacturing of yarn, thread, braids, twine and cordage; (2) manufacturing broadwoven fabrics, narrow woven fabrics, knit fabrics, and carpets and rugs from yarn; (3) dyeing and finishing fiber, yarn, fabrics, and knit apparel; (4) coating, waterproofing, or otherwise treating fabrics; (5) the integrated manufacturing of knit apparel and other finished articles from yarn; and (6) the manufacture of felt goods, lace goods, nonwoven fabrics, and miscellaneous textiles [1, p. 85].

According to the Department of Commerce, in 1986 shipments for the textile industry increased 4 percent. The value of shipments in 1985 ($53.3 billion) has increased 6 percent since 1981. Employment, however, remained on a long-term downward trend, although the 1986 drop was marginal. An upward trend in output and relatively high operating rates helped to keep the drop in employment to a minimum. Also, average hours worked, which increased in the second half of 1985, continued to rise relatively strongly in 1986 [2, p. 41–1].

Table II–1 presents data on the number of establishments and employment in SIC 22. Similar to other manufacturing industries, the mean establishment size in SIC 22 was 64 employees. Between 1981 and 1985, SIC 22 experienced a 15 percent decrease in employment. In 1985, almost 86 percent of the number of employees were production workers [4]. The median rate of return on assets in the textile mill products industry was 5.6 percent in 1985 [5].

SIC 23—Apparel and Other Products

SIC 23 is referred to as the "cutting-up and needle trades," and includes establishments producing clothing and fabricating products by cutting and sewing purchased woven or knit textile fabrics and related materials. These materials may include leather, rubberized fabrics, plastics, and furs. In addition, establishments that manufacture clothing by cutting and joining materials are included [1, p. 97].

SIC 23 includes three types of apparel establishments: (1) The regular or inside factories, which perform the usual manufacturing functions within their own plant; (2) contract factories, which manufacture apparel from materials owned by others; and (3) apparel jobbers, which buy raw materials, design and prepare samples, arrange for the manufacture of clothing from their materials, and sell the finished product [1, p. 97]. According to U.S. Department of Commerce estimates, the 1986 value of shipments for SIC 23 experienced a growth rate of almost 2 percent over 1985 values [2, p. 42–2].

Between 1980 and 1985, SIC 23 was among the top ten SICs to experience the greatest employment decline. Due to large inventories at both retail and wholesale levels and low consumer demand, there were decreases in both shipments and employment in 1985. In several geographic areas, plants were forced to close. The drop in employment has been attributed to the recent rise of imports into the U.S. market and to improvements in industry efficiency through streamlined operations and increased productivity [2, p. 42–2].

The apparel industry is a major employer of women and minorities, employing more than 6 percent of the manufacturing workforce in plants. Due to intense competition in the industry, profits and wages are lower in this industry than in most other manufacturing industries. The price of labor is the single most important cost

component in the industry, which accounts for the sensitivity that employment levels have to industry growth levels. Production workers make up 85 percent of the apparel work force. Typically, as inventory levels grow, production slows down and employment drops [2, p. 42–2].

In 1986, current-dollar shipments in the apparel industry expanded in value by 3 percent. An increase in consumer demand was the major factor contributing to the upturn. Output levels began to regain former levels of output, and the falling rate of employment of about 1 percent was well below the 3.1 percent annual rate of decline during the 1980–1985 period [2, p. 42–2].

Table II–1 presents employment and establishment for SIC 23 for 1985. During the period of 1981 through 1985, SIC 23 experienced a 10 percent decrease in employment. Almost 84 percent of the total number of employees were production workers [4]. In 1985, the median rate of return on assets in this SIC was 6.3 percent [5].

SIC 24—Lumber and Wood Products

This industry produces logs, pickets and fences, mining timbers, railroad ties, poles and pulpwood. SIC 24 includes establishments that cut timber and pulpwood, merchant sawmills, lath mills, shingle mills, cooperage stock mills, planing mills, and plywood mills and veneer mills engaged in producing lumber and wood basic materials; and establishments that manufacture finished articles made entirely or mainly of wood or related materials [1, p. 107]. According to U.S. Department of Commerce estimates, the logging industry's timber harvest in 1986 was an estimated $8.5 billion, compared with $8.3 billion in 1985 (constant 1982 dollars) [2, p. 4–1].

The Department of Commerce reports that a strong expansion of the market for wood products took place in 1985 due to gains in housing and nonresidential construction activities. Although domestic demand for softwood lumber was strong, Canadian imports displaced American products and contributed to an oversupply, depressing prices. These lower prices lowered U.S. lumber producer profit margins and induced industrywide efforts to restrict imports of lower priced Canadian softwood lumber. In addition to the oversupply caused by the competitive prices in Canada, preventive harvesting to avoid pest damage forced inventories to go up and prices to fall further [2, p. 4–1].

In 1986, similar trends continued in the domestic market for wood products. This was due to a 6 percent rise in housing starts, continued growth in home remodeling and renovation, and strong demand from furniture makers and other end users. However, lower-priced softwood lumber imports from Canada continued to squeeze profits in 1986 [2, p. 4–1].

The Canadian softwood lumber prices brought about a trade agreement in March 1987 between the United States and Canada, in which Canada agreed to set a 15 percent export tax on its softwood lumber. This action has proved to be favorable towards the domestic industry for softwood lumber in the United States. Canadian softwood lumber prices in the United States have risen 3 to 4 percent and imports have decreased about 3 to 4 percent. Since the agreement, Canada's market share has dropped from 33 percent to 28 percent. Market earnings in the domestic industry have increased despite a drop in housing starts, a strong suggestion that the U.S. is benefiting from the higher Canadian prices. It is expected that the trade agreement will keep Canadian softwood prices up and continue to aid the domestic softwood lumber market [7].

Table II–1 presents employment and establishment data form for SIC 24 for 1985, as well as for three of the individual three-digit industry groups. In 1985, the mean establishment size in SIC 24 was 19 employees, which is significantly smaller than the average size in other manufacturing sectors. The median rate of return on assets in this SIC was 7.3 percent [5].

SIC 243—Millwork, Veneer and Plywood

This SIC includes establishments that manufacture fabricated wood millwork, covered with materials such as metal and plastics. According to U.S. Department of Commerce, the value of shipments for SIC 243 was $16.7 billion in 1985, which represents 31 percent of the value of shipments for SIC 24. The value of shipments in SIC 243 increased 21 percent since 1981. In 1985, the number of employees in SIC 243 was about 37 percent of SIC 24. The number of employees in SIC 243 increased by 18 percent in 1985, of which about 83 percent of this total was production workers. Average hourly earnings dropped about 1 percent during that same time period. The number of establishments in SIC 243 in 1985 was about 38 percent of all establishments in SIC 24 [4].

SIC 245—Wood Buildings and Mobile Homes

This SIC includes manufacturers of wood buildings and mobile homes. The 1985 value of shipments for SIC 245 ($6.0 billion) represents 11 percent of the value of shipments for SIC 24 in 1985. The value of shipments in SIC 245 increased 6 percent since 1981. In 1985, the number of employees in SIC 245 was 10.5 percent of SIC 24. The number of employees in SIC 245 increased by 8 percent during this period, of which almost 77 percent of these total employees were production workers. The number of establishments in SIC 245 in 1985 was 4.4 percent of all establishments in SIC 24 [4].

SIC 249

This SIC covers miscellaneous wood products, and includes four four-digit SICs. SIC 249 represents 12 percent of the value of shipments for SIC 24 in 1985. The value of shipments in SIC 249 ($6.6 billion) increased almost 19 percent over 1981. In 1985, the number of employees in SIC 249 was about 15 percent of SIC 24. From 1981 to 1985, the number of employees in SIC 249 decreased by 4 percent, of which almost 84 percent of these employees were production workers. The number of establishments in SIC 249 in 1985 was about 14 percent of all establishments in SIC 24 [4].

SIC 2491 includes establishments that treat wood, sawed or planed in other establishments, with creosote or other preservatives to prevent decay and to protect against fire and insects. This industry also includes the cutting, treating, and selling of poles, posts, and pilings. The Department of Commerce reports that during 1985, there was increased use of treated wood for home improvement projects, such as new decks and all-weather wood foundations. Markets for treated lumber and plywood have been expanding, while markets for treated telephone poles, marine pilings, and railroad ties tend to be cyclical and grow more slowly over the long term. The market for railroad ties in 1985 was strong, as railroads were able to generate enough cash flow to maintain their track systems by replacing worn out ties. In 1986, however, the market for railroad ties declined. About 30 percent of total treated wood shipments are lumber and plywood, of which only about 2 percent has been used for wood foundations [2, p. 4–14]. The Department of Commerce estimated that in 1986, the value of shipments in this industry increased by 5 percent [2, p. 4–14]. SIC 2491 represents 23 percent of the value of shipments for SIC 249 [5]. Employment rose in 1986 by 2.7 percent [2, p. 4–14]. The number of employees in SIC 2491 was almost 16 percent of SIC 249 and

SIC 2491 represents almost 11 percent of all establishments in SIC 249 [5].

SIC 25—Furniture and Fixtures

Manufacturers of household, office, public building, and restaurant furniture and office and store fixtures are included in SIC 25 [1, p. 114]. The U.S. Department of Commerce states that producers of furniture and fixtures recently have been benefiting from lower real interest rates, reduction in the value of the dollar versus other major currencies, and changes in the tax laws. In addition, the U.S. furniture industry is undergoing consolidation, so that big firms are becoming larger and dominating a greater share of the market. The remaining smaller firms are finding it more difficult to compete, given the rapid increase in low-priced imports. Moreover, new manufacturing technologies require large capital investments and large volume, neither of which are readily available to small firms [2, p. 44–2].

For the industry, the value of shipments in 1985 increased by 24 percent since 1981. Although furniture manufacturers anticipate stronger demand in the future, these manufacturers remain uncertain as to the duration and extent of increased demand. Therefore, rather than hiring additional workers, producers have increased the average number of hours worked by current employees. This trend was evident in the wood and metal furniture plants, where average overtime hours increased 16 percent and 24 percent, respectively, in the first half of 1986 [2, p. 44–2].

Table II–1 presents employment and establishment data for SIC 25 for 1985. During this period, SIC 25 experienced a 6 percent growth in employment. Almost 80 percent of the total number of employees working in SIC 25 were production workers. In 1985, the median rate of return on assets in the furniture industry was 7.3 percent.

SIC 26—Paper and Allied Products

Establishments in this industry process fiber from trees, wastepaper, and other fibrous materials into end products that are used by both consumers and industry [1, p. 100]. Based on U.S. Department of Commerce estimates, the paper and allied products industry experienced an increase of 14 percent in the value of shipments from 1981 to 1985, and almost 10 percent between 1985 and 1986. The 1985 value of shipments was $93.4 billion [2, p. 5–1].

Growth patterns in the industry vary, depending on the sector. Some sectors of the industry are more closely related to changes in industrial activity, while others are more directly affected by changes in real personal income or demographic factors. The industry's overall demand patterns are closely linked to rates of change in GNP. In 1985, for example, real growth for the industry was judged to be flat, trailing that of GNP. The largest fluctuations in the industry's shipments have occurred in products geared specifically for commercial-industrial use, which are tied to the annual rate of business activity [2, p. 5–1].

Table II–1 presents employment and establishment data for SIC 26 for 1985. From 1981 to 1985, employment declined by approximately 2 percent. Almost 76 percent of the total number of employees were production workers [4]. In 1985, the median rate of return on assets was 7.4 percent [5].

Within SIC 26, there are six, three-digit SIC groups, which are described below. SIC 261 includes manufacturers of pulp from wood or other materials. The Department of Commerce reports that U.S. market pulp prices dropped nearly 10 percent in the first six months of 1985. The main reasons for the decline included a leveling of demand, high operating rates at market pulp mills, large pulp inventories, and new capacity coming into production. By the end of 1985, however, producers' pulp mill inventories had dropped, helping to stabilize pulp prices. About one-fourth of all market pulp companies either shut down some of their mills in 1985 or curtailed production to reduce the oversupply in the market. In 1986, the industry experienced increased productivity, higher prices and improved worldwide demand. For SIC 261, the value of shipments in 1986 increased by 2.5 percent over 1985. SIC 261 represents 3.4 percent of the value of shipments for SIC 26 [2, p. 5–2].

SIC 262 includes manufacturers of paper from wood pulp and other fiber pulp, and manufacturers of converted paper products. SIC 263 includes manufacturers of paperboard. SIC 263 represents 11 percent of the value of shipments for SIC 26. The value of shipments decreased by 3.6 percent. The number of employees in SIC 263 was less than 1 percent of SIC 26 [4].

SIC 264 includes manufacturers of coated or laminated flexible materials used for packaging purposes. In this sector, the value of shipments, which represents 36 percent of the value of shipments for SIC 26, increased by 17 percent during the same period. The number of employees in SIC 264 was 34 percent of SIC 26 [4].

SIC 265 includes manufacturers of setup paperboard boxes from purchased paperboard. Corrugated boxes have taken the place of wooden shipping containers, pallets, and metal drums in the U.S. packaging market in recent years [2, p. 5–6]. Similarly, consumption of folding boxes continued steadily in 1985. This pattern continued in 1986 with shipments of corrugated boxes increasing 5.5 percent and 3 percent for folding boxes. Several important nondurable end users of folding cartons, such as producers of beverages, dry foods, textiles, sporting goods and toys, hardware, candy, and cosmetics, showed significant declines in real growth in 1985, while the market for boxed paper goods either grew slightly or remained fairly level. [2, p. 5–9].

Manufacturers of sanitary food containers, such as paperboard milk cartons and paper serving and eating utensils, are also included in SIC 265. This industry has been strongly influenced by the shift to plastic containers. Having experienced two successive years of decline, in 1986 the industry increased the value of shipments by 2 percent. Since 1983, the most rapid growth area within the sanitary food container industry has been aseptic packaging. This is specially treated paperboard combined with plastic film and aluminum foil. Sanitary paper products have undergone radical changes in manufacturing in recent years; however, due to the non-discretionary nature of most of this industry's relatively high-priced product line, it has developed a stable base from which to expand.

The value of shipments for SIC 265 increased by 16 percent from 1981 to 1985. This three-digit SIC represents 24 percent of the value of shipments for all of SIC 26. In 1985, the number of employees in SIC 265 was 29 percent of SIC 26 [3].

SIC 266 includes manufacturers of building paper and building board from wood pulp and other fibrous materials. Trends in employment and value of shipments have followed overall trends in SIC 26.

SIC 27—Printing, Publishing, and Allied Industries

This industry is divided into a publishing sector and a printing sector. The publishing sector includes newspaper publishing (SIC 271), periodical publishing (SIC 272), book publishing (SIC 2731) and greeting card publishing (SIC 277). The printing sector includes commercial printing (SIC 275), book printing (SIC 2732), and printing trade services (SIC 279) [1, pp. 106–110].

There were approximately 84,279 establishments in the printing and publishing business in 1985. The

majority of these firms (84.1 percent) had fewer than 20 employees, and the mean establishment size was 17 workers. The firms in SIC 27 employed 1.4 million people [Table II–1]. According to the U.S. Department of Commerce, the value of shipments for all printing and publishing establishments in 1985 was 4.9 percent of the value of shipments for all manufacturing industries. Most of the value of shipments in SIC 27 is from the commercial printing sector (32.4 percent). In 1985, the median rate of return on assets was 8.2 percent for the printing and publishing industry.

Foreign trade has not been a major concern for this industry in the past, but imports are starting to increase at a steady rate. The value of imports and exports was fairly equal in 1986 at $1.3 billion each [2, p. 27–2].

The newspaper industry has maintained slow growth in circulation and advertising over the last several years. Most of the growth in circulation has come from the Sunday edition, while daily circulation fell by 0.6 percent. Sales revenues increased by 8.9 percent, from $14.8 billion in 1986 to $16.2 billion in 1987. Advertising revenues rose slightly, but most of this gain was due to rate increases. Total net worth increased by 17.4 percent from 1986 to 1987 [8].

The periodical industry has experienced growth in both advertising receipts and circulation. Advertising revenue increased over 4 percent in 1986, while circulation revenues increased mainly due to the increase in subscriptions for consumer magazines. There was a large increase in the number of new publications entering the market; over 238 new periodicals were published in 1986 [1, p. 27–6].

Both book publishing and printing showed strong gains over the last several years. Sales and employment increased by 3.5 percent and 2.7 percent, respectively. Spurred by the increase in school enrollment, sales of textbooks accounted for 30 percent of total industry sales. Book printing usually follows the path of book publishing, increasing substantially when book publishing has a strong year [1, pp. 27–9 to 27–13].

Miscellaneous publishing and printing consists of newsletters, catalogs, directories, greeting cards, and business forms. This industry has seen steady gains due in part to the success of mail-order catalogs, telephone directories, and newsletters [1, pp. 27–13 to 27–20].

SIC 28—Chemicals and Allied Products

SIC 28 includes establishments that produce basic chemicals, and establishments that manufacture products using chemical processes. There are three general classes of products: (1) Basic chemicals, such as acids, alkalies, salts, and organic chemicals; (2) chemical products to be used in further manufacturing, such as synthetic fibers, plastics materials, dry colors, and pigments; and (3) finished chemical products to be used for consumption, such as drugs, cosmetics, and soaps; or to be used as materials or supplies in other industries, such as paints, fertilizers, and explosives [1, p. 132].

The chemical and allied products industries have experienced small but steady growth over the recent past. Total shipments by the chemical industry increased approximately 1.2 percent in 1986, following a 1.2 percent gain in 1985. Chemical prices have been somewhat stable in the industry since 1982, due to declining energy costs, which are major factors associated with manufacturing costs. Like many other U.S. industries, various sectors within the chemical industry are undergoing structural changes, such as mergers, plant closings, sales of plants, and other adjustments. This industry employs approximately 5 percent of all industrial workers, but more than 10 percent of all U.S. scientists and engineers. As seen in Table II–1, SIC 28 experienced a 6 percent decline in employment between 1981 and 1985. In 1985, 55.4 percent of the total number of employees in SIC 28 were production workers. The value of shipments increased 8.9 percent during the 1981 to 1985 time period. The median rate of return on assets in the chemical industry was 6.3 percent [5].

Within SIC 28, there are eight, three-digit SICs, which are described below. Most known chemicals that are either produced to be used as an end product, by-product, or effluent, or are used as an input in the production of other substances, can be found in SIC 28. In the following descriptions of four-digit SIC groups, examples of chemicals produced are listed.

SIC 281

This SIC includes establishments that manufacture basic industrial inorganic chemicals. SIC 281 represents 10.3 percent of the value of shipments of SIC 28 in 1985. The value of shipments increased 11.4 percent since 1981, and employment declined by 12 percent. Production workers equaled almost 51 percent of all workers. The number of establishments in SIC 281 was 14.5 percent of all establishments in SIC 28 [Table II–1].

SIC 281 is subdivided into four groups. Examples of the products of each four-digit SIC are given below.

SIC 2812 Products—Chlorine, soda ash, caustic potash, caustic soda, washing soda, and sodium bicarbonate.

SIC 2813 Products—Oxygen, acetylene, argon, carbon dioxide, and hydrogen.

SIC 2816 Products—Color pigments, iron colors, iron oxide, lead oxide pigments, mineral colors, titanium pigments, and zinc oxide pigments.

SIC 2819 Products—Sulfuric, hydrochloric, and hydrofluoric acids.

SIC 282

This SIC includes manufacturers of plastics materials and synthetic resins, synthetic rubbers, and cellulosic and other manmade fibers. Plastics make up a variety of products which are used in diverse markets. Packaging and construction account for over 50 percent of consumption, with the remainder going into the transportation, electronics, and medical industries. SIC 282 represents almost 17 percent of the value of shipments of SIC 28. The value of shipments in SIC 282 increased 8.5 percent over the period 1981 to 1985. Industry shipments of plastics in 1986 gained 6.3 percent as volume rose in response to slightly increased demand for materials. However, declining prices of plastic materials held shipments to a 2 percent increase [2, p. 14–1]

Table II–1 gives employment and establishment data for this segment. The number of employees in SIC 282 in 1985 was almost 16 percent of SIC 28 and the number of establishments was 8 percent of all establishments in that SIC. In 1985, employment in SIC 282 declined by 12 percent, and production workers equaled 66.5 percent of all workers [4].

SIC 282 is subdivided into four groups. Examples of the products from each of these four-digit SICs are given below.

SIC 2821 Products—Cellulose plastics materials, phenolic and other tar acid resins, acrylic resins, polyethylene resins, coumarone-indene and petroleum polymer resins, and casein plastics.

SIC 2822 Products—Copolymers of butadiene and styrene, or butadiene and acrylonitrile, and polybutadienes.

SIC 2823 Products—Cellulose, rayon, and triacetate fibers.

SIC 2824 Products—Fibers of acrylic, acrylonitrile, polyvinyl ester, and nylon.

SIC 283

This group includes establishments that manufacture, fabricate, or process medicinal chemicals and pharmaceutical products. The value of shipments in SIC 283 has increased almost 29 percent since 1981. SIC 283 represents 16 percent of the value of shipments of SIC 28 and almost 20 percent of the number of employees. The U.S. Department of Commerce estimated that the pharmaceutical industry experienced a 6.3 percent increase in the value of shipments in 1986. However, after adjusting for price changes, this growth rate was closer to 1.8 percent. Productivity also increased in 1986, growing by approximately 2.6 percent [2, p. 17–1].

As seen in Table II–1, the number of establishments in SIC 283 was almost 12 percent of all establishments in SIC 28. Employment increased by 3 percent since 1981, and production workers equaled approximately 46 percent of all workers in SIC 283. Agar, vitamins, antibiotics, vaccines, and viruses are examples of the products of this SIC.

SIC 284

This SIC includes manufacturers of detergents, emulsifiers, cosmetic, and producers of glycerin. SIC 284 represents 15 percent of the value of shipments of SIC 28. The value of shipments in SIC 284 increased almost 17 percent from 1981 to 1985. In 1986 the value was estimated at $31 billion, which represents about a 2 percent increase after adjusting for price changes over 1985 values [2, p. 16–1].

The number of employees in this SIC was almost 15 percent of SIC 28 and the number of establishments was almost 22 percent. In 1985, employment in SIC 284 had increased by 1 percent since 1981, and production workers equaled approximately 63 percent of all workers in SIC 284 [4].

There are four subgroups within SIC 284. Examples of the products produced by each four-digit SIC are given below.

SIC 2841 Products—Soap, synthetic organic detergents, inorganic alkaline detergents, and crude and refined glycerin from vegetable and animal fats and oils.

SIC 2842 Products—Household, institutional, and industrial plant disinfectants, non-personal deodorants, dry cleaning preparations, household bleaches, and other sanitation products.

SIC 2843 Products—Textile and leather finishing agents, soluble oils and greases.

SIC 2844 Products—Perfumes, cosmetics, home permanent kits, shampoos, shaving products, and talcum powder.

SIC 285

This SIC includes manufacturers of paints and allied paint products such as varnishes, shellacs, and paint removers. The paint industry grew by about 5.3 percent in 1986, a vast improvement over 1985's decline of 2.9 percent. Estimated shipments for 1986 were $11.1 billion, of which architectural coatings accounted for about 41 percent, followed by product coatings (35 percent) and specialty products (24 percent) [2, p. 15–2].

SIC 285 represents about 6 percent of the value of shipments of SIC 28. The value of shipments increased almost 21 percent from 1981 to 1985. The number of employees in SIC 285 was 6 percent of SIC 28 and the number of establishments was 9 percent.

SIC 286

This SIC includes manufacturers of a variety of industrial organic chemicals. Industry shipments of organic chemicals increased approximately 3 percent over 1985, which was the same level of growth experienced in the previous year. In 1985, the value of shipments for SIC 286 was $41.8 billion, representing 21 percent of the value of shipments of SIC 28. The value of shipments in SIC 286 decreased 11.3 percent over the previous year [2, p. 12–6]. The number of employees in SIC 286 was almost 11 percent of SIC 28 and the number of establishments was approximately 7 percent. Employment in SIC 286 increased by 10 percent, and production workers equaled 51 percent of all workers [Table II–1].

There are three subgroups in SIC 286. Examples of products for each four-digit SIC are given below.

SIC 2861 Products—Hardwood and softwood distillation products, wood and gum naval stores, charcoal, natural dyestuffs and natural tanning materials.

SIC 2865 Products—Toluene, benzene, synthetic organic dyes and pigments.

SIC 2869 Products—Alcohols, caprolactum, and ethylene glycol.

SIC 287

This SIC includes establishments that manufacture agricultural chemicals and pesticides. According to the U.S. Department of Commerce, the 1985 value of shipments of SIC 287 ($14.8 billion) represents 7.5 percent of the value of shipments of SIC 28. The value of shipments in SIC 287 decreased 9.6 percent from 1981 to 1985. Employment in SIC 287 represented 5 percent of SIC 28, but has declined by 16 percent since 1981. The number of establishments in SIC 287 was approximately 9 percent of all establishments in SIC 28 and production workers equaled approximately 62 percent [Table II–1].

SIC 2873 includes manufacturers of nitrogenous and mixed fertilizers. The value of shipments of nitrogenous fertilizers in 1986 was $3.43 billion, which represents a decrease of approximately 8.2 percent over 1985 shipments [2, p. 13–1].

SIC 2874 includes manufacturers of phosphatic fertilizers, such as phosphoric acid, made from phosphate rock. The value of shipments of phosphatic fertilizers in 1986 was $4.67 billion, which represents a decrease of approximately 13 percent over 1985 shipments [2, p. 13–3]. Ammonia and phosphoric acid are two substances with potential exposure problems that are produced and or used in SIC 2874.

SIC 2875 includes establishments that mix fertilizers from purchased fertilizer materials. SIC 2879 includes formulators and preparers of ready-to-use agricultural and household pest control chemicals, such as fungicides, insecticides, and herbicides.

SIC 289

This group includes manufacturers of miscellaneous chemical products. For 1985, SIC 289 represents 7 percent ($14.6 billion) of the value of shipments of SIC 28. From 1981 to 1985, the value of shipments in SIC 289 increased 15.5 percent. The number of employees in SIC 289 was almost 10 percent of SIC 28 and has remained unchanged since 1981. The number of establishments in SIC 289 was approximately 19 percent of all establishments in SIC 28. Production workers equaled approximately 62 percent of all workers [Table II–1].

SIC 2891 includes manufacturers of industrial and household adhesives and sealants. Industry shipments for adhesives and sealants in 1986 amounted to $4.2 billion, of which about 60 percent were by synthetic resins and rubber-based adhesives; 20 percent by sealant and caulking compounds; and the remaining 20 percent by natural-based adhesives and miscellaneous compounds [2, p. 15–3].

SIC 2892 includes manufacturers of explosives, such as TNT (Trinitrotoluene). Ethylene glycol dinitrate is one of the products of this SIC which may have potential exposure problems. SIC 2893 includes manufacturers of printing ink, whereas SIC 2895 includes manufacturers of carbon black. SIC 2899 includes manufacturers of miscellaneous chemical products, not elsewhere

classified. Among these three SICs, ethylene glycol, nitrotoluene, hexylene glycol, trimellitic anhydride, and coal dust are all substances with suspected exposure problems that are either produced or used in these sectors.

SIC 29—Petroleum and Related Industries

This industry is divided into petroleum refiners and producers of other related products. Petroleum refineries (SIC 2911) produce fuels (such as gasoline, kerosene, and distillate and residual fuel oils) as well as lubricants and chemical feedstocks. These products are produced through straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking, or other processes. Other producers in this sector manufacture asphalt and tar products for paving and roofing (SIC 295) and other lubricating oils, greases, and petroleum and coal products (SIC 299) [1, pp. 127–128].

The 1985 value of shipments for SIC 29 ($179.1 billion) was 7.9 percent of the value of shipments for all manufacturing industries. Petroleum refining dominates SIC 29, accounting for 94 percent of this sector's value of shipments [2, pp. 10–8 to 10–14].

The number and size distribution of establishments in SIC 29 are shown in Table II–1, as is total employment. Relative to value of output, SIC 29 has few establishments and low employment, accounting for less than 1 percent of all manufacturing establishments and employment [6, pp. 10, 30].

About 40 percent of the establishments in SIC 29 are petroleum refineries [9], which are large and extremely capital intensive. Production is highly automated; enclosed processes are used throughout. Mean employment size is 105 employees. By contrast, plants in the other industries within SIC 29 are relatively small and less capital intensive, and processes are generally not automated. Mean establishment size in the rest of SIC 29 is 19 employees.

The general pattern of firms in SIC 29 in the 1980s has been one of decline. The real value of petroleum product shipments, consumption of petroleum products, petroleum refining capacity, and employment in SIC 29 all peaked between 1977 and 1981. There has been an upturn since 1985, resulting principally from a sharp decline in crude oil prices in the first half of 1986, which stimulated demand for refinery products [4; 2, pp. 10–1 and 10–2]. Demand for petroleum products is expected to grow only slightly in the short run and to show little long-run growth. In the past, trends have been strongly influenced by sharp fluctuations in the price of crude oil [2, pp. 10–3 and 10–4].

In 1985, imports of refined petroleum products were $18.2 billion, which reflects both the price of crude oil and the volume of imports. The volume of imports is itself strongly influenced by the price of crude oil, since low prices of crude oil tend to reduce imports of refined petroleum products by making domestic refineries more competitive in the production of gasoline. Import penetration has been erratic [2, pp. 10–1 and 10–3].

The profitability of firms in SIC 29 is low. The median 1985 rate of return on assets (4.4 percent) is the second lowest median return on assets of all 20 two-digit manufacturing industries [5].

SIC 30—Rubber and Miscellaneous Plastics Products Industry

This industry sector consists of establishments that manufacture a variety of products from plastic resins and from natural, synthetic, and reclaimed rubber. Although plastic products account for the largest share of the value of shipments of this industry group, the industry also manufactures a variety of rubber products, including tires, inner tubes, footwear, and belting [1, pp. 129–132]. The value of shipments for 1985 was $71.3 billion. This industry is dominated by the miscellaneous plastic products sector (SIC 307 until 1987 and now SIC 308), which accounts for 81 percent of the establishments, 66 percent of the value of shipments, and 70 percent of the employment for the entire industry group [9]. The tire and inner tube (SIC 301) sector and miscellaneous rubber products (SIC 306) sector are the other major components of this industry.

Similar processes are used in manufacturing plastic and rubber products, with the nature and form of the final product determining the process more than the product's components. A product's components, however, determine the types of chemical exposures employees experience. Examples of particularly serious types of exposures are those to the foaming agents that are used in the production of foam rubber or plastic foams and to the styrene used to produce polystyrene or for lamination processes.

As shown in Table II–1, the industry sector has relatively small establishments, 61 percent of which have fewer than 20 employees, with an average of 43 employees per establishment. Employment in this industry grew by 7 percent between 1981 and 1985, with growth in the tire and inner tube and miscellaneous plastic product sectors balancing declines in other sectors [4].

Firms in this industry have above-average profits for manufacturing industries, with a 7.7 percent median rate of return on assets compared with a 7.0 percent median for all manufacturing firms [5].

SIC 31—Leather and Leather Products

The leather and leather products industry (SIC 31) consists of several sectors such as leather tanning (SIC 311), non-rubber footwear (SIC 314), and luggage and leather goods (SIC 315–319), [1, pp. 133–135]. Shipments of leather products and employment in the leather industry have been declining steadily over the past several years, due mainly to the worsening import situation [2, p. 43–1].

According to the U.S. Department of Commerce, the 1985 value of shipments for leather and leather products ($8.6 billion) was down 8.2 percent from 1984. The total represents 0.4 percent of the value of shipments for all manufacturing industries. Non-rubber footwear (SIC 314) makes up most of the value of shipments in this industry with 51.9 percent of the total value [3]. The median return on assets in 1985 for the leather and leather product industry was 6.3 percent [5].

The number of establishments in the leather tanning and finishing industry (SIC 311) has decreased by over 244 establishments, from 384 establishments in 1982 to 140 establishments in 1986. Employment and shipments have also decreased significantly. Since the leather tanning industry is highly dependent on the demand from the non-rubber footwear industry, it is not likely that the situation will improve in the near future [2, pp. 43–1 and 43–2].

The footwear, luggage, and handbag industry (SIC 31, other than 311) has had reductions in sales over the past few years. The non-rubber footwear industry has suffered substantially since 1981 when an import restraint agreement with South Korea and Taiwan expired. Since then, import's share of the domestic market has increased to over 80 percent. In the last few years, production, employment, and domestic shipments have declined substantially [2, p. 43–5].

The luggage and leather goods industry has also seen declines in production, employment, and shipments over the past several years. Imports reached over 52 percent of the domestic market in 1986. Employment has also been declining over the past few years, from 42,000 total employees in 1984 to

37,400 total employees in 1986 [2, pp. 43–12 and 13].

SIC 32—Stone, Clay, Glass and Concrete Products

This industry is made up of products such as cement (SIC 324), concrete (SIC 327), pottery (SIC 326), stone (SIC 328), glass (SIC 321–323), and clay brick (SIC 325). Since these products are primarily used as construction materials, the industry is heavily dependent on the amount of new construction activity in a given year.

There were 21,054 establishments in the stone, clay and glass industry (SIC 32) in 1985. Most of these firms (73.7) percent) employed fewer than 20 people in 1985. The mean establishment size was 28 workers. Total employment was 588,000 in 1985, a decrease of 0.8 percent over the 1984 total employment figure of 593,000 [6].

In 1985, the value of shipments in SIC 32 increased 3.1 percent over 1984. The total value was 2.4 percent of the value of shipments for all manufacturing industries. The value of shipments is evenly distributed over the entire industry, except for the concrete sector (SIC 327) with 35.4 percent of shipments [3]. The median rate of return on assets for SIC 32 was 6.5 percent in 1985 [5].

The concrete industry (SIC 327) has seen considerable improvement in production, employment, and demand in the past several years. The demand for concrete has increased substantially since 1982, when shipments were 23 percent below their current figure. Imports are not a significant factor when dealing with concrete. Since concrete demand depends mainly on non-residential building construction, the demand for concrete should decrease slightly in the near future [2, pp. 2–4 to 2–9].

The glass industry (SICs 321–323) has experienced steady growth over the past two years, mainly in production and shipments. New product introductions have allowed the glass industry to make substantial gains in winning market share. The outlook for continued growth for the glass industry is good [2, pp. 2–9 to 2–12].

Shipments of clay bricks (SIC 325–326) have increased substantially over the past few years, from 6.2 billion bricks in 1983 to 7.3 billion bricks in 1986. The outlook for the industry is for slow growth in the near future [2, pp. 2–12, 13].

SIC 33—Primary Metal Industries

The primary metal industry (SIC 33) is divided into two different sectors: Nonferrous metals and foundries (SIC 333–336) and ferrous metals and foundries (SIC 331–332) [1, pp. 145–152]. This includes the basic iron and steel industry, and the metals industry. Both sectors have been hurt in the recent past by a decline in domestic consumption and the growing number of imports into the United States. The future for these industries, however, looks brighter due to an increase in orders, slowing imports, and a decrease in capacity [10]. These industries have had increases in prices, shipments, and profits in 1987 and 1988, helped by the fall in the dollar.

As seen in Table II–1, the number of establishments in SIC 33 in 1985 totaled 10,101. The majority of these had fewer than 20 employees in 1985. Total employment (808,000 employees in 1985) and production employment (612,000 in 1985) have declined over the last several years, while the average hourly wage of production workers has increased by 2.2 percent from 1984 to 1985 [6]. The mean establishment size was 80 workers.

Production in the steel mill products industry has declined over the past few years, from 88.3 million tons in 1985 to 84.0 million tons in 1986, a decline of 4.9 percent. The 1985 value of shipments ($110.3 billion) in SIC 33 was 4.8 percent of the value of shipments for all manufacturing industries [3]. The median rate of return on assets in 1985 was 5.5 percent for the primary metal industry [5].

The outlook for the steel industry is brighter than just a few years ago. In 1987, the industry is expected to have its first profitable year since 1981. This is due mainly to the large decrease in capacity and employment that the industry has implemented over the last several years. The industry has cut costs of production while prices have remained steady.

The import situation has also improved for the steel industry, due in part to the falling value of the dollar against major competitors such as Japan and Europe. Over the past few years, imports of steel mill products took a large share of the domestic market, an increase of 7.7 percent in the market share from 1979 to 1984. Exports declined during the same time period by 13.7 percent [2, pp. 19–1 to 19–9].

The ferrous castings industry (SIC 332) has shown a poor performance over the past few years. The value of shipments has been steadily decreasing, from $10.8 billion in 1985 to $10.1 billion in 1986, a decline of 7.3 percent. The value of shipments for SIC 332 is forecast to increase 7.1 percent in 1987, although this trend is not likely to continue in the future. Total employment and the number of production workers has also fallen since the early 1980's, by 9.7 percent and 10.0 percent, respectively, from 1979 to 1984 [2, pp. 19–1 to 19–9].

Nonferrous metals can be classified as four primary metals: aluminum, zinc, lead, and copper. The aluminum industry has had mixed progress when it comes to improving their industry. Shipments have increased steadily in the past few years, with a 3.3 percent increase in 1986. The aluminum industry does experience a cost disadvantage due in part to its high electrical costs. Most aluminum producers use very high levels of electricity in their production processes; costs of production fluctuate with electrical utility costs. The industry faces potentially higher electricity rates related to legislative bills designed to reduce acid rain depositions produced by coal burning utilities. The enactment of such legislation is projected to increase power rates to aluminum smelters by over 10 percent.

The zinc industry should have steady growth over the next few years, due mainly to a decline in capacity and an increase in consumption. This has caused the price of zinc to rise, although rather slowly. Domestic consumption was still expected to increase to 960,000 tons in 1987. The value of shipments declined by 18.8 percent in 1986, but it is expected to increase by 7.7 percent in 1987. Total employment and the number of production workers has remained steady for the past several years.

The lead industry has had slow growth over the past few years, due mainly to a decline in demand from products such as gasoline and automobile batteries. Consumption is expected to increase slightly by a modest 2.1 percent in 1987, but to continue increasing into the 1990's. Industry production should also increase slowly, about 2 percent a year for the next few years [2, pp. 20–6 to 20–18].

The copper industry has been undergoing restructuring to remain competitive in the world market. This has forced the industry to decrease capacity and reduce employment [2, pp. 20–6 to 20–18]. The price of copper has been driven up recently due to a decline in inventories. This should allow the industry to turn a significant profit for the first time in several years.

SIC 34—Fabricated Metal Products

The fabricated metal products industry (SIC 34) consists of several different groups: Metal cans and shipping containers (SIC 341); cutlery and hand tools (SIC 342); heating equipment (SIC 343); fabricated structural metal products (SIC 344); screw machine products, bolts, and washers (SIC 345); forgings and

stampings (SIC 346); plating and coating (SIC 347); small arms and ordinance (SIC 348); and miscellaneous wire and fabricated products (SIC 349). SIC 34 excludes machinery and transportation equipment [1, pp. 153–166].

The total number of establishments in the fabricated metal products industry in 1985 was 46,322. The majority of these firms (67.0 percent) employ fewer than 20 people, a change of 0.2 percent since 1984. Total employment in this industry has reached 1.465 million employees, an increase of 0.1 percent since 1984 [6].

The 1985 value of shipments for SIC 34 represents a 2.7 percent increase over 1984. This was 6.1 percent of the value of shipments for all manufacturing industries [3]. The median return on assets for the fabricated metal products industry in 1985 was 7.1 percent [5].

Metal cans (SIC 3411) shipments have been increasing steadily in the past few years, from 92.3 billion units in 1983 to 105.0 billion units in 1986, an increase of over 13.75 percent. This was due mainly to the increase in soft drink and beer cans being shipped. The value of shipments has also increased with a compound annual increase of 3.3 percent from 1979 to 1984. Total employment in the metal cans industry has remained steady with only a slight decrease expected in 1987. The number of production workers has increased slightly with an increase of 0.3 percent from 1985 to 1986. Exports of metal cans have decreased substantially since 1984 when they reached an all-time high of $56.5 million. Since that time they have decreased to $37.5 million in 1986 [2, pp. 6–1 to 6–4].

The fabricated structural metal industry (SIC 3441) produces structural metal components used primarily in the construction industry. Shipments of fabricated structural metal increased 8.0 percent from 1984 to 1985, from $7.5 billion to $8.1 billion in 1985. Total employment has been increasing slowly at an annual rate of 1.0 percent, while the number of production workers has been increasing at an annual rate of 1.4 percent [2, pp. 2–3, 4].

The value of shipments in the screw machine products, bolts, and washers industry (SIC 345) decreased slightly from 1984 to 1987, from $7.5 billion to $7.3 billion. Total employment also decreased from 96,200 in 1984 to 95,600 in 1986. Since the automotive industry is the major customer for this industry, stable automotive sales are the key to economic health for this industry sector [2, pp. 24–1 to 24–6].

SIC 35—Non-Electrical Machinery

The non-electrical machinery industry (SIC 35) is made up of several different sectors: Miscellaneous machinery (SIC 351–356); computer and office equipment (SIC 357); refrigeration and service industry machinery (SIC 358); and miscellaneous machinery and equipment (SIC 359 [1, pp. 167–183].

As seen in Table II–1, the number of establishments in 1985 totaled 77,748. The majority of these (77.1 percent) had fewer than 20 employees in 1985. Total employment and production employment have decreased over the last several years. The 1985 value of shipments ($215.1 billion) in SIC 35 was 9.4 percent of the value of shipments for all manufacturing industries [3]. In 1985, the median rate of return on assets for SIC 35 was 7.5 percent [5].

Miscellaneous machinery (SICs 351–356) has been experiencing an increase in shipment over the past few years. In 1984, the value of shipments was $113.5 billion and since then it has increased to $114.0 billion in 1985. The majority of this increase was from metalworking machinery, which increased from $18.6 billion in 1984 to $19.7 billion in 1985, an increase of 5.7 percent. Total employment in this sector has been declining from 1,153,500 workers in 1984 to 1,117,400 workers in 1985 [2, pp. 23–1 to 23–17, 25–1 to 25–5, and 21–1 to 21–17].

The computer industry (SIC 357) has been facing stagnant demand for its products in the U.S. market [11]. The value of shipments of electronic computing equipment (SIC 3573) has decreased from $53.5 billion in 1984 to $49.2 billion in 1986, a decline of 8.0 percent. Total employment and the number of production workers have also declined since 1984 by 15.5 percent and 27.8 percent, respectively. Imported computer equipment have made significant inroads into the domestic market, due mainly to the standardization of products and the fall in price of computer equipment [2, pp. 28–1 to 28–10].

The refrigeration and service machinery industry (SIC 358) has had exceptional performance since 1984, with a compound annual rate of growth of 5.1 percent from 1979 to 1984. This is due mainly to the increase in new residential construction. Total employment and the number of production workers have also been increasing substantially, although this trend slowed in 1986, probably due to the trade situation. Imports have been steadily increasing, while exports have been decreasing at a steady rate [2, pp. 22–9 to 22–11].

SIC 36—Electric and Electronic Equipment

This industry is made up of several distinct sectors: Transformers and switchgear (SIC 361); electrical industrial apparatus (SIC 362); household appliances (SIC 363); electrical lighting and wiring (SIC 364); consumer electronics and communications equipment (SIC 365–366); electronic components and accessories (SIC 367); and miscellaneous electrical equipment and machinery (SIC 369) [1, pp. 184–195].

There were approximately 28,478 establishments in the electric and electronic equipment industry in 1985, employing over 2 million workers. The majority of these firms (62.4 percent) had fewer than 20 employees. The value of shipments for all electric and electronic equipment establishments in 1986 was $192.7 billion. This was 8.4 percent of the value of shipments for all manufacturing industries. Most of the value of shipments in SIC 36 is from the communication equipment sector (33.9 percent) [3]. The median return on assets for the electric and electronic equipment industry was 7.9 percent in 1985 [5].

The transformer and switchgear industry (SIC 361) has had mixed performance in the last year. While the value of shipments increased for switchgear by 2.5 percent, the value of shipments for transformers decreased by 1.9 percent from 1985 to 1986. Total employment and the number of production workers has remained fairly steady since the early 1980's [2, pp. 26–1 to 26–4].

The electrical industrial apparatus industry (SIC 362) is facing an uncertain future. The value of shipments for this industry has remained fairly steady over the past few years, but shipments in the future are predicted to decline due to weak demand from the automotive industry. Total employment has already begun to decline from 190,300 in 1984 to 178,900 in 1985, a decreases of 6.0 percent. The majority of the industry has been forced to cut operating costs to compensate for the reduced demand [2, pp. 26–4 to 26–6].

The household appliance industry (SIC 363) has had a steady increase in sales since the early 1980's, from $12.6 billion in 1982 to $15.2 billion in 1986, an increase of 19.98 percent [12]. The industry is optimistic about its future, due mainly to the increased residential construction and the increase in disposable income. Imports have not been a substantial burden on this industry, although exports have not

increased substantially either. Total employment and the number of production workers have declined from 1984 to 1986 by 9.1 percent and 9.9 percent, respectively. This decline in employment is due to the recent number of acquisitions within the industry and the need to cut costs of production [2, pp. 44–5 to 44–9].

The value of shipments for the electrical lighting and wiring industry (SIC 364) has been increasing steadily over the last decade, from 11,321 in 1980 to 15,606 in 1985, an increase of 39.6 percent. Total employment and the number of production workers have decreased, although at a slow rate. Performance in this industry is due, in part, to the good performance of the construction industry. Since the electrical lighting and wiring industry depends on both residential and non-residential construction, they are able to withstand a slowdown in one sector as long as the other sector is still profitable [2, pp. 3–2 to 3–5].

The consumer electronics and communication equipment industry (SICs 365–366) has had mixed performance over the past few years. While the communication equipment industry has performed well in the past, the consumer electronics industry has not performed as well, due to the large import volume in this industry. Overall, the value of industry shipments has remained fairly stable, with shipments increasing in the communication equipment industry and shipments decreasing in the consumer electronics industry. Total employment and the number of production workers also follow this pattern, decreasing for consumer electronics and increasing for communication equipment [2, pp. 29–1 to 29–5 and 44–9 to 44–15].

The electronic components and accessories industry (SIC 367) is expected to show record growth over the next few years. Industry shipments were up 8.1 percent, from $39.7 billion in 1986 to $43.0 billion in 1987. This was due, in part, to the strong performance of the defense electronics industry. The number of production workers and total employment has remained fairly steady in 1986 and 1987. Imports are still increasing, but may be slowed due to the fall in the value of the dollar [2, pp. 32–1 to 32–4].

SIC 37—Transportation Equipment

This industry sector includes establishments engaged in manufacturing equipment for land, sea, air, space transportation and includes manufacturers of parts and accessories as well as complete vehicles.

The major subdivisions within this sector are motor vehicles and motor vehicle equipment (SIC 371), aircraft and parts (SIC 372), ship and boat building and repair (SIC 373), railroad equipment (SIC 374), motorcycles, bicycles and parts (SIC 375), guided missiles, space vehicles and parts (SIC 376), and miscellaneous transportation equipment (SIC 379). Establishments in the miscellaneous subdivision manufacture a broad range of products (e.g., from tanks to wheelbarrows) [1, pp. 196–201]. Because the manufacture of transportation equipment involves a wide range of industrial processes, establishments in this sector often include or involve foundries, electroplating operations, various types of hot metal work, welding, laminating, plastic molding, and painting and coating. Thus workers may be exposed to the chemicals generated by a broad variety of processes.

Although the transportation equipment industry includes both very small and very large establishments, it has an unusual number of very large establishments that have thousands of employees. These very large establishments are most likely to be found in plants that produce final equipment on a mass-production basis (e.g., automobile plants, aircraft plants, or tank assembly lines). There is still a place in this industry, however, for smaller establishments, and, as shown in Table II–1, 68 percent of all establishments have fewer than 20 employees.

Because foreign competition plays an important role in this sector, the prosperity of the industry fluctuates with business cycles and with the value of the dollar. Employment in this industry declined between 1981 and 1982 but had recovered to the 1981 level by 1984 and had increased another 4 percent by 1985 [4].

The value of shipments for SIC 37 was $301.4 billion in 1985. The average firm in this industry had a 7.3 percent return on assets in 1985, which is slightly above the median of 7.0 for firms in all manufacturing industries. Some sectors within the two-digit industries had significantly lower returns on assets, although no major component of the industry had a return on assets below 4 percent in 1985 [5].

SIC 38—Measuring, Analyzing and Controlling Instruments

SIC 38 includes manufacturers of instruments used to measure, test, analyze and control. It also includes optical instruments and lenses; surveying and drafting instruments; hydrological, hydrographic, meteorological, and geophysical equipment; search, detection, navigation, and guidance systems and equipment; surgical, medical, and dental instruments, equipment, and supplies; ophthalmic goods; photographic equipment and supplies; and watches and clocks [1, p. 243].

The industries in this SIC rely heavily on research and development activities (R&D) of other industries for sales of their products. According to the U.S. Department of Commerce, increases in research and development expenditures by industry and government in 1986 caused increases in sales of scientific and industrial instruments. High tech firms, which represent a large portion of SIC 38's product market, are the largest investors in research and development, where R&D expenditures are measured as a percentage of gross sales. Firms producing semiconductors, computers and related equipment, office equipment, and software, among others, were major sources of R&D funds in 1986. The pharmaceutical and chemical industries also have relied on R&D to a large extent. In addition, the decline in the price of oil, which raises profits by lowering production costs, is expected to further stimulate R&D expenditures by the chemical industry [2, p. 33–1].

Similarly, government outlays for R&D increased in 1986 by more than 9 percent in current dollars. Most of the R&D expenditures, however, were for defense-related research. In addition, the National Aeronautics and Space Administration (NASA) is expected to invest in new instrumentation for the redesign of the space shuttle and other rocket systems [2, p. 33–4].

According to the U.S. Department of Commerce, the value of shipments in 1985 ($61 billion) increased almost 26 percent since 1981. Between 1981 and 1985, SIC 38 experienced a 1 percent loss in employment. Of all employees, 54.4 percent working in SIC 38 were production workers [4]. In 1985, the median rate of return on assets in this SIC was 7.3 percent [5].

From 1981 to 1985, the value of shipments for SICs 383 and 384 experienced growth, rising 60 and 54.3 percent, respectively. SIC 383 comprises 8 percent of the total value of shipments in SIC 38, while SIC 384 represents 23 percent. In contrast, SIC 387 experienced a drop of 36 percent in the value of shipments, representing only 1.5 percent of the total value of shipments in SIC 38 [5].

SIC 39—Miscellaneous Manufacturing Industries

In any classification scheme, some items inevitably fall outside the scheme. In manufacturing, these miscellaneous industries are included in SIC 39, which contains five three-digit industries that are as dissimilar from one another as is usually the case at the two-digit level in other manufacturing sectors. Most of the industries in SIC 39 produce discretionary durable consumer goods, some of which are luxury goods. Establishments that cannot be grouped together even at the three-digit level are included in SIC 399. At the three-digit level, miscellaneous manufacturing industries include producers of jewelry, silverware, and plated ware (SIC 391); musical instruments (SIC 393); toys and sporting goods (SIC 394); pens, pencils, office and art supplies (SIC 394); and costume jewelry and notions (SIC 396). A sixth category, miscellaneous manufactures (SIC 399), includes producers of brooms and brushes, signs and advertising displays, burial caskets, hard surface floor coverings, and manufacturing industries "not elsewhere classified" [1, pp. 211–218].

The number of establishments and employment in SIC 39 are shown in Table II–1. Nearly three-quarters (72 percent) of these employees are production workers.

Establishments in SIC 39 are generally far smaller than those in manufacturing as a whole, with higher proportions of employees concentrated in small establishments. The mean size of establishments is 11 employees, with 85 percent of establishments having fewer than 20 employees, compared with less than 65 percent for manufacturing establishments as a whole. Relatively few establishments in SIC 39 have 100 or more employees [6].

Miscellaneous manufactures (SIC 399) has the largest share (more than one-third) of the value of shipments for SIC 39 ($26.5 billion in 1985) [3, vol. 1: 8, 22, 24]. The SIC 39 industries were generally hard hit by the 1982 recession. Substantial import competition, aided by the strength of the dollar, has impeded the recovery of many of these industries since 1982, and the import share of new supply doubled between 1980 and 1985 in many industries. Imports account for nearly 60 percent of the new supply of sporting and athletic goods and between one-quarter and three-eighths of new supply in many other industries. The recent decline of the dollar has tended to halt or reverse import penetration to varying degrees [2, pp. 45–2 to 45–11; 46–10 to 46–13]; however, domestic production in SIC 39 will also be affected by the tendency of the doll and toy sector to move offshore [2, pp. 45–2 to 45–11; 46–120 to 46–12].

Generally, this cyclical pattern also is found in this industry at the more disaggregated level. In the latest cycle, the peak-to-trough decline of production, employment, and real value of shipments in many of these industries was between 10 and 25 percent. In some cases (particularly in musical instruments and toys and sporting goods), production and/or employment declined by as much as half. Exceptions to this pattern, however, can be found in the manufacture of dolls, sporting and athletic goods, and costume jewelry, where the real value of shipments grew steadily despite the business cycle. (The apparent contradiction between from this growth and decline in production and employment results from the movement offshore of production facilities of domestic companies.) In miscellaneous manufacturing (SIC 399), 1986 employment was 15 percent above the previous peak, making this the only three-digit industry to regain the peak level [5, 2, pp. 45–3 to 45–11; 46–11 to 46–13].

In terms of profitability, the majority of industries in SIC 39 are more profitable than most manufacturing industries. The median 1985 rate of return on assets (8.0 percent) is the second highest median return on assets of all two-digit manufacturing industries. Median rates of return for four-digit industries within this sector range from 3.4 percent to 9.5 percent [5].

SIC 40—Railroad Transportation

SIC 40 includes establishments that provide line-haul railroad transportation, and switching and terminal establishments. General authority for the working conditions at railroad operations is vested in the Federal Railroad Administration. For the most part, OSHA's standards apply only to off-track operations such as shops and servicing areas. The U.S. Department of Commerce estimates that in 1986, there were 23 individual Class I railroads (those with operating revenues of $50 million or more in 1987 dollars), which accounted for over 95 percent of the freight tonnage handled by the railroad industry. The industry also includes about 480 smaller carriers, including shortlines and switching and terminal companies. The 1986 operating revenue for the railroad industry was estimated as $26.5 billion (1982 dollars), representing an annual loss of about 4 percent. Revenue ton miles were estimated as 880 billion, which represents less than a 1 percent rate of growth [2, p. 55–8]. Between 1980 and 1985, the industries in SIC 40 experienced a serious economic decline, as indicated by the fact that it was the second slowest growing SIC (behind SIC 10, metal mining), and third highest in terms of employment losses (behind SIC 33, primary metals and SIC 35, heavy machinery). During this period, employment declined by approximately 27 percent [2, pp. 13–14]. The median rate of return on assets in 1985 was 4.4 percent [5].

SIC 45—Air Transportation

This SIC includes establishments that provide domestic and foreign transportation by air and also those that operate airports and flying fields and provide terminal services. The Federal Aviation Administration (FAA), U.S. Department of Transportation, enforces rules and regulations governing the safety and health of flight and cabin crew of aircraft in flight. In general, the FAA also has jurisdiction over airline maintenance and ground support personnel. According to the U.S. Department of Commerce, the U.S. airline industry consists of approximately 250 individual commercial air carriers operating over 4,500 aircraft and employing over 355,000 people. In 1985, the industry served 380 million passengers and operated 6 billion cargo ton-miles. Twelve major carriers account for 84 percent of all revenue passenger miles. (The U.S. Department of Commerce defines a major carrier as having at least $1 billion in annual revenue, in 1982 dollars.) The remaining passenger revenue is shared by 16 carriers classified as nationals (each with annual revenues between $75 million and $1 billion in 1982 dollars), which account for about 12 percent, and by the regionals/commuters, which account for 4 percent. The U.S. Department of Commerce estimated the 1986 operating revenue for the airlines industry as $49 billion (1982 dollars), representing an annual growth rate of about 4.9 percent. Revenue passenger miles were estimated as 363 billion, which represents an 8 percent rate of growth [2, p. 55–1]. In 1985, the median rate of return on assets in this sector was 4.3 percent [5].

SIC 47—Transportation Services

SIC 47 includes establishments that furnish services related to transportation. Activities classified in SIC 47 include freight forwarding, arranging transportation for passengers and freight, renting railroad cars, inspection and weighing services; and freight car loading [1, pp. 280–281].

According to the U.S. Department of Commerce, between 1980 and 1985, SIC 47 was the third-fastest growing industry group behind SIC 62 (Securities) and SIC 73 (Business Services) [2, pp. 13–14]. Between 1981 and 1985, SIC 47 experienced a 31 percent increase in employment. Table II–1 presents employment and establishment data for SIC 47. The median return on assets in this SIC was 7.1 percent [5].

SIC 49—Electric, Gas, and Sanitary Services

SIC 49 includes establishments that generate, transmit, and/or distribute electricity, gas, or steam. These establishments may be combinations of any of these services, but also may include other types of services, such as transportation, communications, refrigeration and pipelines for natural gas. Water and irrigation systems, and sanitary systems that collect and dispose of garbage, sewage, and other wastes, also are included in this SIC [1, p. 284].

The utilities covered in SIC 49 have been undergoing many changes in the past few years. The utilities have been in a state of transition due to ongoing changes in regulations regarding utility rates and competition. Some industrial customers have begun producing their own energy and utilities are now competing for customers outside their service areas. This competition has forced structural changes in the industry, especially diversification. Utilities have been forced to upgrade their overall efficiency. With declining interest rates, regulators have been decreasing the allowed rate of return for utilities. This, too, has led to intensified pressures on competition [13, p. 56]. The Federal Energy Regulatory Commission is currently considering whether to allow utilities to open their power lines to other competing utilities. Users would be given the choice of suppliers. With the decreasing rate of return and the increasing competition, utilities have stepped up efficiency in order to offset the impending drop in their profit margins [14, p. 48].

Table II–1 presents employment and establishment data for SIC 49 for 1985. Between 1981 and 1985, SIC 49 experienced a 6 percent growth in employment. In 1985, almost 80 percent of all employees were production workers [4]. The median return on assets was 4.0 percent [5].

Within this SIC, there are seven three-digit SICs, including establishments that generate, transmit, or distribute electrical energy for sale and that operate crude petroleum and natural gas field properties; establishments that transmit and or store natural gas for sale; establishments that provide electric or gas services in combination with other services, only if one service does not constitute 95 percent or more of revenues; establishments that distribute water for sale for domestic, commercial, and industrial use; establishments that collect and dispose of wastes conducted through a sewer system, including such treatment processes as may be provided; establishments that produce and/or distribute steam and heated or cooled air for sale; and establishments that operate water supply systems for the purpose of irrigation [1, pp. 284–286].

SIC 50 and SIC 51—Wholesale Trade

The wholesale trade sector includes establishments engaged in the wholesale selling of merchandise to retailers; industrial, commercial, institutional, farm, or business users; or to other wholesalers or firms that act as agents or brokers in the wholesale buying or selling of merchandise. Wholesale trade is divided into trade in durable goods (SIC 50) and in nondurable goods (SIC 51). This analysis focuses only on a few of the wholesale trade industries (e.g., dealers in scrap and waste materials, SIC 5093; grain, SIC 5153; chemicals and allied products, SIC 5161; farm supplies, SIC 5191; and paints, varnishes, and supplies, SIC 5198 [1, pp. 241, 250, 255–257]. In addition to the types of worker exposures associated with materials handling and receiving, some industries engage in other activities that can lead to significant chemical exposures. For example, assembling, breaking up, and sorting scrap and waste materials (SIC 5093) and storing grain (SIC 5153) are activities that can lead to exposures.

Wholesale trade sales ($1,375 billion in 1985) were fairly equally divided between durable goods and nondurable goods—46 percent and 54 percent, respectively [2, p. 56–1]. Of the approximately 425,000 establishments in wholesale trade, about five-eighths were in durable goods, and three-eighths were in nondurable goods. The specific four-digit industries studied for this analysis include about 11 percent of all wholesale trade establishments [3, pp. 59, 62, 64–65].

Table II–1 shows employment data at the four-digit level. Somewhat less than 60 percent of total employment in wholesale trade is in durable goods, while a little more than 40 percent is in nondurable goods. The specific four-digit industries being analyzed here account for less than 9 percent of all employment in wholesale trade [6].

SIC 55—Automotive Dealers and Service Stations

This industry sector includes retailers of transportation equipment for personal use (new and used automobiles) as well as recreational vehicles (boats, motor homes, and dune buggies); sellers of automobile parts and accessories; and gasoline stations. Although it does not include establishments whose primary business is automotive repair, it does include repair operations that are part of automobile dealerships or service stations. Only those retail outlets that earn more than 50 percent of their revenues from gasoline or lubricating oil sales are included. Many car washes and convenience stores that sell gasoline are excluded, as are traditional full-service gas stations that earn more than 50 percent of their revenues from such activities as repairs, towing, or the sale of auto accessories [1, pp. 265–266]. According to one estimate, this sector includes only 55 percent of all retail motor fuel outlets [15, pp. 6–13]. Although many employees are involved in selling, some are exposed to chemicals during painting or stripping or as a result of the indoor operation of engines or the use of solvents.

As shown in Table II–1, most establishments are relatively small (80 percent have fewer than 20 employees). Only in one sector (i.e., new and used automobile dealerships) do more than half of the establishments have more than 19 employees [9]. Even in this sector, however, 90 percent of the establishments have fewer than 100 employees [4]. Although the typical operation is relatively small, total employment is substantial because of the large number of establishments. New and used automobile dealerships account for 48 percent of total employment, gasoline service stations for 31 percent, and automobile and home supply stores for 16 percent.

Although many firms own only a single establishment, large firms own a significant portion of all establishments, which are operated as chains under leasing or franchising agreements.

The profitability of firms in SIC 55 is below the national average, with a medium return on assets of 5.9 percent in 1985; however, this rate of return improved in 1986 as gasoline prices declined, and new car sales increased [5].

SIC 72—Personal Services and SIC 73—Business Services

The personal services industry consists primarily of consumer services. SIC 721, laundry, cleaning and garment

services has the highest potential for overexposure to chemicals. Other segments of SIC 72 include photographic studios (SIC 722); beauty shops, barber shops and shoe repair (SIC 723–725); and funeral service and crematories (SIC 726) [1, pp. 298–300].

As seen in Table II–1, the number of establishments in 1985 totaled 161,004. Almost all of these (96.9 percent) had fewer than 20 employees in 1985. The mean establishment size was 7 employees. The largest single segment of this industry is SIC 7231, beauty shops, which totaled 53,165 firms in 1986 [6]. Total employment (1,056,000 employees in 1985) has increased over the last several years. In 1986, the value of sales was $39.4 billion in the personal services industry, a 6.6 percent increase over 1985 [16]. The median rate of return on assets for the personal services industry was 10.5 percent in 1985 [5].

The business services industry consists of several different sectors. Among the sectors included are mailing, reproduction, and commercial art and photography (SIC 733); building cleaning and maintenance services (SIC 734); and miscellaneous business services (SIC 739), such as photofinishing laboratories and commercial testing laboratories [1, pp. 301–308].

The number of establishments in 1985 totaled 382,626. Almost all of these (90.5 percent) had fewer than 20 employees in 1985. The mean establishment size was 12 workers. Total employment (4,457,000 employees in 1985) has increased over the last several years (4,057,000 employees in 1984) [4]. In 1986, the value of sales was $198.7 billion in the business services industry, a 9.2 percent increase over 1985 [16]. The median rate of return of assets SIC 73 was 11.1 percent in 1985 [5].

SIC 75—Automotive Repair, Services, and Garages

This sector includes establishments that provide automotive repair, rental, leasing, and parking services to the general public, but excludes gasoline stations (SIC 55) and repair shops that are part of automobile dealerships or that service commercial fleets [1, p. 309]. Employees may be exposed to engine emissions in parking garages or repair shops, to a variety of chemical solvents (particularly in painting and stripping), and to dust from body work.

Eighty-five percent of the establishments are automotive repair shops, which is the sector most likely to have significant chemical exposure, and they employ 61 percent of all industry workers [9]. As shown in Table II–1, SIC 75 is dominated by businesses employing fewer than 20 workers (97 percent) with a median return on assets of 9.2 percent in 1985. The profitability of automotive repair and service firms is high, although it varies by size and industry sector. Small firms (under $100,000 in assets) had returns of 18.3 percent in 1985, while large businesses (over $1,000,000) had returns of 3.9 percent. Paint shops (SIC 7535) were the most profitable type of operation, while parking lots (SIC 7523) and parking structures (SIC 7525) registered significantly lower rates of return [5].

SIC 76—Miscellaneous Repair

This industry group includes a wide variety of repair services, differentiated by object repaired and processes used. Industries of particular concern include reupholstery and furniture repair (SIC 7641) and welding (SIC 7692) [1, pp. 312–314]. Reupholstery and furniture repair workers may be exposed to nuisance dusts during wood working, and to solvents; welders may be exposed to fumes.

Nineteen percent of the 56,000 industry establishments in SIC 76 are in SIC 7641 and SIC 7692. These two industries account for approximately 14 percent of all SIC 76 employment [6, pp. 81–82].

The industry is made up almost entirely of very small firms, and the sector has extremely low concentration. Mean business size is 5.5 employees: more than 95 percent of all establishments have fewer than 20 employees, and 65 percent of all workers are employed by establishments of this size. Only 0.2 percent of all miscellaneous repair establishments (with about 6 percent of total employment) have 100 or more employees, and only 17 establishments have 250 or more. The four-digit industries of concern are even more completely dominated by small establishments, with a mean size of 4.8 employees in SIC 7641 and 3.4 employees in SIC 7692 [6, pp. 81–82].

Despite a slight decline in 1981 and 1982, employment in SIC 76 has grown fairly steadily since the 1975 recession, increasing by 23 percent between 1979 and 1984 and by 7 percent between 1984 and 1986. More than 98 percent of all workers are neither administrative nor clerical [4].

Miscellaneous repair firms have high profit rates. The median 1985 rate of return on assets in SIC 76 is 10.0 percent. This rate of return is higher than that of any two-digit manufacturing industry. The median rates of return on assets in SIC 7641 and SIC 7692 are over 11 percent [5].

SIC 80—Health Services

The health services industry encompasses a broad range of medical, surgical, and other health services, both public and commercially owned. These services are provided by a variety of practitioners (e.g., physicians, dentists, osteopathic physicians, chiropractors, optometrists) at a variety of facilities (e.g., hospitals, nursing facilities, outpatient care facilities, medical laboratories) [1, pp. 321–323].

Total expenditures on health care and medical services ($425 billion in 1985) are very large, with 40 percent of this amount going to hospital care and 20 percent to physicians' services. Expenditures on nursing home care, drugs and medical sundries, and dentists' services each accounted for 6 to 8 percent of all health and medical services expenditures [2, p. 54–1].

Data on health care establishments are shown in Table II–1. Although the number of health service establishments (313,000) is very large, 85 percent of these are offices of licensed practitioners. No other three-digit sector within the health services industry accounts for more than 4 percent of health service establishments, and only about 2.7 percent (i.e., 1,500 establishments) are hospitals.

Total health services employment is very large (6.3 million), with hospitals accounting for almost half (i.e., 48 percent) of this workforce. Because of their large numbers, practitioners' offices are next in percentage of workforce employed (24 percent), followed by nursing and personal care homes (18 percent). Mean establishment sizes range from six or fewer employees in practitioners' offices to 250 or more employees in hospitals. The overall mean size of establishments in this industry is 20 employees, with more than 91 percent of these establishments having fewer than 20 employees, and approximately 22 percent of all SIC 80 employees working in establishment of this size. SIC 80 facilities with more than 250 employees employ more than 50 percent of the workforce in this sector, and facilities with more than 100 employees employ more than 60 percent [6; 4].

The health and medical services industry has been expanding rapidly for more than a decade. A variety of factors have caused this increase, including the expansion of the elderly population, the increasing use of sophisticated high-technology equipment, the expanded treatment of expensive diseases, and the increasing costs of malpractice insurance. In addition, between 1985

and 1986, the price for most medical services rose between 6 and 9 percent, compared with 1.5 percent increase in consumer prices. The implementation of Medicare's prospective payment system is also causing major changes in the health care industry [2, pp. 54–1,2].

Hospital care costs have been a major target of cost-cutting measures, resulting in a decline in hospital admissions, a shortening of hospital stays, and substantial industry restructuring, including increased mergers and acquisitions by large chains, vertical integration, diversification of services offered, expanded professional peer review, and more businesslike operations. Major investor-owned nursing home chains also have experienced rapid expansion and acquisition [2, pp. 54–1, 2].

For SIC 80 as a whole, the growth rate in expenditures averaged 12.6 percent per year from 1979 to 1984 and more than 9 percent for the next 3 years [2, p. 54–1]. Employment grew by 31 percent between 1979 and 1986, rising by 2 to 5 percent in each year [4]. The growth picture is fairly consistent across three-digit industries, although expenditures on "other professional services" have shown the most rapid growth of any health service (16.3 percent annually from 1979 to 1984). Expansion has been especially rapid in health maintenance organizations and home health care, both of which have the potential for reducing health costs and substituting, to some degree, for hospital care [2, pp. 54–1 to 54–4].

The median rate of return on assets in health services (5.0 percent in 1985) is relatively low compared with that in manufacturing industries, and hospitals have somewhat lower median rates of return than is the case for health services as a whole. Several "offices" industries, on the other hand, have median rates of return higher than 13 percent. Medical and dental laboratories have median rates of return that are above the median for two-digit manufacturing industries [5].

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TABLE II - 1

Industries With Potential Hazardous Exposures,
Number of Establishments and Employment
(1985)

SIC	Description	Establishments[a] Total Number	Establishments[a] Percent Large[b]	Establishments[a] Percent Small[c]	Employment[d] Total (1,000)	Employment[d] Production Workers (1,000)
20	FOOD AND KINDRED PRODUCTS	29,043	37.14	62.86	1,603	1,118
21	TOBACCO MANUFACTURES	216	46.76	53.24	64	48
22	TEXTILE MILL PRODUCTS	11,023	39.40	60.60	702	607
23	APPAREL PRODUCTS	30,032	33.33	66.67	1,121	945
24	LUMBER & WOOD PRODUCTS, EXCEPT FURNITURE	36,710	19.73	80.27	697	584
243	MILLWORK, VENEER & PLYWOOD	13,921	17.87	82.13	288	190
245	BUILDING & MOBILE HOMES	1,618	40.05	59.95	72	56
249	MISCELLANEOUS WOOD PRODUCTS	5,666	18.73	81.27	77	64
25	FURNITURE AND FIXTURES	16,791	27.16	72.84	494	394
26	PAPER AND ALLIED PRODUCTS	8,750	53.86	46.14	678	512
27	PRINTING, PUBLISHING & ALLIED INDUSTRIES	84,279	15.87	84.13	1,428	789
28	CHEMICAL AND ALLIED PRODUCTS	20,823	32.59	67.41	1,044	578
281	INDUSTRIAL INORGANIC CHEMICALS	3,024	35.42	64.58	142	72
282	PLASTICS & SYNTHETICS	1,666	51.50	48.50	172	114
283	DRUGS	2,454	37.82	62.18	206	95
284	SOAP, CLEANERS, & COSMETICS	4,498	24.59	75.41	148	94
285	PAINTS, VARNISHES, LACQUERS	1,880	36.54	63.46	64	31
286	INDUSTRIAL ORGANIC CHEMICALS	1,528	34.88	65.12	160	82
287	AGRICULTURAL CHEMICALS	1,843	23.77	76.23	59	37
289	MISCELLANEOUS CHEMICAL PRODUCTS	3,930	29.64	70.36	94	54
29	PETROLEUM REFINING & RELATED INDUSTRIES	3,334	28.40	71.60	179	109
291	PETROLEUM REFINING	1,332	33.18	66.82	141	82
295	PAVING & ROOFING MATERIALS	1,222	23.81	76.19	26	20
299	MISCELLANEOUS PETROLEUM & COAL PRODUCTS	780	27.44	72.56	-	-
30	RUBBER & PLASTICS PRODUCTS	18,002	38.85	61.15	786	607
307	MISCELLANEOUS PLASTIC PRODUCTS	14,638	39.62	60.38	550	435
31	LEATHER AND LEATHER PRODUCTS	3,940	29.85	70.15	165	137
311	LEATHER TANNING & FINISHING	480	35.42	64.58	15	12
32	STONE, CLAY, GLASS, & CONCRETE PRODUCTS	21,054	26.26	73.74	588	451

[a] Dun and Bradstreet

[b] 20 or more employees

[c] Fewer than 20 employees

[d] Labstat, U.S. Department of Labor (Database)

TABLE II - 1

Industries With Potential Hazardous Exposures,
Number of Establishments and Employment
(1985)
(continued)

SIC	Description	Establishments[a] Total Number	Establishments[a] Percent Large[b]	Establishments[a] Percent Small[c]	Employment[d] Total (1,000)	Employment[d] Production Workers (1,000)
33	PRIMARY METAL INDUSTRIES	10,101	44.75	55.25	808	612
34	FABRICATED METAL PRODUCTS	46,322	32.96	67.04	1,465	1,084
35	MACHINERY, EXCEPT ELECTRICAL	77,748	22.90	77.10	2,174	1,307
36	ELECTRICAL & ELECTRONIC MACHINERY, EQUIPMENT & SUPPLIES	28,478	37.64	62.36	2,197	1,300
37	TRANSPORTATION EQUIPMENT	16,132	31.58	68.42	1,980	1,257
38	INSTRUMENTS	16,814	29.42	70.58	720	391
39	MISCELLANEOUS MANUFACTURING INDUSTRIES	32,212	15.82	84.18	367	264
40	RAILROAD TRANSPORTATION	2,645	27.30	72.70	359	-
45	TRANSPORTATION BY AIR	11,832	19.46	80.54	522	-
47	TRANSPORTATION SERVICES	35,626	7.56	92.44	276	-
49	ELECTRICAL GAS, & SANITARY SERVICES	21,115	25.71	74.29	915	729
5093	SCRAP & WASTE MATERIALS	7,556	12.61	87.39	92	-
5153	GRAIN	7,523	5.84	94.16	-	-
5161	CHEMICALS & ALLIED PRODUCTS	13,045	8.51	91.49	-	-
5191	FARM SUPPLIES	20,392	4.55	95.45	151	-
5198	PAINTS, VARNISHES, & SUPPLIES	4,033	6.89	93.11	-	-
55	AUTO DEALERS & SERVICE STATIONS	189,214	9.77	90.23	1,890	1,886
72	PERSONAL SERVICES	161,004	3.13	96.87	1,056	-
73	BUSINESS SERVICES	382,626	9.46	90.54	4,457	3,863
75	AUTO REPAIR, SERVICES, & GARAGES	149,260	2.64	97.36	731	614
7641	REUPHOLSTERY & FURNITURE REPAIR	10,655	0.92	99.08	-	-
7692	WELDING REPAIR	9,413	2.21	97.79	-	-
80	HEALTH SERVICES	313,076	8.71	91.29	6,299	5,607

Source: U. S. Department of Labor Occupational Safety and Health Administration, Office of Regulatory Analysis.

[a] Dun and Bradstreet

[b] Labstat, U.S. Department of Labor (Database)

[c] 20 or more employees

[d] Fewer than 20 employees

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III. Employee Exposures and Benefits

Employee exposures to the substances included in the scope of this rulemaking are associated with a wide variety of acute and chronic illnesses. These include sensory irritation, narcosis, organs system dysfunction, chronic respiratory disease, neurological impairment, allergic sensitization, and cancer. Since OSHA's adoption of existing Federal and consensus standard limits in 1971, toxicologic evidence has become available that shows that adverse health effects can occur as a consequence of exposure to many of the substances listed in OSHA's Z tables, and that such health effects occur even when exposures are maintained at the current Z table limits. In addition, many substances that have come into widespread use or been introduced since 1971 have been shown to be potentially hazardous in the workplace environment. OSHA thus believes that reducing worker exposures to such substances by lowering existing exposure limits or by adding limits for previously unregulated substances will result in a significantly reduced risk of illness to workers.

This chapter describes the methodology used to identify workers potentially exposed to the hazardous substances included in this rulemaking and the expected benefits to those workers resulting from lowering permissible exposure levels. An important existing data base for identifying employees potentially exposed to hazardous substances was OSHA's Integrated Management Information System. The IMIS data were used to project expected benefits resulting from lowering permissible exposure levels to the substances being regulated.

The IMIS data base does not include information on all substances and has more information on some substances than others. IMIS contained research information on about 160 substances among the approximately 430 substances covered by the proposal. While the IMIS data base contains the results for over 100,000 samples of substances currently regulated by OSHA, no plant specific information was available for about 200 of the substances included in this rulemaking but currently not regulated by OSHA. To obtain additional information on employee exposures and on substances not covered by IMIS, a nationwide survey was begun in January 1988, which was designed to collect worker exposure data at over 5,300 establishments nationwide that are believed to be affected by this proposal. The survey results include industry-sector-specific data on the extent of employee exposures to hazardous materials and, in addition, provide specific information on the industrial processes in which these substances are used.

To assess the benefits of the proposed revision to OSHA's Z-Tables, OSHA relied both on the survey and IMIS data and used two basic approaches. The first approach relies on IMIS data combined with raw survey data to estimate the extent to which employees are currently exposed to substances included in this rulemaking. From this analysis, OSHA estimates the reduction in illness cases and disease-related fatalities associated with reducing exposure limits for these substances. The second approach relies solely on the use of the imputed survey data base to generate an exposure profile (the imputed survey file was created using statistical procedures to fill in missing responses to particular questions asked in the survey).

Description of Data Sources Used

To assess the quantitative benefits associated with this rulemaking, the following data were used:

- The proposed exposure limits for substances included in the rulemaking;
- Employee exposure data for these substances;
- Employment data for four-digit SIC code for the base year 1985;
- Annual illness and lost workday rates for the base year 1985; and
- Health effects information on the substances included in the rulemaking.

Employee exposure data for about 160 substances were obtained from OSHA's Integrated Management Information System (IMIS). This data base contains exposure measurements obtained by OSHA compliance officers during the conduct of thousands of health inspections. For each facility inspected, the IMIS file includes information on the number of employees at the facility, results of employee air monitoring for specific substances, and the number of employees potentially exposed to each substance monitored. To perform the benefits asssessment, a summary IMIS file was created that contained the following information:

- A list of substances for which personal 8-hour TWA samples were taken, by four-digit SIC and facility inspected
- The number of workers potentially exposed to each substance monitored, by four-digit SIC and facility
- The number of employees at each facility inspected
- The total number of personal 8-hour TWA samples obtained for each substance, by four-digit SIC and facility
- The number of samples taken at each facility that showed concentrations exceeding OSHA's proposed limits.

Only those substances for which OSHA is proposing to reduce an existing 8-hour TWA limit or to add a new 8-hour TWA limit were included in the analysis. A total of approximately 37,500 personal air sample results for about 160 substances were appropriate for use in this analysis. This analysis does not estimate the benefits associated with reducing current ceiling limits or adding new short-term exposure limits (STELs) because the data obtained from the IMIS did not include information on sample duration for ceiling or peak measurements, or OSHA was not able to relate the IMIS data on ceiling or

peak measurements to the proposed short-term or ceiling limits.

In addition to the IMIS exposure data, OSHA has completed a telephone interview survey of over 5,300 workplaces that are potentially affected by the revision of OSHA's Z Tables. Data from this survey provide information on substances that are used in a variety of industrial processes at the facilities surveyed, the number of workers involved in these processes, and whether personal exposure measurements taken at the processes exceeded OSHA, ACGIH, or NIOSH limits.

Employment data by four-digit SIC code were obtained from three data sources. For each four-digit SIC represented in the IMIS file, OSHA first relied on 1985 data from the BLS LABSTAT data base [1]. Where data were unavailable for this source at the four-digit SIC level, OSHA relied on Dun & Bradstreet's *Market Identifiers* file for 1985 [2]. Data from 1985 *County Business Patterns* [3] were used to obtain employment data for four-digit SIC groups not represented in either the LABSTAT or Dun & Bradstreet file.

Data on illness and lost workday rates were obtained from the 1985 LABSTAT file for all industries (at the three- and four-digit level) represented in the IMIS file. These data included rates per 100 employees for total illness cases, lost-workday illness cases, and total number of lost workdays.

Estimates of the Number of Potentially Exposed Employees

Estimates of the number of employees potentially exposed to the substances included in this analysis were derived from the IMIS data, OSHA's survey data, and employment data bases. To conduct the analysis, OSHA used the IMIS and survey data separately to derive independent estimates of the number of workers potentially exposed and the number of workers exposed above the proposed limits for each substance. The estimates derived from these two data sources were then combined to yield an overall assessment of the extent of employee exposure, by four-digit SIC, to substances included in this rulemaking. The following sections describe how each of the data bases was used to develop estimates of employee exposures, and how these estimates were then combined.

Estimates Derived From OSHA's IMIS Data Base

For each facility inspected, the IMIS contained information on the number of employees at the facility and the number of employees observed to be potentially exposed to each substance for which personal air samples were collected. For each substance sampled within an industry (at the four-digit level), the estimated number of employees potentially exposed to that substance in the industry was determined by the following formula:

$$\sum \frac{P_f}{E_f} * W = P$$

where
P_f = number of employees observed to be potentially exposed to the substance at a facility;
E_f = total number of employees at the facility;
W = number of production workers in the industry in 1985; and
P = estimated number of employees potentially exposed to the substance in the industry.

The estimated number of workers currently exposed above the proposed limits for each substance was calculated using the following formula:

$$\sum \frac{S_f}{T_f} * P = Z$$

where
S_f = number of samples that exceeded the proposed limit for the substance at all facilities in an industry sector;
T_f = total number of personal samples taken for the substance at all facilities in the industry sector.
P = estimated number of employees potentially exposed to the substance in the industry; and
Z = estimated number of workers in an industry sector currently exposed above the proposed limits for the substance.

Estimates Derived From OSHA's Survey Data

Facilities participating in OSHA's telephone survey provided the following information that was useful for estimating the extent of employee exposure to chemical substances:

- The facility's four-digit SIC code;
- The total number of production employees at the facility;
- The number of employees involved in each process used at the facility;
- The substances used or present in each process;
- The exposure limits used as internal targets or goals at the facility (i.e., OSHA's current limits, ACGIH limits, NIOSH limits, or "Other" limits such as those from material safety data sheets or insurance carriers); and
- Whether employee exposures exceeded the targeted limits for each process/chemical combination present at the facility.

To estimate the number of employees potentially exposed to a given substance in a 4-digit SIC industry group, OSHA assumed that all employees who are involved with processes in which the substance was used or present are potentially exposed. Thus, the formula for estimating the number of employees who are potentially exposed to a substance in a given industry sector is

$$\sum \frac{X_f}{T_f} * W = P$$

where
X_f = number of employees at the facility who are involved in processes using a given substance;
Tf = total production workforce at the facility;
W = the number of production workers in the industry sector in 1985; and
P = estimated number of employees potentially exposed to the substance in the industry sector.

To estimate the number of employees currently exposed above the proposed limits, OSHA relied on survey responses that indicated whether exposure measurements associated with a process exceeded the facility's internal exposure limits. If a facility responded that exposure measurements taken at a process area did not exceed ACGIH, NIOSH, or some "other" set of limits, OSHA assumed that no potentially exposed employee is currently exposed above the proposed limit for any substance associated with the process. On the other hand, if a facility responded that exposure measurements taken at a process did not exceed current OSHA, ACGIH, or "Other" set of limits, OSHA assumed that all potentially exposed employees are currently exposed above the proposed limits for all substances associated with the process. In addition, if the process had certain characteristics that suggested that the proposed limits were not being achieved (i.e., lack of ventilation system or open process used indoors) all employees involved in the process were assumed to be overexposed. The decision logic for determining when employees at a particular process may be overexposed was the same as that used for estimating costs associated with achieving the

proposed limits (see Chapter VI, Costs of Compliance).

Approach for Combining Estimates Derived From the IMIS Data and Survey Data

To obtain an overall estimate of the extent of employee exposures to substances used in each four-digit SIC industry group, OSHA combined the estimates derived separately from the IMIS and survey data. Table III–1 illustrates how these estimates were combined to yield an overall estimate of the extent of employee exposures in SIC 2851. Where estimates for a given substance could be derived from one data set but not the other, the combined assessment uses the available estimates without adjustment. Where estimates could be derived from both data sets for the same substance, the combined assessment is based on the average of the available estimates; this approach has the effect of giving equal weight to estimates derived from either the IMIS or survey data.

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TABLE III-1

ANALYSIS OF EMPLOYEE EXPOSURES IN SIC 2851 DERIVED FROM IMIS DATA, SURVEY DATA, AND BOTH IMIS AND SURVEY DATA COMBINED

NAME	ASSESSMENT FROM IMIS		ASSESSMENT FROM SURVEY		COMBINED ASSESSMENT	
	WORKERS POTENTIALLY EXPOSED	WORKERS ABOVE LIMITS	WORKERS POTENTIALLY EXPOSED	WORKERS ABOVE LIMITS	WORKERS POTENTIALLY EXPOSED	WORKERS ABOVE LIMITS
2-HEXANONE	6,547	727	26,751	0	16,649	364
ACETONE	2,875	96	5,912	*	4,393	147
ALPHA-ALUMINA	1,286	0			1,286	0
BUTOXYETHANOL	2,121	0			2,121	0
BUTYL ACRYLATE	13,302	0			13,302	0
CARBON MONOXIDE	672	672			672	672
CARBON TETRACHLORIDE	5,912	0			5,912	0
COBALT AS CO	4,604	0			4,604	0
CYCLOHEXANONE	6,821	0			6,821	0
DIISOBUTYL KETONE	4,434	0			4,434	0
ETHYLENE GLYCOL			53,429	19,876	53,429	19,876
FURFURAL	2,956	0			2,956	0
HEPTANE	5,454	0			5,454	0
HEXAFLUOROACETONE	41,383	41,383			41,383	41,383
HEXANE	4,678	0			4,678	0
HEXONE	7,131	319			7,131	319
IRON OXIDE DUST AND FUME, AS F	5,173	0			5,173	0
ISOBUTYL ALCOHOL	10,996	0			10,996	0
ISOPHORONE			17,440	0	17,440	0
MAGNESIUM OXIDE FUME, AS MG	10,560	0			10,560	0
METHYL N-AMYL KETONE	9,038	0			9,038	0
MOLYBDENUM, INSOLUBLE COMPOUND	11,853	0			11,853	0
N-BUTYL ALCOHOL			51,803	12,329	51,803	12,329
N-BUTYL GLYCIDYL ETHER	28,030	0			28,030	0
NAPHTHA			296	*	296	*
NUISANCE PARTICULATES	5,040	1,217			5,040	1,217
PERCHLOROETHYLENE	1,973	0			1,973	0
PETROLEUM DISTILLATES, RUBBER	7,885	0			7,885	0
PHTHALIC ANHYDRIDE	4,427	0			4,427	0
STODDARD SOLVENT	6,961	194	28,821	13,113	17,891	6,654
STYRENE	1,508	0	7,464	5,598	4,486	2,799
TIN METAL AND OXIDE	1,286	0			1,286	0
TITANIUM DIOXIDE	2,668	0			2,668	0
TOLUENE	7,538	187	11,750	*	9,644	239

TABLE III-1

(continued)

ANALYSIS OF EMPLOYEE EXPOSURES IN SIC 2851 DERIVED FROM IMIS DATA, SURVEY DATA, AND BOTH IMIS AND SURVEY DATA COMBINED

NAME	ASSESSMENT FROM IMIS		ASSESSMENT FROM SURVEY		COMBINED ASSESSMENT	
	WORKERS POTENTIALLY EXPOSED	WORKERS ABOVE LIMITS	WORKERS POTENTIALLY EXPOSED	WORKERS ABOVE LIMITS	WORKERS POTENTIALLY EXPOSED	WORKERS ABOVE LIMITS
TRIBUTYL PHOSPHATE	244	0			244	0
TRICHLOROETHYLENE	3,695	0			3,695	0
TRIETHYLAMINE	244	0			244	0
TRIMELLITIC ANHYDRIDE	1,626	813			1,626	813
TRIMETHYL BENZENE	8,099	0			8,099	0
VINYL ACETATE	13,302	0			13,302	0
VM & P NAPHTHA	25,909	0			25,909	0
ZINC OXIDE, FUME			3,178	*	3,178	*

*Insufficient data from survey responses to permit an assesment of exposure levels.

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Estimates of the number of employees potentially exposed and the number exposed above the proposed limits are available in Supplement ι2, ι3, ι4, ι5, and ι6 to this regulatory analysis. In addition to exposure estimate these Supplements also contain process and industry use information by substance. (Copies of these Supplements are available, upon request, from the office of Regulatory Analysis, Room N3627, OSHA.)

Aggregate estimates of the number of employees potentially exposed or exposed above the proposed limits to any substance considered in the analysis are presented by two-digit SIC code in Table III–2. Because an employee may be exposed to more than one substance in a given industry, aggregate estimates of the size of the exposed population are presented as minimum and maximum estimates. Maximum estimates of the size of the exposed population assume that no employee is exposed to more than one substance; minimum estimates assume the greatest possible extent of multiple chemical exposure. For example, if 200 employees are estimated to be exposed to acetone and 300 employees are estimated to be exposed to toluene in a given industry, a minimum of 300 employees is estimated to be exposed to either substance in the industry, and a maximum of 500 employees is estimated to be exposed to either substance in the industry.

Employees exposed above the proposed limits are considered to be "at risk" of adverse health effects. It should be noted that this presentation shows risk reduction in employee equivalent terms; while all (100 percent) of the workers currently exposed above the new proposed limits would benefit from reduced risk, the new lower limits would not eliminate all chemical exposure risk. An estimated five, ten, or twenty percent residual risk equivalent would remain at the new lower limits. Although not quantified, all employees currently exposed to hazardous substances at or below the recommended new levels would experience this residual risk. To obtain an approximation of risk reduction at the lower exposure levels being proposed, OSHA estimated that 95, 80, or 90 percent of the workers currently exposed above the proposed limits (i.e., the midpoint between the minimum and maximum estimates) will benefit from reduced risk after their exposures are lowered to or below the proposed limits. The results of this analysis are also presented by two-digit SIC codes in Table III–2.

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TABLE III-2. NUMBER OF WORKERS EXPOSED AND NUMBER OF WORKERS FOR WHOM RISK IS REDUCED, BY 2-DIGIT SIC

SIC Code	Number of Production Workers	No. Workers Potentially Exposed, Minimum Estimate	No. Workers Potentially Exposed, Maximum Estimate	No. Workers Exposed Above Limits, Minimum Estimate	No. Workers Exposed Above Limits, Maximum Estimate	No. Workers With Reduced Risk, (80% Risk Reduction)	No. Workers With Reduced Risk, (90% Risk Reduction)	No. workers With Reduced Risk (95% Risk Reduction)
20	1,149,971	218,638	275,837	109,289	161,000	108,115	121,630	128,387
21	48,625	1,298	1,298	62	62	50	56	59
22	244,367	147,842	170,842	13,730	16,909	12,256	13,788	14,554
23	994,363	271,934	353,225	13,494	15,894	11,755	13,225	13,959
24	543,695	201,869	318,642	81,184	99,437	72,248	81,279	85,794
25	496,760	189,194	429,107	77,910	96,802	69,885	78,620	82,988
26	667,082	367,943	606,256	66,302	108,383	69,874	78,608	82,975
27	1,255,639	1,069,582	1,198,072	137,557	180,397	127,182	143,079	151,028
28	866,859	788,571	866,570	300,562	426,653	290,886	327,247	345,428
29	178,202	177,058	178,202	133,282	134,096	106,951	120,320	127,005
30	817,652	607,900	810,873	156,191	591,627	299,127	336,518	355,214
31	152,241	41,525	76,274	4,347	5,907	4,102	4,614	4,871
32	587,946	307,033	493,751	56,274	93,588	59,945	67,438	71,184
33	754,180	451,813	719,699	114,179	311,416	170,238	191,518	202,158
34	1,228,572	606,058	1,104,519	138,744	262,805	160,619	180,697	190,735
35	1,508,032	661,605	1,186,259	139,409	197,843	134,901	151,763	160,195
36	1,319,939	693,114	996,305	139,421	169,876	123,718	139,183	146,916
37	1,270,731	708,119	1,015,308	90,357	182,918	109,310	122,974	129,806
38	606,978	374,905	482,051	34,649	35,131	27,912	31,401	33,146
39	417,988	232,354	294,590	53,671	67,160	48,333	54,374	57,395
40	193,605	174,308	180,573	15,421	19,430	13,941	15,683	16,555
45	346,071	127,515	159,158	45,756	45,756	36,605	41,180	43,468
47	85,386	31,917	32,596	1,731	2,382	1,645	1,850	1,953
49	804,200	759,231	775,063	477,380	481,333	383,485	431,420	455,388
50	2,759,479	545,417	1,065,910	193,893	211,291	162,074	182,333	192,462
51	1,147,688	592,777	748,500	226,780	288,088	205,947	231,691	244,562
55	1,470,816	1,017,352	1,470,816	249,123	325,852	229,990	258,739	273,114
72	765,244	551,441	604,813	41,497	46,935	35,373	39,794	42,005
73	4,179,928	2,113,228	2,266,266	347,718	569,457	366,870	412,729	435,659
75	675,834	461,366	593,967	54,146	75,771	51,966	58,462	61,710
76	331,435	252,837	268,243	76,296	139,331	86,251	97,033	102,423
80	6,237,985	2,399,295	2,749,195	46,599	54,400	40,400	45,450	47,975
TOTAL	34,107,493	17,168,039	22,469,780	3,668,060	5,386,824	3,621,954	4,074,696	4,301,071

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Estimates of the Reduction in Illness Cases and Lost Workdays

The BLS LABSTAT data base contains illness and lost workdays rates by SIC code. These rates are expressed as the annual number of illness cases or number of lost workdays per 100 full-time-equivalent employees. Reducing employee exposures to hazardous substances to a level below that associated with adverse health effects will result in a decrease in the number of illness cases and lost workdays.

To assess the impact on illness and lost workday rates of reducing employee exposures, OSHA first examined the relationship between the percentage of workers estimated to be exposed above the proposed exposure limits for the 160 substances included in the study and current illness and lost workday rates. This analysis was conducted at the three-digit SIC code level because of the lack of illness rate data for some of the four-digit SIC code groups. The results of this analysis are presented graphically in Figure III–1. Among three-digit industries for which OSHA has found that no employees are currently exposed above the proposed limits, total illness case rates reported by the BLS for the same industry group are usually less than 0.2 cases per 100 employees per year, and frequently are reported to be zero. In contrast, where OSHA has found that industry groups have more than 2 percent of their workforce exposed above the proposed limits, total illness case rates above 0.2 cases per 100 employees are frequently reported. In no instance does an industry group having 10 percent or more of its workforce exposed above the proposed limits report a total illness case rate of zero. Among three-digit SIC code industry groups for which OSHA has not found employee exposures above the proposed limit, 37 percent of the groups reported an illness rate of zero, 45 percent reported an illness rate of 0.1 to 0.2 cases per 100 employees, and only 18 percent of the industry groups reported an illness rate greater than 0.2 cases per 100 employees (but none above 0.5 cases per 100 employees). Given this distribution of illness rates across these particular industry groups, it is concluded that industry groups in which employee exposures have been controlled to or below the proposed limits will have an illness rate approximating 0.1 cases per 100 employees. It is believed that total illness cases at the three-digit level will be reduced to no more than 0.1 cases per 100 employees after employee exposures are reduced to or below the proposed limits.

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Figure III-1. Relationship Between Employee Exposures to Hazardous Substances and Industry Illness Rates

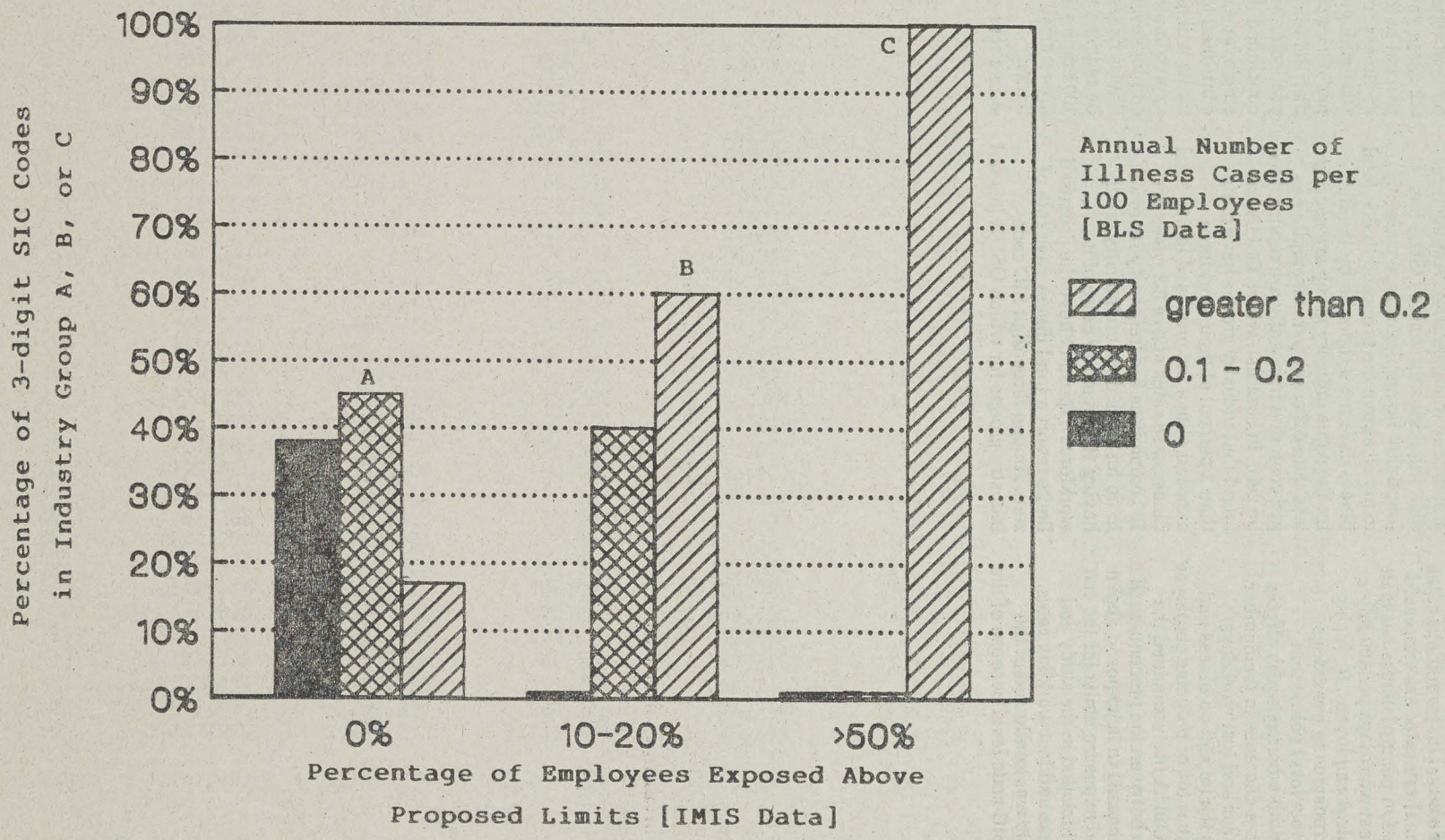

Figure III-1

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OSHA performed a similar analysis that also indicates that the rate of lost-workday illness cases will decline to a base rate of 0.05 cases per 100 employee and the annual rate of lost workdays will decline to 1 per 100 employees after employees exposures are reduced to or below the proposed limits.

OSHA estimated the number of illness cases and lost workdays potentially avoided annually by applying current illness rates to the estimated number of production workers per three-digit SIC group; this yielded an estimate of the annual number of illness cases and lost workdays reported by each three-digit SIC code industry group. It was assumed that, after promulgation of the proposed limits, these industries would experience illness rates of 0.1 cases per 100 employees, 0.05 lost-workday illness cases per 100 employees, and 1 lost workday per 100 employees per year. Using this approach, OSHA estimated that promulgation of the proposed limits will potentially avoid 55,216 illness cases per year, 23,608 lost workday illness cases per year, and 533,197 lost workdays caused by illnesses per year.

The movement to a 0.1 illness rate is presented as a best estimate supported by OSHA's interpretation of the relationship between chemical exposure levels and current industry illness rates. It may be argued, however, that if a 0.1 illness rate were achieved, the reduction in illnesses could not be credited exclusively to OSHA's rulemaking initiative, since some portion of the current BLS illness rate is made up of illnesses associated with exposures to hazardous agents or physical stress (e.g., radiation, noise, ergonomic stress).

While no claim is made that this rulemaking action will reduce illnesses related to these causes, OSHA believes that the benefit estimates related to this proposal of over 55,000 illnesses, over 23,600 lost workday illnesses, and over 533,000 lost workdays avoided each year are reasonable. This is based on the belief that company records, upon which the BLS data are based, rarely show chronic illnesses caused by exposures to toxic substances [4, 6]. The potential level of underreported illnesses in the BLS series is illustrated in a recent report by Landrigan and Markowitz. Using California physicians' reports of occupational illnesses, these authors estimated an occupational illness rate among New York State employees that was more than twice the BLS illness rate [8].

Estimates of the Number of Employees Potentially at Risk by Type of Hazard

In addition to estimating the number of employees exposed to the substances included in this analysis, OSHA also estimated the number of employees who are at risk of experiencing particular types of adverse health effects. To conduct this analysis, each substance included in the rulemaking was assigned to a health hazard category; these assignments were based on the primary health effects that provided the impetus for reducing an existing limit or proposing a new limit for a particular substance. (The assignment of substances to health effect categories is described in detail in Section IV–C of the preamble.) It should be noted that, in some instances, substances included in this rulemaking were grouped together in the preamble according to some basis other than a particular health effect; for example, several substances were grouped together because the ACGIH-recommended limits were derived based on the structural analogy of the grouped substances with that of other substances. For the benefits analysis described here, these substances were re-classified according to the primary health effect associated with exposure to the analogous chemical.

The number of employees estimated to be exposed to substances causing a particular health effect in an industry group was calculated by summing the number of employees exposed to all substances causing the same effect. Aggregate estimates across all affected industry sectors are presented in Table III–3. This table provides estimates of employees potentially exposed to substances in each health group, as well as estimates of employees exposed above the proposed limits for substances in each health group. Employees are frequently at risk from a variety of adverse health effects as a result of concurrent exposure to more than one toxic substance. Thus, the total number of employees considered to be at risk from any type of illness (as estimated in Table III–3) cannot be summed because the sum would result in doublecounting.

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TABLE III-3. ESTIMATED NUMBER OF WORKERS POTENTIALLY AT RISK OF EXPERIENCING ADVERSE EFFECTS, BY TYPE OF ADVERSE EFFECT

ADVERSE HEALTH EFFECT	NO. OF WORKERS POTENTIALLY EXPOSED TO SUBSTANCES ASSOCIATED WITH EFFECT, MINIMUM ESTIMATE	NO. OF WORKERS POTENTIALLY EXPOSED TO SUBSTANCES ASSOCIATED WITH EFFECT, MAXIMUM ESTIMATE	NO. OF WORKERS EXPOSED ABOVE PROPOSED LIMITS FOR SUBSTANCES, MINIMUM ESTIMATE	NO. OF WORKERS EXPOSED ABOVE PROPOSED LIMITS FOR SUBSTANCES, MAXIMUM ESTIMATE
NUISANCE EFFECTS	4,729,417	5,804,846	829,487	892,725
ODOR AND TASTE EFFECTS	718,522	808,537	59,102	59,102
SYSTEMIC TOXICITY	3,233,319	3,818,742	250,282	256,909
MUCOUS MEMBRANE IRRITATION	12,077,315	15,813,663	59,969	1,021,197
METABOLIC INTERFERENCES	2,277,113	2,345,975	746,879	746,879
LIVER/KIDNEY DISEASE	2,321,573	2,488,604	383,581	384,876
OCULAR DISTURBANCES	194	194	0	0
RESPIRATORY DISEASE	3,765,717	4,023,525	639,717	654,319
CARDIOVASCULAR DISEASE	164,576	164,576	44,355	44,355
NEUROPATHY	1,231,744	1,349,421	201,760	210,203
NARCOSIS	4,601,993	6,381,899	526,021	547,731
CANCER	3,663,053	3,784,374	499,716	499,716
ALLERGIC SENSITIZATION	2,710,576	2,903,153	296,444	297,255

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Estimates of the Number of Illness-Related Fatalities Avoided

As discussed in the preceding section, OSHA has estimated the number of employees currently at risk of experiencing a variety of adverse health effects brought about by over-exposures to the substances included in this rulemaking. Many of these adverse effects result in lethal outcomes, in particular cancer, cardiovascular effects, chronic respiratory disease, and chronic liver and kidney damage. OSHA also believes that employees who are excessively exposed to substances causing systemic organ damage, neurological impairment, or metabolic effects (i.e., cardiovascular disease through excessive formation of methemoglobin or carboxyhemoglobin, and neurological impairment through cholinesterase inhibition) are at excess risk of incurring a fatal condition.

To estimate the number of fatalities associated with excessive exposure to the 160 substances included in this analysis, OSHA relied on standard U.S. mortality rates and on published estimates of the proportion of fatalities that are believed to be associated with occupational illnesses. These data allowed OSHA to calculate cause-specific mortality rates that are attributable to occupational illnesses (i.e., mortality rates that represent the excess risk of mortality from occupational disease). OSHA then applied these occupationally-related mortality rates to its estimates of the number of employees exposed to the 160 substances of concern at levels above the proposed limits. OSHA's methodology and estimates are presented in Table III–4, and are described in detail below.

TABLE III-4

Estimated Annual Number of Fatalities Caused By Occupational Illness Among Workers Currently Exposed Above Proposed Limits, Using Alternative Assumptions

Cause of Death	U.S. Annual Death Rate Per 100,000 Residents (1985), by Cause[a]	Total Number of Deaths Per Year in U.S., by Cause[b]	Number of Deaths Attributed to Occupational Illnesses, by Cause	Annual Death Rate Per 100,000 Attributed to Occupational Illnesses	Number of Workers Exposed Above Proposed Limits	Annual Number of Fatalities Among This Group of Workers
Cancer	193.3	461,484	46,148[c]	55.3	499,716[g]	276
			23,074[d]	27.7	499,716	138
Chronic Pulmonary Disease	31.3	74,726	2,242[e]	2.7	647,018[h]	17
			747[f]	0.9	647,018	4
Chronic Liver Disease	11.2	26,739	802[e]	1.0	384,229[i]	4
			267[f]	0.3	384,229	1
Cardiovascular, Neurological, and Renal	418.5	999,127	29,974[e]	35.9	1,250,811[j]	449
			9,991[f]	12.0	1,250,811	150
TOTAL, All Causes						293–746

[a] Source: National Center for Health Statistics [5, Table II].
[b] Based on a total residential population in 1985 of 238,740,000. [7, p. 18].
[c] Assumes 10 percent of all cancer deaths are of occupational origin (Landrigan and Markowitz, 1987).
[d] Assumes 5 percent of all cancer deaths are of occupational origin (Landrigan and Markowitz, 1987).
[e] Assumes 3 percent of all deaths are of occupational origin (Landrigan and Markowitz, 1987).
[f] Assumes 1 percent of all deaths are of occupational origin (Landrigan and Markowitz, 1987).
[g] From Table III–3, midpoint estimate of number of workers exposed above proposed limits for potential carcinogens.
[h] From Table III–3, midpoint estimate of number of workers exposed above proposed limits for respiratory toxins.
[i] From Table III–3, midpoint estimate of number of workers exposed above proposed limits for liver toxins.
[j] From Table III–3, midpoint estimate of number of workers exposed above proposed limits for systemic toxins, metabolic toxins, cardiovascular toxins, and neuropathic agents.

Estimate of the Number of Cancer Fatalities

The U.S. National Center for Health Statistics has published cause-specific U.S. mortality rates for 1985 (the most recent data available) [5]. This source reported that the annual U.S. cancer death rate in 1985 was 193.3 per 100,000 residents. Based on a total resident U.S. population of 238,740,000 in 1985 [7, p. 18], the number of cancer deaths that occurred in 1985 was 461,484. Landrigan and Markowitz [8] reviewed several published estimates of the percentage of cancer deaths that are attributable to occupationally-related disease. These estimates range from less than 5 percent to 33 percent of all cancer deaths. Landrigan and Markowitz believe that, as a best estimate, 10 percent of all cancer deaths have an occupational origin.

Using an occupational cancer death estimate of 10 percent and applying it to the estimated number of cancer deaths in 1985, OSHA estimates that 46,148 occupationally-related cancer deaths occurred in the United States in that year. Table III–4 also shows an alternative assessment of occupationally-induced mortality that is based on an assumption that only 5 percent of all cancer deaths are of occupational origin.

As the next step, OSHA estimated the overall cancer death rate among the population which is occupationally exposed to chemicals and the remainder of the population. In 1985, there were an average of 108,856,000 persons employed [9, p. 8]. However, 25,469,200 of these were employed in industries or occupations where there is a low risk of exposure to toxic substances, such as finance, insurance, real estate, and private households [9, pp. 30, 84–88]. The remaining 83,386,800 persons are considered to be occupationally exposed to chemicals in varying degrees. Many would have only intermittent exposure at very low levels. Using the two alternative assumptions of the percentage of all cancer deaths which are of occupational origin (10 percent and 5 percent), OSHA calculated the annual cancer death rate attributed to occupational exposure by dividing the number of cancer deaths attributable to occupational illness by the population exposed, and multiplying by 100,000. If the 10 percent assumption is used, OSHA estimates that the annual cancer mortality rate attributable to occupational exposure to toxic substances is 55.3 per 100,000; with the 5 percent assumption, the rate would be 27.7. OSHA then estimated that there are 499,716 workers currently exposed above the proposed limits to the potential carcinogens included in this rulemaking. Applying the work-related cancer death rates to this population, OSHA estimates that between 138 and 276 cancer fatalities occur each year among these workers and that these fatalities will be prevented by the proposed rule.

In arriving at this estimate, two important offsetting arguments were considered. Because some of these workers may also be exposed to occupational carcinogens that are not covered in this rulemaking (such as asbestos or benzene), the number of occupational cancer deaths attributed to the substances included in this rulemaking may be overestimated. Offsetting this potential overestimate is the fact that the excess mortality rates of 27.7–55.3 per 100,000 workers were developed on the basis of occupational exposures among all exposed workers. However, the excess mortality rate experienced among workers with high average exposures to hazardous chemicals typically runs at least two or three times higher than the national average rate. In consideration of this, OSHA believes that any overestimate of cancer fatalities avoided attributed to regulated chemicals not covered under this rulemaking is offset by the use of a mortality rate which understates the true excess mortality rate among workers with very high exposures to toxic chemicals. (Additional comments on excess mortality rate estimates are included in the final section of this chapter.)

An alternative analysis of the reduction in cancer mortality was conducted using OSHA's quantitative risk assessments for the potential human carcinogens included in this rulemaking (the results of OSHA's risk assessments are presented in the preamble to the proposal). This analysis is presented in table III–5. Using the combined IMIS and survey data, OSHA found that employees are currently exposed above the proposed limits to four of these potential carcinogens (acrylamide, carbon tetrachloride, chloroform, and styrene). Applying OSHA's risk estimates to the estimated number of workers currently overexposed to thse substances, OSHA estimates that compliance with the proposed limits will avoid 5,005 cancer fatalities over the working lifetime of the population (i.e., 45 years). The average annual reduction in the number of cancer fatalities avoided over 45 years is estimated to be 111.

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TABLE III-5

ESTIMATES OF CANCER DEATHS POTENTIALLY AVOIDED, BASED ON QUANTITATIVE RISK ASSESSMENTS[a]

Substance	Number of Workers Above Proposed Limit	Estimated Number of Cancer Deaths		Estimated Number of Potentially Avoidable Cancer Deaths over a Working lifetime
		Current PEL	Proposed PEL	
Acrylamide	7,784	75	8	67
Carbon Tetrachloride	86,682	1,554	798	756
Chloroform	152,170	1,852	31	1,821
Styrene[b]	248,603	4,723	2,362	2,361
TOTAL		8,204	3,199	5,005

[a]Risk assessments are presented in Section IV-C of the preamble.

[b]This figure reflects an average estimate resulting from the combined IMIS and survey data. The 1988 sample survey alone identified just over 30,000 employees overexposed to this chemical. The Styrene Information and Research Center estimates that 224,250 workers make products with styrene.

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Although OSHA has evaluated the cancer risk for 17 potential carcinogens, there were IMIS and survey data for only four of these. Lack of IMIS or survey data means that the substance has not been sampled by an OSHA compliance officer or that none of the survey participants indicated that the substance was used at their facilities. This does not mean that no workers are currently exposed to these substances. Lacking a basis for estimating the extent of employee exposure, OSHA could not estimate the extent of reduction in cancer deaths attributable to the proposed reduction in exposure limits for these substances. To the extent that employee exposure to these carcinogens is reduced, further reductions in the number of cancer deaths will occur.

Estimated Reduction in Occupational Deaths From Causes Other Than Cancer

As shown in Table III–4, OSHA also estimated the number of occupationally-related fatalities that are expected to occur annually among employees exposed to substances associated with adverse health effects other than cancer. To perform this analysis, OSHA relied on an estimate made by Landrigan and Markowitz [7] that between 1 and 3 percent of all non-malignant disease is of occupational origin. Using the 1 and 3 percent figures as alternative assumptions and using the same methodology as that described above for cancer deaths, Table III–4 shows the following:

—Between 4 and 17 deaths caused by respiratory disease are estimated to occur each year among workers exposed to respiratory toxins covered in this rulemaking;
—Between 1 and 4 deaths are estimated to occur each year among workers exposed to liver toxins covered in this rulemaking;
—Between 150 and 449 deaths are estimated to occur each year among workers exposed to systemic toxins, cardiovascular toxins, metabolic toxins, and neurological toxins covered in this rulemaking.

Summing these estimates, OSHA believes that between 155 and 470 non-cancer-related occupational fatalities occur each year. The same offsetting considerations discussed in the analysis of the cancer fatalities avoided under this rule, also apply here. While some substances are being controlled by activity outside of this rulemaking, any overestimate effect is balanced by an underestimate of the real excess mortality rate for workers with high exposure levels to the chemicals under consideration.

In sum, the combined estimate for the number of cancer and non-cancer deaths potentially avoided each year by compliance with the proposed new limits, is between 293 and 746 or an average of 519 fatalities avoided each year.

Additional Comments and an Alternative Method for Estimating Excess Mortality Rates

The analysis described above to estimate the number of fatalities that are potentially preventable relies on published estimates of the proportion of all U.S. fatalities that are believed to result from occupational illnesses. These estimates were used with U.S. cause-specific mortality rate figures to estimate the excess mortality rate among all U.S. workers, by cause of death (shown in Table III–4).

In making these excess mortality rate estimates, OSHA applied the excess number of fatalities across the U.S. working population occupationally exposed to chemicals. Implicit in this approach is an assumption that all workers are at some risk of fatality from all causes of death. In fact, only a portion of the workforce are at risk of fatality from each type of occupational illness. Deaths will occur only among workers who are potentially exposed to carcinogens; no excess deaths will occur among workers who are not so exposed. Similarly, not all workers are at risk of dying from occupationally-related cardiovascular illnesses; only some portion of the workforce are at excess risk and all fatalities resulting from occupationally-related cardiovascular disease will occur among this subset of workers. Because OSHA's excess mortality rate estimates presented earlier were derived by applying the estimated number of work-related fatalities across the exposed U.S. workforce, excess mortality rate figures are likely to be substantially understated.

To assess the magnitude of this bias, OSHA conducted an alternative analysis to estimate the number of work-related fatalities that are expected to occur among workers exposed above the proposed limits. This alternative assessment relied on judgments regarding the general increase in mortality rates that are frequently observed in epidemiologic studies that demonstrate a causal relationship between exposure to toxic substances and excess disease mortality. The alternative assessment is presented in Table III–6.

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TABLE III-6

ALTERNATIVE ASSESSMENT OF NUMBER OF FATALITIES EXPECTED TO OCCUR AMONG WORKERS CURRENTLY EXPOSED ABOVE PROPOSED LIMITS

Cause of Death	U.S. Cause-Specific Mortality Rate, Per 100,000 Residents[a] (1985)	Estimated Excess Mortality Rate Per 100,000 Workers at Risk From Hazard	Number of Workers Exposed Above Proposed Limits	Annual Number of Fatalities Among This Group of Workers
Cancer	193.3	193.3[b]	499,716[c]	966
Chronic Pulmonary Disease	31.3	9.4[d]	647,018[c]	61
Chronic Liver Disease	11.2	3.3[d]	384 229[c]	13
Cardiovascular,	418.5	125.6[d]	1,250,811[c]	1,571
TOTAL				2,611

[a] Source: National Center for Health Statistics [5, Table 11].

[b] Assumes that overall cancer mortality rate among workers at risk is twice the U.S. rate (i.e., a 100 percent excess rate).

[c] From Table III-4.

[d] Assumes that overall disease mortality rate among workers at risk is 1 3 times the U.S rate (i.e., a 30 percent excess risk).

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The overall U.S. cancer mortality rate for 1985 is 193.3 deaths per 100,000 residents (Table III–6). Typically, when causal relationships between exposure and excess lung cancer mortality are found in epidemiologic investigations, the exposed cohort frequently shows a cancer mortality rate of 1.1 to 10 times higher than the general population. For cancers that are more rare than lung cancer, mortality rates among working populations may be 50 times higher than for the general population. An alternative estimate of the number of cancer fatalities expected to occur among the estimated 499,716 workers exposed above the proposed limits for the potential carcinogens could be developed based on the assumption that the overall cancer fatality rate among these workers is twice that of the U.S. population (i.e., 386.6 per 100,000 workers vs. 193.3 per 100,000 residents). The *excess* cancer mortality rate among these workers is therefore assumed to be 193.3 per 100,000 workers (386.6–193.3). Applying this estimated excess cancer mortality rate to the 499,716 workers exposed above the proposed limits yields as estimated 966 cancer deaths occurring annually that are attributable to occupational exposure. This same approach could be used for estimating non-cancer-related fatalities assuming that the overall fatality rate among workers at risk from these illnesses is 1.3 times the corresponding U.S. mortality rate (mortality rates of 1.1 to 1.5 are frequently observed in epidemiologic studies demonstrating causal relationships between exposure and excess fatalities). This amounts to an *excess* mortality rate of 30 percent above the overall U.S. rate.

Applying these excess mortality rate figures to the estimated worker populations exposed above the proposed limits, OSHA estimates that, among these workers, 61 deaths occur annually due to chronic pulmonary disease, 13 deaths occur annually due to liver disease, and 1,571 deaths occur annually due to cardiovascular, neurological, and renal disease. In total, including cancer, OSHA estimates that 2,611 work-related fatalities may be occurring each year among employees who are exposed above the proposed limits for substances included in this rulemaking.

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IV. Assessment of Nonregulatory Alternatives

Introduction

The declared purpose of the Occupational Safety and Health (OSH) Act of 1970 is "* * * to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources * * *." Thus, the Act requires the Secretary of Labor, when promulgating occupational safety and health standards for toxic materials or harmful physical agents, to set the standard "* * * that most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity * * *." It is on the basis of this congressional directive that OSHA has initiated regulatory actions to reduce the adverse health effects associated with occupational exposure to hazardous substances.

Market Failure

Economic theory suggests that the need for government regulation is greatly reduced where private markets work efficiently and effectively to allocate health and safety resources. The theory typically assumes perfectly competitive labor markets where workers, having perfect knowledge of job risks and being perfectly mobile among jobs, command wage premiums that fully compensate for any risk of future harm. Thus, theoretically, the costs of occupational injury and illness are borne initially by the firms responsible for the hazardous workplace conditions and, ultimately, by the consumers who pay higher prices for the final goods and services produced by these firms. With all costs internalized, private employers have an incentive to reduce hazards wherever the cost of hazard abatement is less than the cost of the expected injury or illness. The resultant level of safety and health is considered "efficient" in the sense that it minimizes the sum of the costs of hazard prevention and of injury or illness. Perfectly competitive labor markets, however, do not exist for many industrial markets. OSHA, therefore, believes that it must take appropriate actions to provide greater health protection for workers exposed to toxic substances.

Evidence indicates that market forces have not been effective in reducing excessive occupational exposure to hazardous substances, thereby contributing to the consequent development of occupational diseases. In spite of the danger associated with the inhalation or other exposure to hazardous substances, the social costs of production have not been internalized, in part, because of market imperfections and the existence of externalities. Consequently, the amount of protection that the private market will offer to workers differs from the socially desired level.

First, evidence on occupational health hazards in general suggests that in the absence of immediate or clear-cut danger, employees and employers have little incentive to seek or provide information on the potential long-term effects of exposure. Employers faced with potentially high compensatory payments may, in fact, have a disincentive to provide information to employees. When relevant information is provided, however, employers and employees might still find informed decisionmaking a difficult task, especially where long latency periods precede the development of chronic disabling disease. Morever, if signs and symptoms are nonspecific—that is, if an illness could be job-related or could have other causes—employees and employers may not link disease with such occupational exposure.

Second, even if workers were fully informed of the health risks associated with exposure to hazardous substances, many face limited employment options. Nontransferability of occupational skills and high national unemployment rates sharply reduce a worker's expectation of obtaining alternative employment quickly or easily. A worker employed in a foundry, for example, could find it difficult to apply occupational skills to a new job in searching for a safer workplace.

In many regions of the country, the practical choice for workers is not between a safe job and a better paying

but more hazardous position, but simply between employment and unemployment at the prevailing rates of pay and risk. In addition to the fear of substantial income loss from prolonged periods of unemployment, the high costs of relocation, the reluctance to break family and community ties, and the growth of institutional factors such as pension plans and seniority rights serve to elevate the cost of job transfer. Thus, especially where wages are more responsive to the demands of more mobile workers who tend to be younger and perhaps less aware of job risks, hazard premiums for the average worker will not fully compensate. Where this is the case, labor market negotiations are unlikely to reflect accurately the value that workers place on health.

In addition to the market imperfections, externalities occur if employers and employees settle for an inefficiently low level of protection from hazardous substances. For the competitive market to function efficiently, only workers and their employers should be affected by the level of safety and health provided in market transactions. In the case of occupational safety and health, however, society shares part of the financial burden of occupationally induced diseases, including the costs of premature death, chronic illness, and disability. Those individuals who suffer from occupationally related illness are cared for and compensated by society through taxpayer support of social programs, including welfare, Social Security, and Medicare. These combined factors of labor market imperfections and the existence of externalities contribute to the failure of the market to supply healthful working conditions in industries where hazardous substances exist.

Tort Liability

The use of liability under tort law is one nonregulatory alternative that has been increasingly used in litigation concerning occupationally related illnesses. Prosser [1] describes a tort, in part, as a "civil wrong, other than a breach of contract, for which the court will provide a remedy in the form of an action for damages," although he says that "a really satisfactory definition has yet to be found."

If the tort system applies, it would allow a worker whose health has been adversely affected by occupational exposure to a hazardous substance to sue and recover damages from the employer. Thus, if the tort system is effectively applied, it might shift the liability of direct costs of occupational disease from the worker to the firm under certain specific circumstances.

With very limited exceptions, however, the tort system is not a viable alternative in dealings between employees and their employers. All states have legislation providing that Workers' Compensation is either the exclusive or principal remedy available to employees against their employers. Thus, under tort law, workers with an occupational disease caused by exposure to a hazardous substance can only file a product liability suit against a third party manufacturer (e.g., Johns Manville), processor, distributor, sales firm, installer, agency, or contractor. It is often difficult, however, to demonstrate a direct link between an exposure to a hazardous substance and the illness.

In order to pursue litigation successfully, there must be specific knowledge of the magnitude and duration of a worker's exposure to a hazardous substance, as well as the causal link between the disease and the occupational exposure. Usually, it is extremely difficult to isolate the role of occupational exposures in causing the disease, especially if workers are exposed to many toxic substances. This difficulty is further compounded by the long latency periods that are frequently involved. In addition, the liable party must be identifiable, but workers may have several employers over a working lifetime. The burden of proof that an occupational exposure to a hazardous substance occurred, that a specific employer is the liable party, and that the exposure level was significant may prohibit the individual from initiating the suit.

The costs associated with producing information and with litigation itself may be quite substantial. First, information is a public good, which means that once produced it can be transmitted inexpensively to any number of individuals without diminishing the quality or quantity of the information. It is, therefore, difficult to control distribution once the information is produced. A producer of information may find that information produced at great expense can be acquired freely by potential customers, and that consequently, the market for the information has virtually disappeared. As a result, public goods are typically underproduced relative to what is considered economically efficient. This general undersupply of information adversely affects the workers' awareness of the cause of their illness and thus reduces the likelihood that they will pursue tort liability suits.

Second, legal proceedings impose costs on both plaintiffs and defendants. In deciding whether to sue, the tort victim must be sure that the size of the claim will be large enough to cover legal expenses. In effect, the plaintiff is likely to face substantial transaction costs in the form of a contingency fee, commonly 33 percent, plus additional legal expenses. The accused firm must also pay for its defense.

The majority of occupational disease tort activity has involved workers exposed to asbestos. To date, about 25,000 individual plaintiffs have filed asbestos lawsuits in the country. These employees avoided the exclusive remedy of Workers' Compensation by suing suppliers of asbestos instead of employers. A report prepared by the Research Triangle Institute entitled, *Tort Liability and Worker Health: An Examination of the Economic, Legal, and Scientific Issues Surrounding the Occupational Disease Protection Afforded by Tort Law* [2], contains some data pertaining to legal costs and the size of awards. One investigator, for example, found that an average ratio of legal costs to proceeds was 37 percent for a sample of cases. The data, however, do not separate legal fees paid by the defendants and plaintiffs.

Insurance and liability costs are not borne in full by the specific employer responsible for the risk involved. For firms that are insured, the premium determination process is such that premiums only partially reflect changes in risk associated with changes in exposure to hazardous substances. This lack of complete adjustment is the so-called "moral hazard problem," which is the risk that arises from the possible dishonesty or imprudence of the insured. As the insured firm has paid an insurance company to assume some of the risks, that firm has less reason to exercise the diligence necessary to avoid losses. Transfer of risk is a fundamental source of imperfection in markets.[1]

For firms that self-insure or carry liability insurance with a large deductible, the costs of a single claim may be fully borne by the firm. Very small firms, and large firms with a large number of claims, however, may fail to meet the full costs by declaring bankruptcy. For example, the Johns

[1] For a general discussion of moral hazard as a source of market failure, see Arrow [4] and Spence and Zeckhauser [5]. For applications of this concept to employee health and safety, see Chelius [6], Rea [7], and Consad and General Research Corporation [8, Section 5.1].

Manville Corporation [2] declared bankruptcy to avoid massive claims associated with asbestos-related disease. Although the firm experienced a sharp decline in the value of its stock, it is still in business, while its obligation to pay asbestos-related claims is in considerable doubt. Other asbestos producers including U.N.R. Industries, Inc. and Amatex Corporation have followed the example of the Manville Corporation by filing for bankruptcy [9], further reducing the chances that their workers or others who contract asbestos-related diseases will collect Workers' Compensation or tort liability awards.

Workers' Compensation

The Workers' Compensation system is a result of the perceived inadequacies in liability or insurance systems to compel employers to prevent occupational disease or compensate workers fully for their losses. The system was designed to internalize some of the social costs of production, but in reality, it has fallen short of compensating workers adequately for occupationally related disease. Thus, society shares the burden of occupationally related adverse health effects, premature mortality, excess morbidity, and disability through taxpayer support of social programs such as welfare, Social Security disability payments, and Medicare.

Compensation tends to be inadequate, especially in permanent disability cases, in view of the expiration of benefit entitlements and the failure to adjust benefits for changes in a worker's expected earnings over time. As of January 1987, 8 states still restricted permanent disability benefits either by specifying a maximum number of weeks for which benefits could be paid or by imposing a ceiling on dollar payments [10].

At present, time and dollar restrictions on benefit payments are even more prevalent in the area of survivor benefits. The duration of survivor benefits is often restricted to 10 years, and dollar maximums on survivor payments range from $7,000 to $60,000. In addition, it should be noted that if the employee dies quickly from the occupational illness and has no dependents, the employer need pay only nominal damages under Workers' Compensation (i.e., a $1,000 death benefit).

Finally, in spite of current statutory protection, disability from occupational diseases represents a continuing, complex problem for Workers' Compensation programs. Occupational diseases may take years to develop, and more than one causal agent may be involved in their onset. Consequently, disabilities resulting from occupationally induced illness often are less clearly defined than those from occupationally induced injury. As a result, Workers' Compensation is often a weak remedy in the case of occupational disease. For example, as recently as April 1983, the U.S. Supreme Court refused to hear an occupational disease case *(Richard D. Bunker* v. *National Gypsum Co.)* involving a worker who was diagnosed as having asbestosis 23 years after the expiration of the 3-year time limit allowed by Indiana law for filing a compensation claim [11]. Indeed, there is some evidence indicating that the great majority of occupationally induced illnesses are never reported or compensated [12].

The insurance premiums paid by a firm under the Workers' Compensation system are generally not experience rated—that is, they do not reflect the individual firm's job safety and health record. About 80 percent of all firms are ineligible for experience rating because of their small size. Such firms are class rated, and rate reductions are granted only if the experience of the entire class improves. Even when firms have an experience rating, the premiums paid may not accurately reflect the true economic losses. Segregation of loss experience into classes is somewhat arbitrary, and an individual firm may be classified with other firms that have substantially different normal accident rates. An experience rating is generally based on the benefits paid to workers, not on the firm's safety record. Thus, employers may have a greater incentive to reduce premiums by contesting claims than by initiating safety measures.

In summary, the Workers' Compensation system suffers from several defects that seriously reduce its effectiveness in providing incentives for firms to create safe and healthful workplaces. The scheduled benefits are significantly less than the actual losses to the injured workers, and recovery is often very difficult in the case of occupational diseases. Thus, the existence of a Workers' Compensation system limits an employer's liability significantly below the actual costs of the injury. In addition, premiums for individual firms are unlikely to be specifically related to that firm's risk environment. The firm, therefore, does not receive the proper "signals" and consequently fails to invest sufficient resources in reducing workplace injuries and illnesses. The economic costs not borne by the employer are borne by the employee or, as is often the case, by society through public insurance and welfare programs.

Standards of Other Organizations

Traditionally, representatives of professional organizations have collectively developed voluntary guidelines to assist members in maintaining safe and healthful working conditions for their employees. These guidelines are widely disseminated among members of the organizations and, at times, have been adopted as guidelines by organizations beyond the initiating one as well as by industry groups. In some cases they have become the *de facto* industry standard. Three professional organizations have developed voluntary guidelines in the form of exposure limits for chemical substances: The American National Standards Institute (ANSI); the American Industrial Hygiene Association (AIHA); and the American Conference of Governmental Industrial Hygienists (ACGIH). ANSI has withdrawn its earlier hazardous substance standards and has stated it does not intend to publish any others. The AIHA has a rather limited list of recommended limits. However, the ACGIH has published an extensive list of threshold limit values (TLVs) for many years. The ACGIH is recognized throughout the world for its members' expertise and contribution to industrial hygiene.

In May 1971, OSHA adopted as Federal health standards the exposure limits recommended by ANSI and ACGIH for 425 chemicals. Since that time, advances in scientific knowledge have demonstrated that those limits are not always adequate to protect employee health. Consequently, the ACGIH, the professional organization which continues to develop TLVs, has changed its recommendations yearly to reflect later information. However, adherence to the TLVs developed after 1971 is purely voluntary. Except for imminent hazards, there is no sanction for failure to comply with the limits and many employers have not adopted practices which would control employee exposure to these new levels.

In addition to professional organizations, international bodies such

[2] Johns Manville Corporation, formerly the world's largest asbestos manufacturer, filed for Chapter XI protection under the Federal Bankruptcy Law in August 1982. The company was financially solvent when it filed for bankruptcy but estimated that it would ultimately face a cost of more than $2 billion to settle 52,000 asbestos-related claims. In the meantime, the company's assets have been frozen and successful plaintiffs cannot collect awards [9].

as the European Economic Community, the International Labor Organization, and the World Health Organization have recommended exposure limits for some hazardous substances. While these limits may not be as widely known in the United States as those of U.S. professional organizations, they are made available to the industrial hygiene community through professional journals and meetings. Within the U.S., the National Institute for Occupational Safety and Health (NIOSH) of the Department of Health and Human Services has published recommended exposure limits (RELs) for a number of chemicals. These are publicized through NIOSH Current Intelligence Bulletins and other publications which are widely disseminated.

Although the ACGIH TLVs and the NIOSH RELs are widely recognized by health professionals and employers alike, OSHA has found that some employers are not complying voluntarily with the newer TLVs, the RELs, or the standards of other bodies. Chapter III discussed OSHA's estimates of the extent of exposures in excess of the TLVs, and the adverse health effects resulting from the exposure. OSHA believes that significant numbers of employees are exposed to chemicals at levels exceeding those recommended by other organizations, and that OSHA cannot rely on employers to comply voluntarily with the recommendations. Therefore, OSHA concluded that this nonregulatory alternative is not generating the optimal level of occupational health.

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V. Technological Feasibility

Feasibility Determination

This chapter presents a technological feasibility analysis of industry's ability to meet OSHA's proposed permissible exposure limits (PELs) for a wide range of occupational health hazards. These PELs would include limits on airborne concentrations of substances, and in some instances, direct contact of the skin with the substance.

The control of workplace exposures to toxic chemicals involves combining a variety of standard techniques to solve a situation-specific problem. OSHA believes that existing engineering controls are available to reduce exposure levels to new proposed levels. Standard controls have been adapted in numerous situations to solve situation-specific problems.

In this chapter, a number of process situations where airborne exposures have been controlled by the use of engineering controls are described. OSHA has found examples of successful engineering controls for each of the processes identified in the sample survey and presented in Supplement 2.

Types of Controls

In general, three basic types of controls may be employed to reduce employee exposures:

- Engineering controls
- Work practices and administrative reforms
- Personal protective equipment

Consistent with OSHA regulations and policy, this chapter examines the feasibility of engineering controls and work practices to control employee exposure, in preference to personal protective equipment.

Engineering Controls

Engineering controls involve the use of: Local exhaust ventilation; general ventilation; isolation of the worker and enclosure of the source of emissions; process modifications; equipment modifications; and substitution of non-hazardous chemicals. These methods may be used alone or in combinations of any two or more controls depending upon the needs of a specific situation. Variations in situations usually result from the type of process being used and the number of chemicals in the air. However, these controls are considered standard techniques which will effectively control these variables either by themselves, or coupled with changes in work practices.

Ventilation

Perhaps the most widely used technique for controlling chemical exposures is the use of ventilation. General ventilation uses the movement of air within the general work space to displace or dilute the contaminant with fresh outside air. General ventilation is not typically the preferred control method in most operations due to the large volumes of air movement required. Local exhaust ventilation uses much smaller volumes of air, exhausted from the point at which contaminants are generated to remove the contaminant at the source.

Isolation

Isolation involves placing a physical barrier between the hazardous operation and the worker. Many modern, automated manufacturing processes are now fully enclosed in ventilated cabinets. The effectiveness of such a control technique depends on the frequency with which the workers have to enter the enclosure during normal operations. In other situations, rather than placing the process or machine in an enclosure, the worker may be put into a controlled atmosphere enclosure. Many processes which involve potential chemical exposures are operated remotely by operators in air conditioned booths.

Substitution

Substitution refers to the replacement of a toxic chemical in a particular process or work area with another, less toxic product. Properly applied, substitution can be a very effective control technique. However, care must be taken to ensure that the proposed substitution performs in a similar manner to the product being replaced. In addition, it is essential that the substitute be carefully evaluated to

ensure that in controlling one hazard, that another, different hazard is not inadvertently introduced. The substitute must also be compatible with existing manufacturing equipment and processes.

The success of these techniques will depend on the physical properties of the chemicals and emissions encountered (boiling point, vapor pressure, etc.) and the process operating conditions (temperature, pressure, etc.). In some cases, particularly with cleaning solvents, substitution may provide the quickest and most effective means of reducing exposure. In other situations where particular physical or chemical properties are required, major effort may be required to alter processes or install or expand local or general dilution ventilation. The extent to which engineering controls may be effectively used will vary from industry to industry, as well as plant to plant within an industry.

Work Practices and Administrative Reforms

Work practice controls include housekeeping procedures, material handling or transfer procedures, leak detection program, training and personal hygiene. In many cases, it is possible to bring about substantial reduction in employee exposures by applying work practice controls.

Personal Protective Equipment

Where it is impractical to apply engineering or work practice controls, or where their application will not consistently reduce employee exposures below the proposed PELs, personal protective equipment may be used to prevent and reduce exposures.

Industry Engineering Controls

To determine whether engineering controls and work practices can reduce employee exposures to the proposed PELs, OSHA, through its contractors, examined typical work processes found in a cross section of industries. Supplement 2 contains a list of processes identified in the nationwide sample survey of over 5,300 firms. Using this list, industry experts identified which major processes had potential hazardous exposures and may require additional engineering controls or different work practices in order to achieve the proposed PELs. To assess whether these would be feasible for the processes within the industry group, records maintained by OSHA and NIOSH were searched to identify examples of the successful application of controls to these processes. Based upon the judgments of the industry experts, a determination was made as to the probable feasibility of achieving the proposed PELs.

The following are examples of feasible methods of controlling exposure to hazardous substances encountered in processes used in the SICs for which costs and benefits have been identified. Unit costs for these similar controls were used as the basis for the cost projections in Chapter V.

SIC 20—Food and Kindred Products

The levels of ammonia gas encountered in poultry processing (SICs 2016 and 2017) were controlled by the appropriate placement of cut-off valves to freezer coils and by the use of an alarm detection system to monitor ambient air conditions.

In beet sugar refining (SIC 202), exposure to calcium oxide was controlled by replacing slide gates with rotary feeders. A milk products plant (SIC 2023) controlled carbon dioxide exposures by using a hood which fully enclosed the chiller-conveyor line and exhausted air from the system to an exterior baghouse.

Carbon dioxide levels resulting from the use of dry ice were controlled at a meat packing plant (SICs 2011 and 2013) by a stainless steel exhaust hood. Similarly, a poultry dressing plant controlled carbon dioxide emissions by using a slotted blood exhaust ventilation system.

A food processing plant (SIC 202) controlled carbon dioxide exposure by increasing the number of air changes in the packaging room.

SIC 21—Tobacco Products

Tobacco dust and residual pesticide dusts created during cutting and shredding operations are reduced through the use of local exhaust ventilation. This is also used to control emissions of ethyl alcohol-based chemical flavorings during blending operations.

SIC 22—Textile Mill Products

Textiles are dyed at various stages in their manufacture, including unspun fibers, unwoven yarn, and finished fabric. Workers who prepare fabrics from unspun fibers are of particular concern, since they could be potentially exposed to dyes contained on dusts generated during manufacture. In addition, some dyes possess much poorer fastness to wet treatment than do others; persons who launder such clothing are potentially exposed to dyes. Stringent control measures and work practices can prevent such exposure.

Several generally acceptable practices for the control of hazardous materials can be used wherever there is potential for exposure. For example, pressure failure alarms for closed systems and exhaust ventilation can rapidly indicate a system failure that might result in the release of substantial quantities of dyes. Continuous flow indicators, such as water or oil manometers properly mounted at the juncture of a fume hood and duct throat and marked to indicate acceptable airflow, will give a readily observable indication of decreased efficiency in the ventilation system for the hood. Wet methods, vacuum cleaning, or other methods that do not lead to redispersion of settled dust should be used for plant maintenance and sanitation. Dry sweeping or blowing with compressed air should be prohibited.

SIC 23—Apparel

Chemical exposures in the apparel industry occur principally as a result of three exposure sources: Spot cleaning, dry cleaning and contact with treated fabrics.

Spot cleaning and dry cleaning operations can be controlled with the use of local exhaust ventilation and general ventilation. Work practice improvements help reduce solvent exposure during transfer operations. Routine scheduled maintenance is used to detect and control leaks from door gaskets and seals. Contact dermatitis is reduced through the use of disposable gloves and adherence to a personal hygiene program.

SIC 24—Lumber and Wood

The primary worker exposure in the lumber and wood industry is wood dust. For the operation of large equipment (e.g. in debarking and sawmill activities), the operator can be placed in an enclosed control booth, or in the case of moving equipment (e.g. cherry pickers, loaders and cranes), the operator can be located in an enclosed cab. In both cases, air would be filtered and conditioned. In the case of felting or matting process lines, or such equipment as belt sanders, the equipment can be enclosed or hooded and vented to a baghouse. For smaller equipment, such as variety saws, tenoners, and dovetailers, hoods or various types of negative pressure (or combinations of positive and negative pressure) local ventilation devices can be used to control wood dust. In the case of hand-held sanders, a vacuum system can sometimes be applied to the process. Some other wood dust generating equipment can also be enclosed (e.g. planers), but this is generally done for noise control.

SIC 25—Furniture

In the metal office furniture manufacturing sector (SIC 2522), air contaminants from the coating process have been controlled. Prefabricated sheet components for file cabinets are prewashed and coated with polyester or acrylic on a high speed conveyor line. The application process includes manual spraying of cabinets with airless atomizing sprayers and electrostatic spray guns on reciprocators. Manual spraying operations are performed in downdraft booths. Filtered fresh air is supplied through the open top of the booths and removed at the bottom through a water curtain by exhaust fans mounted on the roof of the booth. Spray headers in exhaust plenums clear paint mist from the air stream. Automatic spray booths contain electrostatic spray guns and side draft ventilation. Furthermore, organic solvent vapors in the paint mixing and storage room are controlled by equipping each drum with a heavy barrel cover, an integral adgitator, sealed pipe openings, and a closeable access line.

SIC 26—Paper and Allied Products

Pulp mills occur primarily in SIC 2611, but can also be present as part of the operations in SICs 2621 and 2631. High control costs could potentially be incurred because of the large quantities of chemicals used in breaking down pulp to form cellulose and the reactions that occur in the digesting process between these chemicals and the substances contained in the wood fiber. Large quantities of chemicals are also used in the bleaching operations. The digesting and bleaching operations are also very extensive. Large quantities of pulp are generally produced from wood in these mills either for captive use or for shipment to paper and paperboard mills. The type of controls that would be used include ventilation, enclosure and/or process change, but less likely the latter. Various engineering controls have been used by the paper mill industry to prevent the mixing of toxic chemicals in sewer lines. Tanks containing the hazardous chemicals have been isolated and surrounded by dikes. Discharge lines have been re-routed to prevent accidental mixing.

SIC 27—Printing and Publishing

Exposure to solvent vapors in the silk-screening sector of a printing plant (SIC 2751) was controlled by installing a new ventilation system and an exhaust fan.

SIC 28—Chemicals and Allied Products

The plastic materials and resins manufacturing sector (SIC 2821) used a tank with a hinged cover and fixed ductwork as an exhaust when dumping dye and additives into hot methanol.

Dust exposure during the bag opening operation in paint manufacturing (SIC 2851) was controlled by modifying the hood to increase dust capture. Likewise, a new dust collection system (collection hoods) with increased capture velocity was installed for use in the bagging and packaging of pesticides (SIC 287).

Pharmaceutical manufacturers (SIC 2824) addressed the problem of nuisance dust particles by fitting vacuum crescents and elephant trunks on point sources, by fitting chutes with covers, and by placing vacuum attachments on receiving drum covers. Additionally, monitoring was performed from an outside room.

In order to reduce employee exposure to sulfur dioxide while producing sulfur dioxide gas (SIC 2819), sample collection units were enclosed and attached to a fume collection system. Sample waste was recycled to prevent open exposure in process areas. Electronic spent acid interface detectors were installed to eliminate the need for employee visual inspection of intermittently pulled samples. To control TDI exposure in urethane foam manufacturing (SIC 2822), the bun conveyor was enclosed and exhausted. Employee exposure was limited to the startup and finish procedures when installing and removing bun support. A mechanism was designed to support the bun, which eliminated the need for it to be done manually.

The production of paints (SIC 2851) is a batch procedure which involves the following steps: Prebatching, mixing, dispersing, tinting and shading, filling, and storage or shipping. When prebatching or mixing, an employee will slit a bag of dry pigment with a knife and either scoop out the contents for weighing or dump the pigment into the mixer. In some cases, pigments are received in a slurry form and are piped directly into the mixer. Solvents and other raw materials are added into the mixer. Once combined, the mixture is in a past or slurry form. This mixture is then thoroughly dispersed in a roller, ball, or sand mill or a high-speed disperser all of which are generally closed processes. The paste is transferred to a storage tank where thinning or other agents are added. The paint is later drawn off, filtered and packaged in cans or drums. Airborne dust exposures to components in dry pigments occur during the prebatching and mixing operations when the bags of pigments are opened and dumped. Exposure to chemicals in dry pigments can also occur from pigment spillage and empty bag flattening and disposal. Once the batch is in solution in the mixer, there are no further dust emission points. Exposure to solvents can occur during addition of these ingredients to the mixing tanks, during any leaks or spills, and during packaging.

Local exhaust ventilation would be used to control exposures to dusts and fumes in the paint production processes. Pigment dust exposures at the dumping station can be controlled with the use of a vented enclosure kept under negative pressure by a ventilation system. Empty bags would be manually ejected through a side opening into a large plastic disposal bag to minimize dust generation during bag flattening and disposal.

Exposures to solvents would be minimized with the use of portable hoods attached to flexible ductwork. These ventilation hoods could be placed over the liquid dumping process and also the packaging operation if the percentage and volatility of the solvents would result in exposures.

SIC 29—Petroleum Refining

In order to assure the quality of petroleum products and determine quality of waste streams, petroleum refiners must sample their process streams periodically. As with maintenance, workers that sample process streams are at risk of being in close contact with a variety of chemicals. Controls for this operation involve sampling boxes that vent gases and vapors away from the operator and/or shield the operator from accidentally splashed or spilled material.

Process stream samples are taken to the laboratory to determine if their qualities lie within acceptable limits. As laboratory workers perform analyses, they can be exposed to various organic and inorganic chemicals if appropriate engineering controls are not in place or if proper procedures are not used. Exposure controls include exhaust fans and laboratory ventilation hoods.

SIC 30—Rubber and Miscellaneous Plastics Products

To control dust while cutting reinforced plastic, a local exhaust fan was installed at the back of the cutting instrument.

The materials to be mixed in a Banbury mixer used in tire production (SIC 3011) are charged into a hopper and then into a chamber which contains the mixing rotors. The rotors mix the materials into a homogeneous mixture, and then are discharged through a drop

door or slide gate. When the hot rubber mixture is discharged, it emits an aerosol which looks like smoke. These aerosols are typically well controlled. The operations and equipment used to charge the mixer can be sources of dust exposures. The powdered chemicals in the operation are weighed in rigid plastic containers or paper bags, all of which are either emptied or dropped into the mixer by workers. This dropping, the handling of these contaminated containers or the crushing of the bags which contained chemicals, all expose the workers to dust. When the rubber and chemicals are charged using a charging conveyor, a dust exposure can result from the use of kaolin as an anti-tack agent. The conveyor belt becomes contaminated by the kaolin. When workers place materials on the conveyor, dust puffs into the worker's breathing zone.

One design which minimizes dust dispersion is the use of an automated batching system to isolate the worker from the dust. Other techniques include the use of rubber bins on a tilt stand to charge carbon black rather than the use of screw conveyors. The kaolin can be replaced by a soap anti-tack agent. To capture the aerosol fumes, a local exhaust hood can be placed by the drop gate between the legs of the mixer. Exhaust hoods may be placed by the hopper vents, on the carbon black charge chute, about the charging door and surrounding the dust ring seal on the mixer ram.

SIC 31—Leather and Leather Products

Toluene exposure in the shoe manufacturing industry (SIC 314) was decreased by revising standard work practices to reduce the contact time between leather and toluene. This also reduced the generation of vapors.

SIC 32—Stone, Clay and Glass Products

In batch mixing of raw materials for glass production (SICs 321 and 322) drysweeping and/or the use of compressed air for cleaning may contribute substantially to the employees overall exposures. By substituting vacuum cleaning systems, worker exposure can be reduced.

SIC 33—Primary Metals Industries

In the primary metal industries (including SICs 331, 332, 333, and 334), the overall size of the process equipment and buildings makes contaminant control difficult. Local exhaust and general ventilation systems used in this industry group must move large volumes of air as compared to similar systems in other industries. Baghouses and other air cleaning devices used in such systems must also be proportionally larger. This effect of scale translates to higher than average control costs, but use of ventilation can control exposures to the proposed levels.

SIC 331—Basic Steel Products

Primary metal products manufacturing (SIC 331) controlled dust with a side draft enclosure exhaust hood and a circular backdraft booth, both driven by a blower-dust collector. Ventilation was provided by a freely suspended hood and conical hood.

The replacement of slide gates on transfer hoppers with butterfly-type valves assisted in dust control in the material handling of electrometallurgical products (SIC 3313).

SIC 332—Iron and Steel Foundries

The arc air process in steel foundries (SICs 3324, 3325) was used during the processing of steel castings to control fumes. In order to ventilate the arc air booths, fumes were exhausted through the back of the booth and fresh air was supplied from above and behind the operator.

Steel foundries (SICs 3324, 3325) used an overhead canopy hood during the induction melting of steel to control fumes. The hood consisted of sheet metal barriers extending down from the roof to the top of the hot metal ladle monorail. Thermal drafts carried the fumes upward into the hood where they were exhausted by ventilators. Mancooler fans behind the workers pushed some fumes under the hood.

Emissions during the oxy-acetylene torch cutoff of risers from steel castings was encountered in iron and steel foundries (SIC 332). Castings were cut in a specially designed booth with a rear exhaust flow and a frontal air supply flow. Air pressure from the cutting nozzle of the torch was directed toward the rear exhaust port for effective dust and fume control.

Fume control of a sandwich-type inoculation in iron foundries (SICs 3321, 3322) was achieved through the use of a commercially available canopy hood. The fume-laden air was exhausted through mobile duct work and cleaned by a fabric collector before being discharged into the surrounding environment. The hood tilted with the furnace so that it always was directly over the ladle for fume capture.

Fume, dust, and gas control from the melting of iron (SICs 3321, 3322) in an arc furnace was achieved by the installation of a hood. The exhausts collected by the hood were filtered by cloth filters before being released into the external environment.

Control of dust and gas emissions from phenolic urethane cold box coremaking in iron foundries (SIC 3321, 3322) included local exhaust ventilation which provided negative pressure at the core box. Parting line gaskets, blow seals, and stripper pin o-rings were regularly maintained for emission control. Exhaust outlets captured excessive dust.

In an iron foundry (SICs 3321, 3322), hot combustion gases were exhausted and flowed through an after burner, cooled, and then passed through a dust collector. Tapping emissions were captured by a canopy hood. General ventilation was provided by mancooler fans.

SIC 333/334—Primary and Secondary Non-Ferrous Metals

Control of emissions from aluminum ore handling and storage (SIC 3334) was addressed with an unloader which uses movable vacuum nozzles to remove alumina and coke from barges. The ore was moved on an enclosed conveyor which was equipped with air exhaust hoods at loading and transfer points. The operator can be situated in an air conditioned cab.

Reduction of alumina dust emissions during ship unloading (SIC 3334) was achieved by automating and controlling operations from an enclosed control booth. Furthermore, mixing operations were hooded and exhausted.

During anode rodding in prebake plants during primary aluminum production (SIC 3334), spent butt remover, butt crushers, cast iron remover, and shot cleaner were exhausted to a bag filter dust collector. Use of induction furnaces and exhaust hooding reduced metal fume exposure during melting. Hoods and slotted hoods were also used. The operator can maintain controls from an enclosed console.

Control of air emissions during potline operations of aluminum smelters (SIC 3334) was achieved through the use of potroom ventilation and automated processes such as the use of hooding which consists of curved and ribbed shields, the employment of a dual draft system, and an exhaust system which leads to a dry scrubber. Other control methods included hooding with rigid air-operated doors which exhausted the emissions through air takeoffs to an expanding duct exhaust manifold which, in turn, was exhausted by a fan. Furthermore, computer-controlled systems existed which could automatically perform production functions without requiring workers to open pots or hood shields above pots.

The mercury cell process may be used in aluminum smeltering (SIC 3334) to produce chlorine gas from brine water. To reduce chlorine gas exposure as a result of this production, the diameter of the brine header was increased to accommodate the gas phase above the liquid phase; the number of cells in the system was increased; the pH of the brine was adjusted; the compressor controls were modified to accommodate surges in pressure; inlet box covers were replaced with better covers; and the brine feed nozzle flange was modified.

Several engineering controls have been recommended for copper smelting locations (SICs 3331, 3341). A preventive maintenance program can be developed and implemented to insure that ventilation and conveyor systems are operating properly. Dead beds can be installed in chutes to break the fall of material and reduce the level of dust generated. Pneumatic aerators can be installed to eliminate the need for manual air lancing in bins and chutes. Industrial vacuum systems can be used.

Collection hoods can be installed at each conveyor transfer point at copper smelter sites (SICs 3331, 3341) to control copper particulate. Primary copper smelting conveyor skirting can be properly adjusted, and fingers installed at discharge points. Inspection doors should not be left open, and the lunchroom/breakroom should be located outside of the reclaim building. General measures throughout copper smelting plants (SICs 3331, 3341) to control copper dust emissions included: Using local exhaust ventilation for localized sources, and general exhaust ventilation for areas with unidentifiable sources; enclosing conveyor belts and transfer points; enclosing the air conveying system for the transfer of flue dusts; enclosing workers' operating vehicles; installing secondary hoods on converters; prohibiting the blowing out of converters while on stack; performing preventive maintenance on balloon flues; not allowing converters to remain rolled out for extended periods of time; and providing cleaning rooms with filtered, tempered, positive pressure air. When hauling slag from the metal smelting operation, slag can be granulated after skimming with high velocity water; a chemical dust suppression system can be used when crushing any cooled slag; and the slag crew can ride downwind from fumes. Further engineering controls include constructing pulpits for operators; close-coupling the ventilation system to the Larry car; using dead beds in calcine loading; enclosing a portion of the building to block wind; and vacuuming the superstructure of the Larry car and any spills.

Controls used to decrease exposures to arsenic, dust and sulfur dioxide at primary copper and lead smelters (SICs 3331, 3332) included upgrading the present ventilation systems; operating electric furnaces at negative pressure; eliminating air lancing as a method of removing concentrates from receiving hoppers; using pneumatic aerators or belt wipes; using wet techniques in storage; reclaiming concentrates; and improving general housekeeping.

Exposures to lead, cadmium, and arsenic at lead and copper smelters (SICs 3331, 3332) were reduced by the replacement of old sintering machines with ones equipped with dust and fume controls and by placing a cover over the charge hole when slag was not being charged into the reverberatory furnace.

Use of a multipurpose crane with an enclosed cab reduced operator exposures to air emissions at carbon bake plants (SIC 3334). The cab was supplied with filtered conditioned air. The crane was equipped with a vacuum system which could aspirate cake from ovens and separate fines.

Controls for exposure to soluble platinum salts in precious metal refining (SIC 3339) included local exhaust ventilation used in jaw crusher and recovery sampling, maintenance of a closed system in refinery through use of glove box filters, the use of borohydrate solution to wash down spills and reduce salts to insoluble platinum metal, and mandatory showers and daily clothing changes.

Controls for the primary non-ferrous metals industry (SIC 333) included local exhaust ventilation systems; general dilution ventilation; covers, hoods and exhaust systems for belts, material handling and transfer systems; enclosure and exhaust of sinter machine area; local exhaust and dilution ventilation for the reverberatory and refinery areas.

The reduction of exposures to inert cadmium and silver dust during a ball mill operation was accomplished by building and equipment process changes such as local exhaust ventilation, hood enclosure of process or worker, and air cleaning equipment.

In the secondary smelting and refining of non-ferrous metals (SIC 334), particulate emissions from a dross mill were reduced by making modifications to the dust collection system and to air volumes drawn through the baghouse. Engineering controls used include increasing fan efficiency through the use of sheaves and belts, installing water sprays on crusher infeeds, running new pipe to localized dust areas, installing additional cleanout ports, and replacing the top of the baghouse.

Employee exposure to nuisance dust from zinc smelters (SIC 3333) was controlled by replacing the dross handling operation with a dross mill. The crusher was replaced with a rotating mixer, thus eliminating fugitive dust from this part of the process.

SIC 336—Non-Ferrous Foundries

Fumes were controlled during the casting of bronze in foundries (SIC 3362) through the use of enclosing hoods. A mobile hood exhausted the ladle at all hot metal transfer points. Flexible ducting connected the hood to a traveling exhaust carriage.

SIC 339—Miscellaneous Primary Metals Products

Manufacturers improved dust control using closed screw conveyors in the transport and manufacture of iron powder (SIC 3399). Open conveyor belts were changed to a closed screw conveyor system. Duct work was totally replaced. Local exhaust was provided for the rotary screens. New baghouses and electrostatic precipitators were also installed.

SIC 34—Fabricated Metal Products

Control of copper dust at a cookware manufacturing plant (SIC 3469) was addressed by unclogging the ventilation system, repositioning cooling fans, and instituting weekly ventilation system inspection and maintenance programs.

A plating shop (SIC 3471) uses extensive local exhaust ventilation to control worker exposure. Each part to the plated undergoes some surface pretreatment. This can consist of shot-peening, abrasive blasting, degreasing, wax or tape masking and other treatments. Parts are manually placed into the tank using an overhead hoist for large parts.

The tanks are set on top of concrete ducts. The floors of the shop and the aisles between the tanks are reinforced concrete, however the area around the perimeter of the tank is open to the basement and covered by steel grating. The ducts are connected to a fan on the roof of the building.

The largest of the hard chrome tanks, holding over 1000 gallons of plating solution, has a two sided lateral exhaust ventilation system. The slot on each side consists of a series of seven slots. The slots are set back from the edge of the tank but an overhanging hood extends to the edge of the tank. A second tank has both a two sided slot ventilation system and a cover. This two piece

cover is hinged to a ventilation manifold and extends beyond the front and rear edges of the tank.

Arc welding is performed in many SICs as an auxilliary process and in several industries such as fabricated structural metals (SIC 3441), as the principal process requiring engineering control. During the welding process, temperatures are sufficiently high to vaporize some of the base material of the electrode and produce large quantities of fumes containing the elements in the electrode and the base metal. Thus welders and other workers in the vicinity are exposed to mixtures of fume-sized particulates and both irritant and toxic gases which in combination may have additive or synergistic physiological effects.

Differences in worker exposure are attributable to a variety of factors including type of welding helmet worn, position of the welding operator, the work environment, arc time, and the availability and performance of ventilation equipment.

Arc time varies greatly due to differences in work schedules, set up times, and the sizes, shapes and types of tasks. Tasks can vary from short-term repairs conducted irregularly to full time production welding.

During arc time the fume is generated within or close to the worker's breathing zone. Background fume concentrations could also be significant if a large number of welders are working or the work is being performed in a relatively confined space.

Because of the numerous factors that can influence exposure levels during welding, four different types of controls can be used for various welding situations. The controls include: (1) Local exhaust ventilation for welding in shops; (2) ambient air cleaning devices to minimize background fume concentrations; and (3) a portable blower for use in confined areas.

Local exhaust ventilation configurations include: A welding bench with a backdraft hood for small to medium work pieces; a fixed close-capture hood placed at the back of a work rest table; a portable close-capture system including electrostatic precipitator; or an exhaust hose incorporated into the structure of the welding gun.

Ambient air cleaning devices are designed to lower background welding fumes which escape collection by the local exhaust system. The ambient air cleaner is expected to surpass general dilution ventilation systems in terms of both fume removal and cost.

A portable blower system works by exhausting fumes from a confined space through a large flexible tube.

SIC 35—Machinery

Employee exposure to welding fumes was controlled in the manufacture of pumps (SIC 3561) through the use of an air lux fume eliminator.

In the milling of tungsten carbide tools (SIC 354), the placement of local exhaust ventilation controlled cobalt exposures during the transfer of carbide.

In farm equipment manufacturing and repair (SIC 3523), paint mist was controlled through sophisticated application techniques as applied to downdraft spray booths. The use of heated paint in the painting of hay stack wagons allowed the airless atomization to take place at relatively low paint pressures. This resulted in low droplet velocity with little rebound.

SIC 36—Electric and Electronic Equipment

Electric lamp manufacturers (SIC 3641) have reduced mercury vapor in lighting plants. Glass pellets used as starters for fluorescent lamps were flame sealed after mercury had been injected into them. Overhead suction velocity of the exhaust system was increased to reduce mercury overexposure. Also, a special vacuum cleaner was employed to clean the turntable.

SIC 37—Transportation Equipment

A four-sided enclosure with electrostatic precipitator ventilation was used on the welding table in the manufacture of travel trailers (SIC 3792).

Engineering controls for styrene exposure in the fiberglass boat works industry (SIC 3732) included flexible duct exhaust ventilation that is transportable to the employee's point of operation.

General recommendations in the reinforced plastic boat making industry included local exhaust, the use of styrene-suppressed resins, and good work practices.

In the manufacturing of aircraft engine parts (SIC 3724), a hood was installed above an abrasive cutoff saw to capture the cobalt dust produced.

In the repairing and rebuilding of railroad cars (SIC 3743), present exhaust fans were relocated, cleaned and serviced and "upblast" roof ventilator fans were installed, thus changing the air every 15 minutes.

SIC 38—Instruments

Many fluxing agents are used in soldering and brazing operations during instrument manufacture. In most cases, these fluxes give of acid or alkali fumes when heated that can irritate the skin. Conducting soldering and brazing operations in well-ventilated areas and use of protective clothing and gloves is recommended.

For many soldering and brazing operations, control of fumes and vapors generated by dilution ventilation will be sufficient. That is, enough fresh air is added to the contaminated air that hazardous concentrations do not develop.

Local exhaust ventilation is the most effective means of control for airborne contaminants produced by the soldering or brazing process. Local exhaust ventilation can be provided by several types of equipment: freely movable hoods, fixed enclosures (booths), and down-draft benches.

A freely movable hood consists of a movable hood attached to a fan. The fan draws air from the work space and exhausts it outdoors, either directly or through a dust collection system. The hoods are normally constructed so that they can be moved into place by the solderer. The air handling system should move air at least 100 feet per minute across the soldering site at even the most remote point from the exhaust opening. It is important that the exhaust hood be placed as near as possible to the work being done. As such, the proper functioning of a freely movable hood is dependent upon good work practices of the solderer.

In some instances soldering or brazing operations carried out in a fixed location can be provided with a fixed enclosure. This is a structure built around the soldering or brazing operation which has a top and at least two sides. A means for drawing air through the work area is provided so that the work space is flushed continuously with fresh air.

Within such an enclosure, work should be arranged and conducted in such a way that the fresh air enters in the enclosure through the worker's breathing zone and then through the work space in which the contaminants are produced. For most fixed enclosures, the air should move at least 100 feet per minute across the entrance to the enclosure.

A third type of local exhaust ventilation system is the down-draft bench or table. The soldering or brazing is performed on a bench or table which has an open grid as the work surface. Air is drawn downward through the grid, into the duct work, and then exhausted.

SIC 39—Miscellaneous Manufacturing

In the manufacturing of hard surface floor coverings (SIC 3996), processes include pre-weighing and blending raw materials, followed by mixing and gelling of the composition in internal batch mixers of the Banbury type or by continuous mixing operations carried out in mixers of the extruder type.

Potential worker exposures may result from dusts of the raw materials as they are handled (automatically or manually) prior to and during charging of the mixer. Fumes and dusts can emanate from leaks on the mixer and from hot, freshly mixed material as it is discharged.

The types of exposures depend on the substances used, though dusts of any type can constitute exposure to nuisance particulates. Applicable exposure controls include local exhaust ventilation at the mixer doors and over conveyor transfer points. The use of good working practices is extremely effective in controlling exposures during the opening of the mixers and the pouring of materials.

SICs 40, 45, 47—Transportation

Cleaning and coating operations are conducted in rail (SIC 40), and air transport industries (SIC 45), as well as in transportation services (SIC 47). These operations require the application of cleaning agents and/or the sandblasting of particles prior to the application of paints or coating. Spraying processes are required for the application of both the cleaning agents and the paints and coatings.

Rail car applications, for example, are generally performed within a large facility, part of which is established as a spray room. The cars are rolled into an enclosed spray area. In manual spray painting rooms, the operator is required to enter and move about the enclosure during spraying. Automatic spray rooms (or booths) are similar but the pressurized spray guns are automatically operated.

Three major spray techniques are used to apply cleaning agents, coatings or paints. These are: Compressed air spraying (low pressure spraying); airless spraying (high-pressure spraying); and electrostatic spraying. The compressed air spray gun atomizes a stream of liquid by impaction with a jet of air. Atomization may take place inside or external to the gun. The air stream and paint droplets intersect the prepared surface. The airless spray gun atomizes the liquid by forcing it through a small orifice under high pressure. The resulting particulate cloud is impelled by the pressure-created momentum toward the surface. Electrostatic spray equipment is based upon the attractive force between two oppositely charged objects. The liquid is atomized by compressed air, airless, or electrostatic techniques. The particles are given either positive or negative charge and the conductive surface to be sprayed is grounded. In general, electrostatic spray techniques result in the lowest exposure levels, followed by airless and then compressed air spraying.

In enclosed spray rooms, particulates enter the operator's breathing zone due to backspray. Exhaust ventilation to control exposure can be designed using down draft or a multiple sidedraft system. Worker positioning in relation to the spray plume is also critical in minimizing exposures. These include minimized line pressure, changing and cleaning of filter banks, enclosure integrity and ventilation maintenance. Personal protective equipment is also generally worn to insure the worker protection.

SIC 49—Electric, Gas and Sanitary Services

Coal-fed power plants present the potential for exposure to coal dust as well as a number of other substances. Coal dust exposure potentially occur in the area where coal is fed into the furnaces. The coal is generally fed into large hoppers off conveyors. Conveyors are filled by front-end loaders from the coal storage area. The operators of the front-end loaders are protected from coal dust exposure with the use of closed, air-conditioned cabs which provide purified breathing air.

SICs 50 and 51—Wholesale Trade

Some firms in this classification receive liquid chemicals in bulk quantities from a tank truck, store them and then redistribute them in smaller containers.

Solvents, for example, emit considerable vapor when poured from one container to another or when a container is being filled, displacing the air in it. Pouring and filling operations are often enclosed to minimize vapor losses (this helps to reduce product loss as well as prevent exposures). In addition, secondary vapor recovery is often incorporated, whereby vapors emitted at the transfer points are captured and returned through a separate circuit to the storage tank from which the volatile liquid is being removed.

SIC 72—Personal Services

To control dry cleaning emissions (SICs 7216, 7217), louvered wall fans and grilled ducts were installed to provide ventilation. Ceiling exhaust fans provided general ventilation. Natural ventilation was provided by through doors in the production area and by louvered panels along walls in the plant. Forced ventilation was provided by ceiling mounted exhaust fans and evaporative coolers. A local exhaust system with a standard single floor pickup exhausted air through a carbon absorption unit to the outside. Gaskets in machinery doors and ductwork needed routine maintenance to prevent deterioration. Various cleaning machines, pressure filter extractors and dryers were used. Dryers and drying cabinets were provided with local exhaust ventilation.

SIC 73—Business Services

Blueprinting and photocopying firms (7332) control ammonia fumes from blueprint duplication machines through use of local exhaust ventilation. The exhaust system is often built into large, high volume machines. Improvements in work practices control exposures during transfer.

SIC 55, 75—Automotive Repair Shops, Dealers

In automobile engine reconditioning lines (SIC 7538), exhaust fans and flexible ducts which extend directly over the engines were installed in order to control carbon monoxide exposure.

SIC 76—Miscelleanous Repair Services

Control techniques for welding fumes (SIC 7692) included a "smoke exhaust" welding gun which captures and removes fumes. These guns have some limitations and are applicable to continuous or semicontinuous flux core or metal inert gas welding operations. Crossdraft airflow was also suggested. The use of a portable fan is not recommended.

SIC 80—Health Services

Many medical and dental practitioners perform surgery in outpatient clinics and private offices outfitted for the procedure. Air contamination in an operating room may consist of waste anesthetic, the propellants of different sprays, scrubbing agents, cleansing agents, methylmethacrylate (released from surgical cement) and the possible decomposition products of the volatile or gaseous agents. The magnitude of gas flow, type of flow circuit and scavenging of waste gases significantly influence the levels of waste gases in the room air. Exposures are usually controlled by general dilution ventilation. Some clinics and offices, which are specifically

designed for surgical use, may have local exhaust systems installed.

Personal Protective Equipment

In the operations and processes included in Supplement 2 reductions in exposure limits can be achieved through engineering controls and work practice notifications. However, certain generic work activities are more problematical and may require the use of personal protection equipment.

Examples of these are:

Maintenance Activities in all SIC codes. It may be more difficult to control exposures of plant maintenance personnel by using engineering controls except for activities taking place in the maintenance shops. These maintenance employees may work in areas not normally accessed by production workers or may work under conditions which normal production workers do not. Respiratory protection is sometimes the appropriate control technology.

Painting and Coating Activities in all SIC codes. Although spray painting operations are performed in exhausted paint booths, the painting of many larger non-production items, such as construction equipment and heavy machinery, requires that the operator enter the booth. The booth is then primarily a control to prevent migration of the paint spray into other areas of the plant. In these circumstances it is usually necessary to provide respiratory protection to the workers painting.

Exterminating. Exposure of pesticide applicators cannot be controlled through engineering controls because their work does not take place in a fixed place of employment, but rather at a customer's facility. Personal protective equipment and/or work practice controls would therefore be required. EPA has jurisdiction in most situations.

Welding In certain situations, such as in confined spaces, or where the welder must be positioned directly above the fume plume, welders cannot be sufficiently protected by local exhaust ventilation. Personal protective equipment would be required.

In addition to the above examples, a number of the substances included in this rulemaking carry the designation "Skin." This refers to potential exposure through the skin. Table V–1 presents a list of chemicals for which skin protection would be required. Employees exposed to substances with the "Skin" notation would be required to wear protective equipment, including gloves, long sleeved shirts and coveralls.

Products are commercially available to adequately protect workers from dermal exposure. In some cases the permeability of currently used materials may be inadequate and firms will have to change the specific product now used to one offering greater protection.

TABLE V–1.—INDUSTRIES AND PROCESSES WHERE SKIN PROTECTION HAS BEEN ADDED

SIC No.	Chemical name	Process name
20	CAPTAFOL (DIFOLATAN)	Food Storage and Preservation
	CARBON DISULFIDE	Food Storage and Preservation
24	2-HEXANONE	Coating and Finishing
25	N-BUTYL ALCOHOL	Coating
	2-HEXANONE	Coating and Finishing
	STYRENE (PHENYLETHYLENE)	Lay-up, Molding
26	METHYL ALCOHOL	Chemical Recovery
27	CYCLOHEXANONE	Plate cleaning
	FURFURYL ALCOHOL	Plate cleaning
	2-HEXANONE	Plate cleaning
	HYDROGEN CYANIDE	Plate making/Engraving
	METHYL ALCOHOL	Plate cleaning
28	N-BUTYL ALCOHOL	Blending, Packaging
	CARBON DISULFIDE	Blending, Packaging
	DIAZINON	Blending, Packaging
	DISULFOTON	Blending, Packaging
	2-HEXANONE	Blending, Packaging
	METHYL ALCOHOL	Blending, Packaging
	METHYL PARATHION	Blending, Packaging
	STYRENE (PHENYLETHYLENE)	Lay-up, Molding
30	N-BUTYL ALCOHOL	Finishing, Trimming, Painting
	CARBON DISULFIDE	Compounding, Mixing and Blending
	2-HEXANONE	Solvent Mixing, Molding, Mold cleaning
	STYRENE (PHENYLETHYLENE)	Lamination, Foam Processing
31	CARBON TETRACHLORIDE	Finishing/Degrading
	DDT	Defestation/Disinfestion
	2-HEXANONE	Finishing/Degreasing
	HYDROGEN CYANIDE	Beamhouse
	METHYL ALCOHOL	Finishing/Degreasing
	TRIORTHOCRESYL PHOSPHATE	Finishing/Degreasing
32	CARBON DISULFIDE	Batch preparation
	CARBON TETRACHLORIDE	Batch preparation
	METHYL ALCOHOL	Batch preparation
	STYRENE (PHENYLETHYLENE)	Packaging
	THALLIUM (SOLUBLE)	Batch preparation
	TIN	Float Process
33	HYDROGEN CYANIDE	Coremaking
34	N-BUTYL ALCOHOL	Coating/Painting
	CARBON TETRACHLORIDE	Degreasing/Cleaning
	STYRENE (PHENYLETHYLENE)	Coating/Packing
35	N-BUTYL ALCOHOL	Coating/Painting
	HYDROGEN CYANIDE	Soldering/Brazing
	1,2-PROPYLENE GLYCOL DINITRATE	Coating
	STYRENE (PHENYLETHYLENE)	Packing/Coating
36	N-BUTYL ALCOHOL	Coating/Painting
	HYDROGEN CYANIDE	Soldering/Brazing

TABLE V-1.—INDUSTRIES AND PROCESSES WHERE SKIN PROTECTION HAS BEEN ADDED—Continued

SIC No.	Chemical name	Process name
	MERCURY (VAPOR)	Soldering/Brazing
	METHYL ALCOHOL	Cleaning
	STYRENE (PHENYLETHYLENE)	Packing/Coating
37	2-HEXANONE	Degreasing
	STYRENE (PHENYLETHYLENE)	Painting, Coating
38	2-HEXANONE	Injection Molding, Foaming
	MERCURY (VAPOR)	Handling of measurement liquids
		Preparation of Special Tubes
		Assembling
	METHYL ALCOHOL	Blending/Packaging
39	N-BUTYL ALCOHOL	Painting, Coating
	2-HEXANONE	Degreasing, Coating
	STYRENE (PHENYLETHYLENE)	Painting, Coating
40	2-HEXANONE	Coating
44	2-HEXANONE	Coating
45	N-BUTYL ALCOHOL	Cleaning/Spraying
	2-HEXANONE	Cleaning/Spraying
	METHYL ALCOHOL	Cleaning/Spraying
47	2-HEXANONE	Coating/Spraying
50	2-HEXANONE	Materials Recev./Packaging
	STYRENE (PHENYLETHYLENE)	Materials Recev./Packaging
51	CARBON TETRACHLORIDE	Materials Recev./Packaging
55	N-BUTYL ALCOHOL	Painting/Coating
72	MERCURY (VAPOR)	Embalming
	METHYL ALCOHOL	Embalming
73	DIAZINON	Exterminating
	DIOXATHION	Exterminating
	PHENOTHIAZINE	Exterminating
75	N-BUTYL ALCOHOL	Painting/Coating
80	N-BUTYL ALCOHOL	Disinfectant and solvent use
	MERCURY (VAPOR)	Preparation of amalgams

VI. Costs of Compliance

Costs of compliance result from the purchase, installation, operation and maintenance of equipment to maintain workers' exposures at or below the levels specified in the proposed standard. Costs are related to the engineering controls needed for specific processes which involve the use of hazardous substances. Existing data sources and expert judgement were used to sort the approximately 430 substances being regulated, by industry and by process within industry segments. Given the large number of substances being regulated, a process orientation rather than a chemical specific focus, was recommended, since prescribed engineering controls can address worker exposure problems to several chemicals, involving the same general process, simultaneously. The approach has proven to be efficient analytically and reduces the problem of double counting the costs of similar or the same engineering controls for separate chemicals involved in the same process or operation.

OSHA has a large amount of exposure data in its Integrated Management Information System and from NIOSH and other sources. But to improve the available information on the use of substances, OSHA decided to engage in a nationwide field survey of affected establishments. This survey, involving over 5,300 establishments in both manufacturing and nonmanufacturing sectors, has provided valuable information on chemical usage by industry process and potential worker exposures to these chemicals. Supplement 1 contains a description of the sample survey design and a statistical evaluation of the data collected.

In order to maximize the efficiency of this nationwide sample survey and limit the number of required sample observations per SIC category, a considerable effort was made to verify chemical by industry usage from existing data sources and to make best estimates of where likely or potential workers exposure problems (and consequently engineering costs) existed. For the purposes of the statistical survey being conducted, the larger the suspected potential exposure/cost problem in a particular industry sector, the more important it was to insure a large enough sample of firms in that sector so as to reduce the standard error of the cost estimates.

The following sections of this chapter outline the methodology adopted to identify:

- Chemicals by their industrial usage and employee exposures
- Processes involving known or suspected schemical exposures and control costs
- Industry costs for the controls needed to reduce industry exposure levels

Linking Hazardous Substances by Industry Use and Employee Exposure

Figure VI-1 presents a flow chart of the methodology used for identifying chemicals by industry use and employee exposure. The first step in the methodology was an analysis of the chemicals for which OSHA proposes new exposure limits. The 1982 NIOSH National Occupational Exposure Survey (NOES) and the OSHA IMIS data files was searched to determine the potential for worker exposure to each of the chemicals on the proposed list. The objective of this analysis was to create a subset of chemicals which are known to be present in specific industries at exposure levels above the proposed limits. These chemicals would then be considered to generate potential compliance costs within a specific industry sector.

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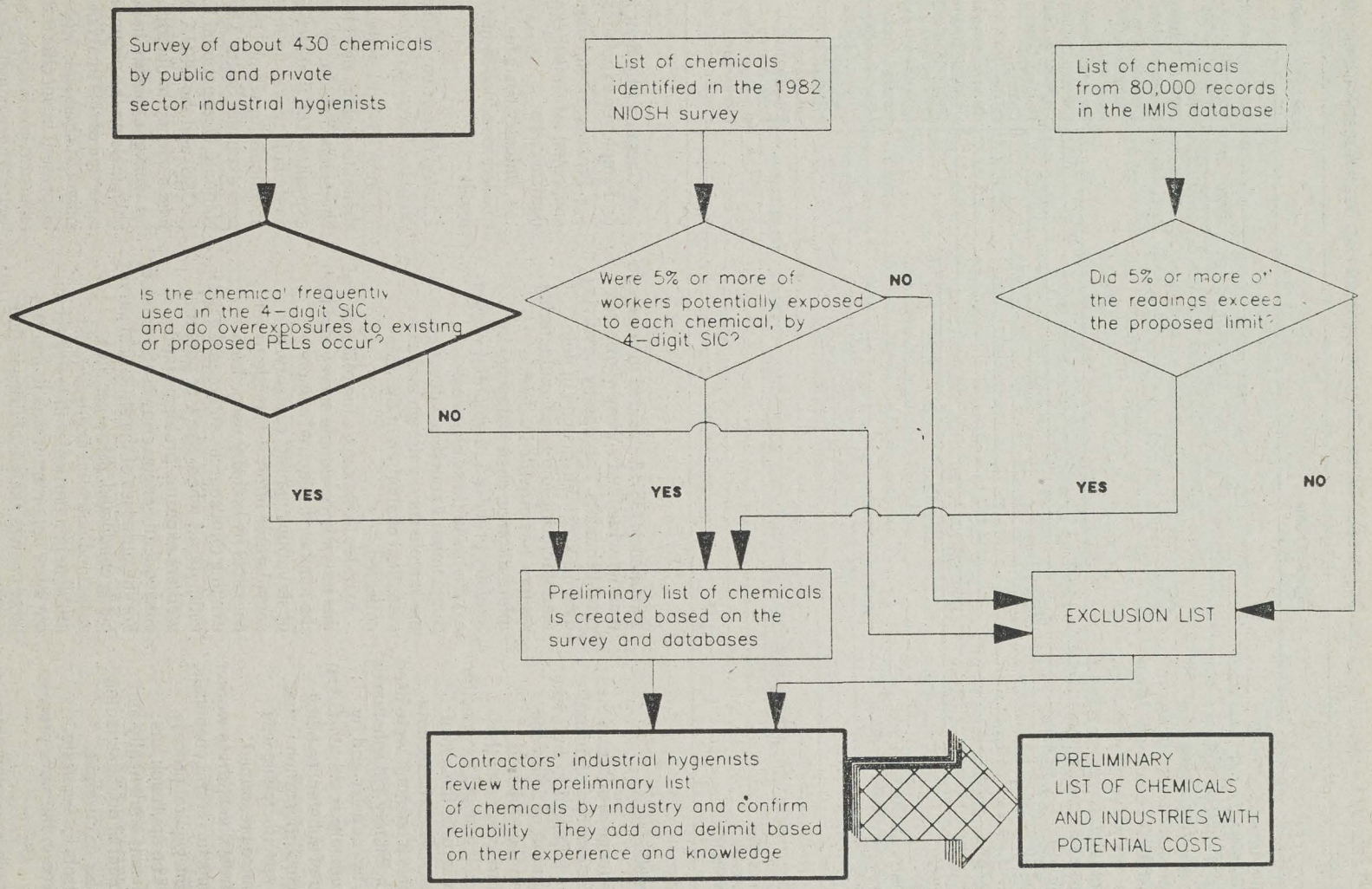
FIGURE VI-1

METHODOLOGY FOR IDENTIFYING CHEMICALS WITH POTENTIAL COST IN EACH 4-DIGIT SIC



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The 1982 NIOSH National Occupational Exposure Survey (NOES) data (supplemented by results from NIOSH's 1972 survey) provided an estimate of the number of workers potentially exposed to a specific chemical in a four-digit SIC. OSHA divided this estimate by the total number of employees in an industry segment to get a percentage of workers potentially exposed to that chemical. If 5 percent or more of the workers were potentially exposed, that chemical was considered to present a potential cost within the four-digit SIC. For example, in SIC 3011, Tires and Innertubes Manufacturing, 1,532 persons were potentially at risk of exposure to n-hexane at the sample of plants included in the NOES database. This represented 21.9 percent of all workers sampled in the four digit industry sector and this chemical would have a potential cost impact depending upon current exposure levels.

From the OSHA IMIS data, the severity of exposure within a four-digit SIC was estimated. OSHA compared the total number of monitored readings for each chemical with the number of readings which exceeded the proposed limits and calculated the percentage of all sample monitor readings which were above the proposed limits. If there were no readings which exceeded the proposed limits, the chemical was not considered to have a compliance cost within the four digit SIC. If 5 percent or more of the readings exceeded the proposed limits, then the chemical was identified as having a potential compliance cost within the four-digit SIC. For example, in SIC 2641, Paper Coating and Glazing, 22 samples were taken for n-hexane. Thirteen of these, or 59 percent, were above the proposed standard for n-hexane. This chemical, therefore, was believed to have a potential cost impact and questions regarding its use were included in the field survey. Chemicals with non-compliance percentages between zero and 5 percent were evaluated individually by industrial hygienists to determine whether or not specific survey questions needed to be asked about their industrial usage.

In addition to the IMIS and NOES databases, a survey of about one dozen industrial hygienists was conducted (under personal services contracts). The purpose of this survey was to identify any additional hazardous substances or industry sectors not identified in the IMIS or NOES databases with potential exposure problems at new recommended levels. For example, in SIC 2891, Adhesives and Sealants Manufacturing, the surveyed industrial hygienists reported that n-hexane overexposures could exist under the proposed standard. (Overexposures in SIC 2891 were not previously identified in the IMIS or NOES databases.)

The information from all sources was combined to compile a preliminary list of substances with potential compliance costs by four-digit SIC classification. To further refine the list of chemicals, a second group of six industrial hygienists, using personal industry knowledge and the information gathered from the survey of the initial group of industrial hygienists, reviewed once again the chemicals which appeared in the NOES and IMIS datasets. They also made chemicals by industry use linkages when particular chemicals were known to be present in certain SICs, but had not been identified in the NOES and IMIS data bases.

Upon completion of the two-tier industrial hygienist review, a list of chemicals believed to be present at exposure levels above the proposed standard, within specific four-digit SIC industry sectors was finalized. This list identified those industry segments with potential compliance costs needed to comply with the proposed standards. This chemical by industry listing is presented in Supplement 2 of this Appendix.

Industrial Processes and Control Costs

The number of industrial processes, exposure levels and exposure controls in place varies greatly within industry segments. In order to efficiently structure the statistical sample of surveyed firms, it was necessary to make a best estimate of which industry segments were likely to experience compliance costs. As noted above, the survey was designed to limit the standard error for potential high cost industry sectors. To concentrate the survey on the potential high cost sectors, a process orientation was adopted which supplemented and refined the chemical use information. Industry sectors with very low incidence of processes and chemicals with low potential exposure levels (and consequently low potential compliance costs) were included in the sample survey.

A team of engineers and industrial hygienists analyzed each four digit SIC to assess the processes in which worker exposure to listed chemicals occur. Examples of industrial processes included grinding, mixing, spraying, degreasing, separation, bagging and loading. A list of potential cost chemicals and related processes was then developed to identify potentially high impact (cost) industries. Supplement 2 presents the chemical by process listing for each four digit SIC covered by the sample survey. In general, an industry segment with a relatively large number of processes using chemicals with suspected high exposure levels was sampled at the three digit industry level. Industries with fewer processes and low chemical exposures were sampled at the two digit level. (See Supplement 1 for a more detailed explanation of the survey design.)

Each of the over 5,300 respondents in the survey was asked to verify the chemicals used, manufactured or generated by process within the establishment. Thus, chemicals were linked to specific processes, process controls and workers exposed at the process in the surveyed industries. Control methods and costs were then assigned for each process where employee exposures would exceed the proposed PELs.

Controls were assigned to protect workers exposed to all chemicals in total at a process. The controls were designed and costed to lower exposure to the chemical(s) with the greatest change in the permissible exposure limit (PEL). It was the judgment of the experts involved that by assigning controls for the "major" chemicals, exposures for all other chemicals would be controlled. Chemicals and/or processes not included in the proposed standard (e.g., those covered by separate 6(b) rulemaking) were excluded from the survey. Examples of chemicals not included in the survey are asbestos, formaldehyde and benzene.

Survey information collected from each respondent include:

- Type of processes at the establishment;
- Type and amount of chemical used, manufactured, or generated in each process;
- Number of work stations and workers related to the process;
- Potential chemical exposure above the proposed standards (monitoring data, recorded overexposures) at the process;
- Process location (indoors/outdoors), and configuration (size, full enclosure, partial enclosure);
- Ventilation or other controls in place; and
- Economic and other characteristics of the plant.

A computer algorithm was developed to assess survey data to determine if potential worker overexposure and therefore compliance costs occur for each process at an establishment. Figure

VI–2 presents a general diagram of the computer logic adopted for use in the survey. The logic assesses potential overexposures on the basis of: Actual reported monitoring data; statements that overexposures occur; and the particular process location, configuration, type and amount of chemical use and existing controls in place.

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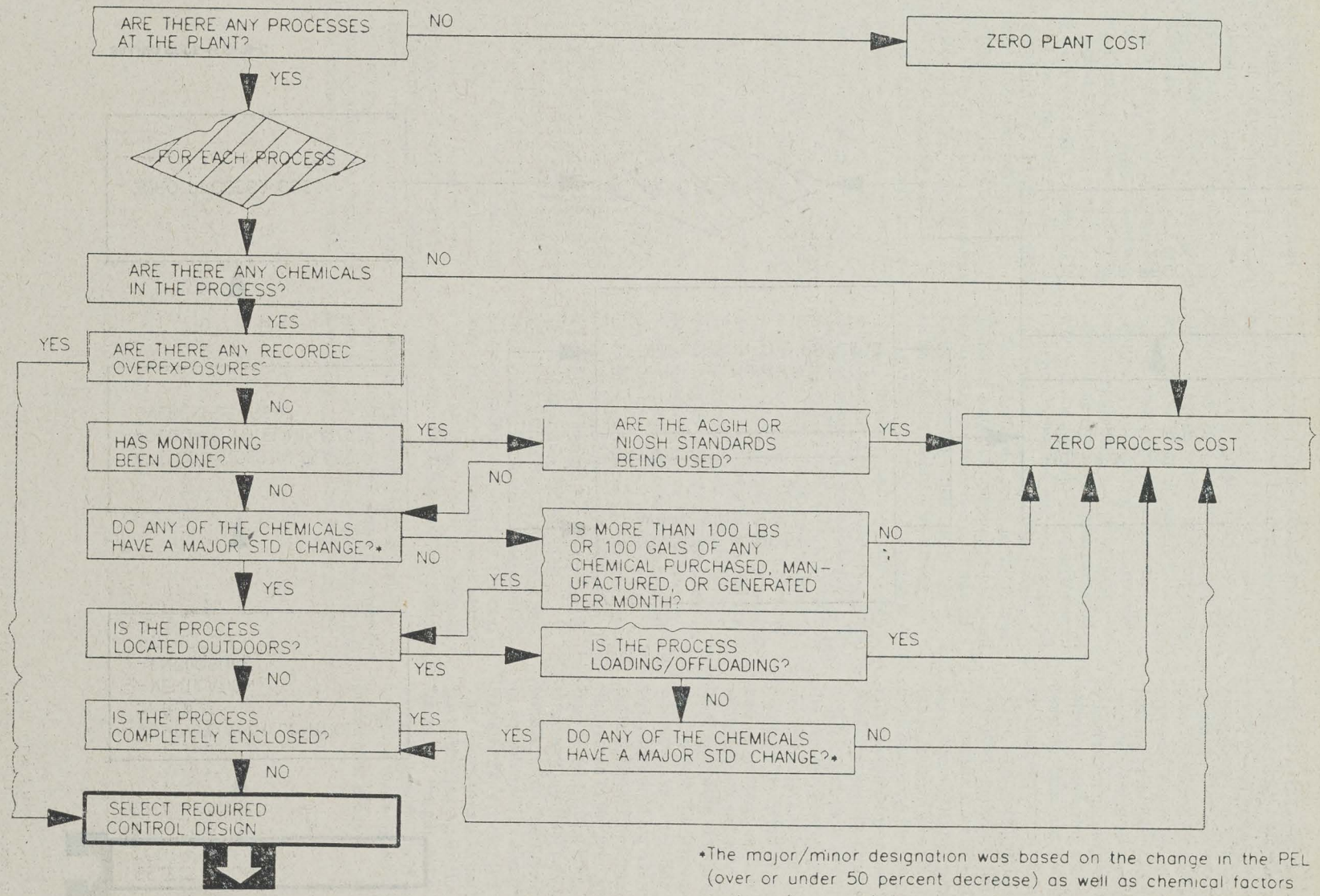
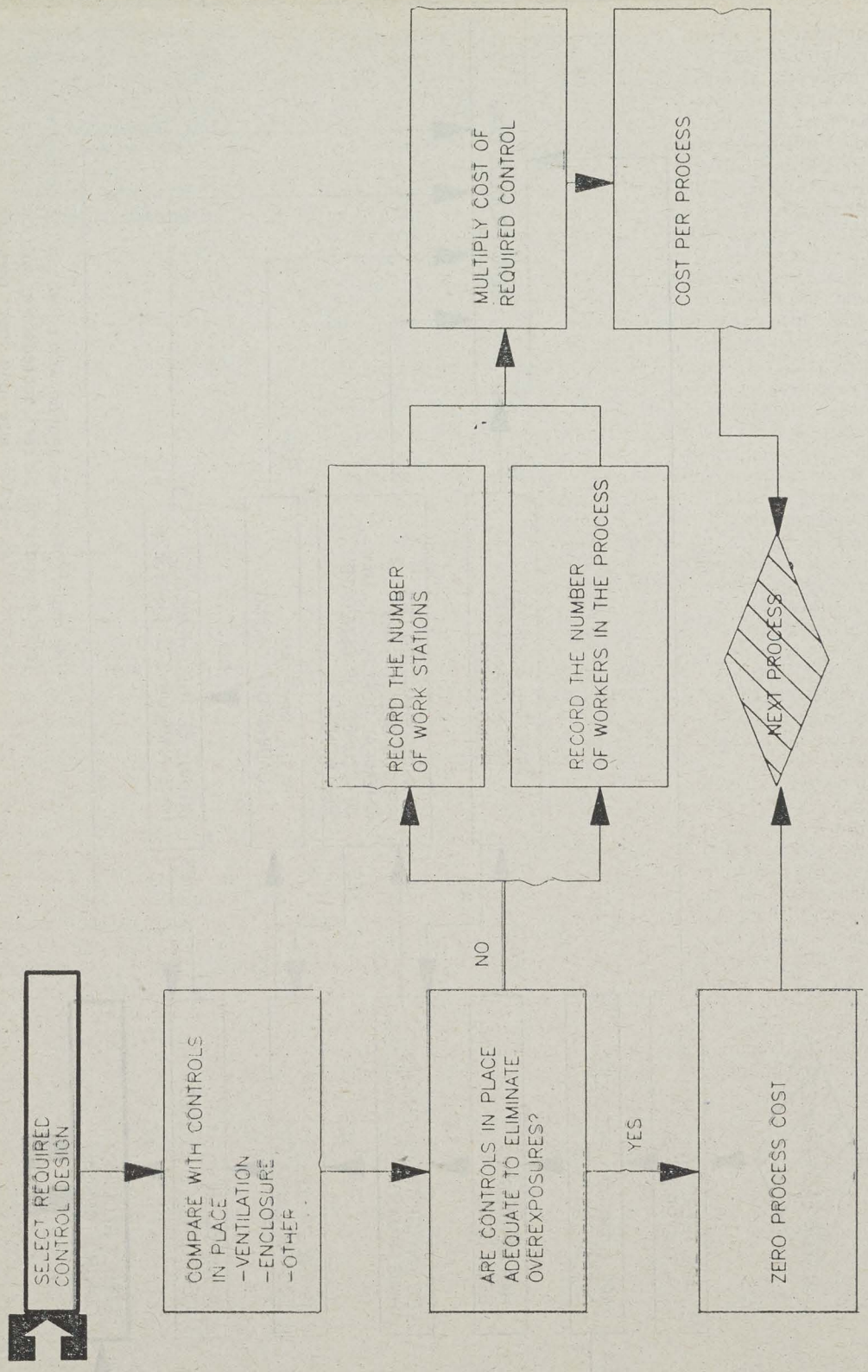
FIGURE VI-2
COMPUTER LOGIC FOR DERIVING INDUSTRY COST OF COMPLIANCE



*The major/minor designation was based on the change in the PEL (over or under 50 percent decrease) as well as chemical factors such as form, particle size, and vapor pressure

FIGURE VI-2 (CONTINUED)
COMPUTER LOGIC FOR DERIVING INDUSTRY COST OF COMPLIANCE



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When a respondent provided actual monitoring data for a process that indicated chemical exposures above the proposed standard, compliance costs were assigned to that process on the basis of prescribed controls for the given process. Where no monitoring data or reports of overexposure were available, the computer algorithm logic examined process and chemical characteristics to determine if workers at the process were potentially exposed to chemicals at levels over the proposed standard. The logic assessed the controls reported to be in place at the process and compared them with a list of controls throught necessary to control exposures in that process within the industry. When the requried controls were reported to be in place, no compliance cost was assigned. When the required controls were not reported to be in place, a compliance cost per work station was assigned.

The computer algorithm determined that some processes within plants had no potential overexposures and consequently no compliance costs. Zero compliance costs resulted where no proceses and/or chemicals were reported to occur at the establishment. Zero compliance costs also resulted when the respondent had monitored a process using ACGIH or NIOSH standards and found no overexposures. Where only very small quantities of chemicals, none of which were designed as "major" proposed exposure limit changes were present in a process, no overexposure was determined and zero compliance costs assigned. The major/minor designation was based on the proposed change in the PEL (over or under a 50 percent decrease) as well as chemical characteristics such as form, particle size, and vapor pressure.

Process configurations and location also were indications of compliance. Processes which were reported as completely enclosed with no worker entry were assumed to be in complaince with the proposed standard (have no compliance cost). Outdoor loading/offloading processes or other outdoor processes with no chemicals with "major" proposed exposure limit changes were assumed not to require control equipment and costs. Zero compliance costs were also assessed where processes which required control equipment reported that the prescribed equipment was currently in place.

An example of a process which was assigned a cost of compliance to install engineering controls is a coating and spraying process in SIC 2511, Wood Household Furniture. The survey respondent reported that toluene, n-butyl alcohol and xylene were used in this operation. The proposed standard for toluene reduces the existing PEL by 50 percent. This reduction is considered to require concerted exposure control and is considered a "major" proposed exposure limit change. Because workers were involved in the process and the process was reported to be neither located outdoors nor fully enclosed, controls were assumed necessary to insure compliance with the proposed standard. The control required for controlling exposures at this process was determined as local ventilation. The type of local ventilation prescribed in this case is a spray booth at an estimated cost of $3,070 annually per work station. Because the respondent reported no local ventilation, the cost was assigned for the eight work stations reported, resulting in a total estimated annual cost of $24,560 for this process at this site.

Expert engineering and industrial hygiene judgment was used to determine which of the various controls would be necessary to control for exposures by process in the affected industries. Engineering controls identified included exhaust ventilation (local and general); process enclosure; and process change. Some or all of these will be required by affected plants for compliance with the proposed exposure levels. In addition, personal protective equipment such as respirators will be needed for intermittent maintenance activities where engineering controls are not feasible. Skin and eye protection may also be required in certain situations.

The engineers and industrial hygienists classified the approximately 180 specific processes identified in the survey into about 20 process groups for the purpose of assessing required controls and estimating costs. These process groupings were based on similarities in the processes and levels and types of exposures resulting from the process. Factors used to group processes include the chemicals generally invovled in the process, type and usual configuration of the equipment, usual work station design, level and route of exposure, industry group where the process exists and worker tasks in relation to the equipment and exposure route. The process similarities translated into likenesses in required controls such as type of ventilation hood, booth or enclosure, air flow rates, duct configuration and type and size of filters or scrubbers. The compliance costs framework is presented in Figure VI–3. This figure presents the process groups, the industries where the processes were identified, the general classification of controls specified and work station unit costs for the required controls assigned.

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FIGURE VI-3.
COMPLIANCE COST FRAMEWORK AND WORK STATION UNIT COSTS

PROCESS GROUP (1)	INDUSTRY GROUP (SICs)	REQUIRED CONTROL CONFIGURATION (2)	ANNUAL COST PER WORK STATION
Leather Processing, major	31	Local Ventilation	$ 2,510
Leather Processing, minor	31	General Ventilation	$ 720
Electrical & Electronics Manufacture	36	Local Ventilation	$ 2,520
Printing Processes, minor	27, 38, 73, 80	Local Ventilation	$ 1,240
Printing Processes, major	27, 39	Local Ventilation	$ 3,510
Glass Processing, major	32	Local Ventilation	$ 3,890
Glass Processing, minor	32, 36	Enclosure	$ 90
Resource Recovery & Water Treatment, major	28, 29, 33, 49	Enclosure & Local Ventilation	$ 21,900
Resource Recovery & Water Treatment, major	26	Enclosure & Local Ventilation	$ 14,000
Resource Recovery & Water Treatment, minor	26, 29, 49, 50	Enclosure & Local Ventilation	$ 14,000
Foundry Operations, major	33	Local Ventilation	$ 2,520
Foundry operations, minor	33, 39	Local Ventilation	$ 1,820
Grinding, Blasting, & Metalworking, major	25, 33, 36, 39	Local Ventilation	$ 7,200
Metalworking & Welding	All SICs	Local Ventilation	$ 1,140
Coke Ovens	29 (3)	Enclosures, Local Ventilation & Air Purifiers	$150,000

1 The "major" and "minor" designation of process groups refers to the level of the exposure change and consequently the extent of required control configuration costs within a given control and process configuration. For example, leather processing is the general process group and processes within that group are classified based on whether the employee exposure control requires major or minor control costs.

2 The specific required control configuration cost was estimated including all necessary components, such as ductwork, fans, hoods, baghouses, etc.

3 Coke ovens in SIC 33 are not included as they are covered by OSHA's Coke Oven Standard

FIGURE VI-3 (Cont.)
COMPLIANCE COST FRAMEWORK AND WORK STATION UNIT COSTS

PROCESS GROUP	INDUSTRY GROUP (SICs)	REQUIRED CONTROL CONFIGURATION	ANNUAL COST PER WORK STATION
Paper Manufacturing, major	26, 30, 39	Ventilation & Air Purification in Control Rooms	$ 2,900
Paper Manufacturing, minor	All SICs	Local Ventilation	$ 180
High Temperature Drying	All SICs	Local Ventilation	$ 4,740
Layup	3632,3715,3732 3792,3995	Local Ventilation	$ 16,550
Coating, Spraying, & Adhesive Application	All SICs	Local Ventilation	$ 3,070
Chemical Handling & Formulation	All SICs	Local Ventilation	$ 1,760
Material Handling & Inspection, major	All SICs	Local Ventilation & Partial Enclosure	$ 1,120
Material Handling & Inspection, minor	All SICs	General Ventilation	$ 560
Cleaning & General Solvent Use, major	All SICs	Local Ventilation	$ 1,500
Cleaning & General Solvent Use, minor	All SICs	Local Ventilation	$ 710
Waste Collection & Transport	4953, 5093	Respirators (4)	$520 per worker
Painting, Maintenance	All SICs	Respirators (4)	$520 per worker
Welding, Maintenance	All SICs	Respirators (4)	$520 per worker
Zero Cost Processes:			
Laundering	72		
Embalming	72		
Permanents	72		
Anesthesia	80		

4 Use of respirators is considered the only feasible control for these processes due to their intermittent performance and because they are generally not performed at a fixed site.

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The development of unit costs for each control configuration required the development of "model" control designs. Model configurations were selected to provide exposure control at "typical" process/work stations with the specified process group. This costing approach ("model" configurations for "typical" work stations) required the differentiation of some process groupings as major or minor. The major/minor differentiation addresses the expected level of control required.

The control designs were developed by engineers based on their experience in industry and extensive secondary research on operations and exposure situations in each industry sector. This research included an examination of industry and industrial hygiene journals, engineering process reports, and texts. Included in the detailed cost calculations for the control configurations were costs for enclosure construction, baffles, fans, ductwork, filters, scrubbers, baghouses, and all other equipment required for exposure control. All of the costs were developed on a per work station basis so that an average size did not need to be estimated for the process. Investment costs were assigned to each control design on the basis of engineering handbooks and supplier catalogs. Investment costs were annualized over the projected life of equipment (10 years) using a 10 percent cost of capital and adding annual operating and maintenance costs estimated at 10 percent of the capital cost. Respirator costs for use by maintenance workers for intermittent activities were considered annual costs and include the respirator purchase as well as an estimated year's work of cartridges and canisters.

Process control costs were summed per establishment and any maintenance worker respirator requirements cost included. A total annualized capital cost and annual operating cost was developed for each establishment. Costs for the survey establishment were then weighted (by SIC and size) to represent compliance costs for the universe of affected plants.

Projected Impact by Industry Sector

Following the methodology described in the preceding section of this chapter, annual compliance costs were estimated by industry sector. The costs presented are based on the data collected from the over 5,300 survey respondents. (For industries not included in the survey, expert judgment and secondary sources were used for estimating costs.) A small percentage of respondents (less than 5 percent) actually provided monitoring data during the survey. However, based on survey data it was determined that about 86.1 percent of all establishments in the surveyed industries have no exposures in excess of the proposed standard and will not incur any costs to comply with the proposed standard. Only 11.1 percent of all establishments in the surveyed industries will incur costs to provide engineering controls for processes within the plant. However, over 20 percent of the firms which reported using the chemicals being regulated, will incur some engineering control costs. About 2.8 percent of the establishments in the surveyed industries will be required to provide personal protective equipment only for maintenance workers whose intermittent operations cannot be controlled with engineering controls.

Table VI–I presents the total annualized capital and annual operating cost for compliance with the proposed standard by industry. As shown, annual compliance costs are estimated to total $927.8 million. These costs represent an estimate of compliance costs for large and small plants in the universe of establishments to be affected by the proposed standard. Industries with some anticipated cost impact are identified below in order of the total annual compliance costs estimated.

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TABLE VI-1

ANNUAL OPERATING AND ANNUALIZED CAPITAL COST OF COMPLIANCE BY INDUSTRIAL SECTOR (a)

SIC (b)	SIC DESCRIPTION	LARGE PLANTS	SMALL PLANTS	ANNUAL COST
20	FOOD PROD. (c)	$21,704,100	$11,789,000	$33,493,100
21	TOBACCO (c)	$19,700	$0	$19,700
22	TEXT. MILL (c)	$23,308,400	$6,170,000	$29,478,400
23	APPAREL PROD. (c)	$23,604,300	$8,139,900	$31,744,200
24	LUMBER & WOOD	$20,534,800	$175,551,300	$196,086,100
25	FURNITURE	$7,915,300	$6,805,300	$14,720,600
26	PAPER PROD.	$30,966,900	$290,800	$31,257,700
27	PRINTING & PUB.	$15,263,300	$60,425,000	$75,688,300
28	CHEMICAL PROD.	$31,745,500	$8,412,100	$40,157,600
29	PETRO. REFINING	$6,800,700	$414,600	$7,215,300
30	RUBBER & PLASTICS	$53,256,200	$22,225,900	$75,482,100
31	LEATHER PROD.	$1,464,400	$1,115,100 (c)	$2,579,500
32	STONE & CLAY	$15,079,300	$7,463,300	$22,542,600
33	PRIM. METAL	$34,721,200	$5,612,400	$40,333,600
34	FAB. METALS	$50,927,100	$5,010,500	$55,937,600
35	MACHINERY	$43,986,300	$13,754,100	$57,740,400
36	ELEC. MACH.	$24,210,900	$7,570,500	$31,781,400
37	TRANS. EQUIP.	$20,884,600	$26,214,500 (c)	$47,099,100
38	INSTRUMENTS	$10,257,300	$3,207,400	$13,464,700
39	MISC. MANUF.	$13,861,200	$4,334,300	$18,195,500
40	R.R. TRANS.	$532,200	$0	$532,200
45	AIR TRANS.	$1,828,900	$0	$1,828,900
47	TRANS. SERV.	$1,853,100	$0	$1,853,100
49	ELEC. GAS. SAN.	$19,373,900	$3,314,500	$22,688,400
50	WHOLESALE TRADE	$1,416,300	$2,638,300	$4,054,600
51	WHOLESALE, NON-DUR	$3,094,200	$5,764,000	$8,858,200
55	AUTO DEALERS (c)	$9,862,500	$2,092,200	$11,954,700
72	PERSONAL SRV. (c)	$15,648,500	$15,639,300	$31,287,800
73	BUSINESS SRV. (c)	$3,701,700	$5,252,100	$8,953,800
75	AUTO REPAIR (c)	$466,800	$1,044,100	$1,510,900
76	MISC. REPAIR SRV.	$669,500	$4,179,000	$4,848,500
80	HEALTH SERV. (c)	$2,413,000	$2,026,400	$4,439,400
TOTAL		$511,372,100	$416,455,900	$927,828,000

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

(a) Costs were calculated by annualizing the capital cost over the projected life of the equipment (10 years) using a 10 percent cost of capital and adding an annual operating and maintenance cost estimated at 10 percent of the capital cost.

(b) Industry sectors not identified in this table include industries with no major cost impact expected, the construction industry, which will be the subject of a separate regulatory analysis, and industries such as mining, over which OSHA has no jurisdiction.

(c) Costs in these sectors were based on expert judgement and secondary data collection. Survey data for SICs 55, 72, 73, 75 and 80 was insufficient to estimate compliance costs.

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Manufacturing

Lumber and Wood Products (SIC 24). The annual costs of compliance in the lumber and wood products industry are estimated to total $196.1 million. The compliance costs for this sector are heavily weighted by the cost of controls required to lower exposures to the proposed limits for wood dust. The survey indicated that sanding and other "dusty" processes would require controls to lower wood dust exposure. The large number of establishments that must engineer ventilation systems for wood dust control account for the substantial proportion of compliance costs to be incurred by small establishments in this sector.

In addition to wood dust, controls for exposures to solvents and other chemicals in coating processes and exposures to wood preserving chemicals are estimated to result in compliance costs in SIC 24. Overall, about a fourth of all establishments is SIC 24 are estimated to incur compliance costs.

Printing and Allied Industries (SIC 27). Compliance costs in the printing industry sectors (an estimated $75.7 million) would result from ventilation requirements to control exposures to cleaning solvents and ink spray generated within the printing process. A very large number of small establishments are involved in printing and over 4,600 of them would be affected by the proposed standards. The survey indicated that a large number of small establishments currently lack exposure controls and provision of these controls account for the high control costs in this sector.

Rubber and Miscellaneous Plastics Products (SIC 30). Annual costs of compliance in this industry sector are estimated to total about $75.5 million. Controls were required for processes such as molding, and vulcanizing. Worker exposure to chemical vapors require the addition of local ventilation to many processes. The miscellaneous plastic products industry (SIC 3079) accounts for over 20 percent of the annual costs in this sector. The costs in SIC 3079 result from the high proportion of small plants in this sector which will incur costs of compliance. Controls are required in SIC 3079 for many crushing and grinding operations used to prepare plastic material for hot processes.

Machinery Except Electrical (SIC 35) and Electrical Machinery (SIC 36). The machinery manufacturing sectors together are estimated to incur total annual compliance costs of $89.5 million. Machinery except electrical accounts for $57.7 million of this total. The electrical machinery sector is estimated to require $31.8 million in annual compliance costs. Controls in these sectors would be required for exposures to metals, solvents and nuisance dusts.

Fabricated Metal Products Manufacturing (SIC 34). Plating and coating establishments (SIC 347) and miscellaneous fabricated products (SIC 349) would account for a major portion of the $55.9 million annual costs in SIC 34. Worker exposures in this industry sector result from chemicals used in plating processes, solvents and coatings, metals and dusts. The survey indicated that ventilation systems are not now present at many of the processes with chemical exposure.

Transportation Equipment Manufacturing (SIC 37). Annual costs of compliance for SIC 37 are estimated at $47.1 million. Costs in the truck and car body and motor vehicle parts sectors (SICs 3711, 3713, 3714) would account for a large percentage of the costs in SIC 37. Controls may be needed in order to control exposures to heavy metals, solvents, welding fumes and a large variety of other chemicals at large scale hot processes. Additionally, costs in small plants in this sector will include compliance activities to control exposures to styrene and other chemicals in small boat construction, as well as trailer and recreational vehicle insulation.

Primary Metal Manufacturing (SIC 33). The annual costs of compliance in primary metal manufacturing are estimated to total $40.3 million. This estimate derived from the survey may somewhat undercount the compliance costs required in this sector. The cost algorithm assigned costs where prescribed controls were not in place. While many establishments in SIC 33 had controls in place, it is possible that the controls were not all operationally sufficient to control missions to the levels of the proposed standard.

The compliance costs for this sector are heavily weighted by the cost of controls required in large establishments in this segment. Blast furnace establishments, and primary foundries contain large numbers of hot processes which require controls. Control of emissions from hot metal processes to the levels indicated in the proposed standard will require large increases in the amount of air being moved through the ventilation systems. Additionally, costs will be required to enlarge the capacity of scrubbers and baghouse operations.

Chemicals and Allied Products (SIC 28). Annual compliance costs in SIC 28 are estimated to total $40.2 million. Over 25 percent of the costs in SIC 28 are estimated to occur in paints and allied products manufacturing (SIC 2851). The survey indicated that a large proportion of plants will require additional controls for the number and type of substances used in paint and paint product manufacturing. There are many chemicals in this industry segment which present exposure problems in a variety of wet and dry processes, including reaction, separation, crushing, mixing, drying and bagging.

Industry group SIC 282, Plastics Materials, Synthetic Resins, Synthetic Rubber also accounts for a major portion (about 22 percent) of compliance costs in this sector. Compliance costs are related to ventilation and other requirements to control carbon disulfide and other emissions in the manufacture of plastics materials and synthetic rubber.

Food and Kindred Products (SIC 20). Costs are projected for a large number of establishments in this sector. The prepared feeds and feed ingredients, not elsewhere classified (SIC 2048) are estimated to account for a large percentage of the $33.5 million annual costs in SIC 20. Controls may be necessary for dust exposures and chemical fumigants.

Paper and Allied Products (SIC 26). Annual costs in the paper and allied products industry are estimated to be $31.3 million. Much of the estimated costs in SIC 26 will be associated with the cost of controls in large pulp mill and associated operations. Pulp mills are operated separately (those listed in SIC 2611) or as part of paper or paperboard mills (SIC 2621 and SIC 2631 respectively). The cost of compliance in these operations would result from controlling the large quantities of chemicals used in breaking down the pulp to form cellulose and the reactions that occur in the digesting process. The digesting and bleaching operations required further ventilation or enclosure.

Apparel and Other Finished Products (SIC 23) and Textile Mill Products (SIC 22). These sectors have a large number of establishments which may incur compliance costs. The apparel industry is estimated to incur about $31.7 million in annual compliance costs. Many of the affected establishments in SIC 23 may require controls for cleaning solvents such as perchloroethylene as well as nuisance dusts. The $24.5 million annual costs in the textile industry are estimated to result from control of exposures to dusts, solvents, dyes and other substances.

Stone, Clay, Glass and Concrete Product Manufacturing (SIC 32). The stone, clay, glass and concrete product industry is estimated to incur

compliance costs of about $22.5 million. A major part of the annual costs in this industry segment may occur in the concrete, gypsum and plaster products (SIC 327) industries. According to the survey, controls in this sector are primarily expected to control nuisance particulates generated during large scale crushing, grinding and sizing operations.

Miscellaneous Manufacturing (SIC 39). This industry accounts for a wide range of products, processes and chemical exposures. About half of the establishments that would incur the $18.2 million annual cost in the industry are believed to be included in SIC 3999, miscellaneous manufacturing not elsewhere classified.

Furniture and Fixtures (SIC 25). Annual costs of compliance in the furniture and fixtures industries are estimated to total $14.7 million. Costs to control wood dust exposures during sanding, cutting and other dusting processes are the major components of compliance costs in this sector. Establishments would also incur costs for control of coatings and solvents. The survey indicated that the furniture sectors which include metal working (SICs 2514, 2515, 2522, 2542, 2591 and 2599) would also require controls for welding fumes and various metal particulates resulting from grinding and other processes.

Instruments Manufacturing (SIC 38). Annual control costs in SIC 38 are estimated to total $13.5 million. Exposures in this sector are to a large number of chemicals used within instruments and to dust, metals and solvents.

Petroleum Refining and Related Products (SIC 29). Petroleum refining may account for a large percentage of the $7.2 million annual costs in SIC 29, even though a relatively limited number of establishments in the petroleum refining industry would require additional controls. This industry has extensive control technology in place as well as many closed processes with few exposed workers.

Other Manufacturing. The lowest costs of compliance in the manufacturing sectors are expected to occur in SIC 21, Tobacco Manufacturers, ($0.02 million) and SIC 31, Leather and Leather Products ($2.6 million). It is estimated that very few plants will incur costs in the tobacco manufacturing industry. In the leather and leather products industry sector, most of the affected establishments produce manufactured leather goods.

Transportation, Communication, Utilities

The transportation and utilities sectors (SICs 40, 45, 47, and 49) include a large number of establishments. However, operations at Railroad (SIC 40), and Air Transport establishments (SIC 45) are subject to regulation by other Federal agencies in addition to OSHA. Consequently, the number of establishments which would incur costs to comply with the proposed standard are limited. For railroads, OSHA's standards normally apply to off-track operations.

Electric, Gas and Sanitary Service Utilities (SIC 49). Annual cost in the utilities sectors are estimated to total $22.7 million. Costs would result from installation and improvement of controls necessary for activities such as boiler/furnace feed preparation in electric services, odorant addition by natural gas companies, and water treatment and purification of water supplies.

Transportation Services Sector (SIC 47). The $1.8 million annual costs in the SIC 47 may primarily be incurred in SIC 4789, transportation services not elsewhere classified. This sector includes establishments which provide incidental services such as cleaning railroad ballast and other rail car maintenance.

Wholesale and Retail Trade

Costs in the wholesale trade sectors (SICs 50, 51), are estimated to total about $12.9 million annually. A large percentage of the total number of establishments which would incur costs to comply with the proposed rule are in SIC 5093, scrap and waste materials, wholesale.

The only retail trade sector expected to incur compliance costs, Auto Dealers (SIC 55) is estimated to incur $12.0 million annually. These costs result from the potentially large number of motor vehicle dealers (SIC 5511) which may incur compliance costs to control exposures to paints, coatings and solvents during vehicle spray and coating operations. The costs result from the installation of paint spray booths.

Services

The services sectors, SICs 72, 73, 75, 76 and 80 are estimated to total about $51.0 in annual compliance costs. The major costs (61.3 percent) in these sectors would result from potential compliance activities in SIC 721, laundry, cleaning and garment services. Establishments in SIC 721 would incur annual operating and annualized capital costs to control exposures for dry cleaning operations.

Additional costs in the service sectors may result from control of solvent chemicals in SIC 734, building services, control of welding fumes at welding repair operations (SIC 7692), control of solvent and photographic chemicals in mailing, reproduction, commercial art and photography and stenographic services (SIC 733), and local ventilation for exposure control in SIC 8071, medical laboratories.

Per Plant Average Costs

Table VI–2 presents the estimated average per plant annual cost of compliance by industry sector. Costs shown in this Table are calculated only for those establishments in a sector which would incur costs. Average per plant annual operating and annualized capital costs for all affected establishments across industry sectors is estimated at $9,200. The per plant cost for large plants is $14,400 and for small plants with fewer than 20 employees, $6,300.

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TABLE VI-2

AVERAGE PER PLANT ANNUAL COSTS AND NUMBERS OF AFFECTED PLANTS

SIC (a)	SIC DESCRIPTION	ANNUAL COST OF	TOTAL # PLANTS	# OF AFFECTED PLANTS	% AFFECTED	AVERAGE COST PER AFFTED PLANT	AVERAGE COST PER LARGE AFFTED PLANT	AVERAGE COST PER SMALL AFFTED PLANT
20	FOOD PROD. (b)	$33,493,100	29,043	4,932	16.98%	$6,800	$13,000	$3,600
21	TOBACCO (b)	$19,700	216	3	1.39%	$6,600	$6,600	$0
22	TEXT. MILL (b)	$29,478,400	11,023	2,765	25.08%	$10,700	$21,400	$3,700
23	APPAREL PROD. (b)	$31,744,200	30,032	6,179	20.57%	$5,100	$11,500	$2,000
24	LUMBER & WOOD	$196,086,100	17,383	3,715	21.37%	$52,800	$14,200	$77,400
25	FURNITURE	$14,720,600	13,072	2,001	15.31%	$7,400	$9,900	$5,700
26	PAPER PROD.	$31,257,700	6,583	2,060	31.29%	$15,200	$20,400	$500
27	PRINTING & PUB.	$75,688,300	59,107	6,077	10.28%	$12,500	$10,500	$13,100
28	CHEMICAL PROD.	$40,157,600	15,345	3,620	23.59%	$11,100	$14,500	$5,900
29	PETRO. REFINING	$7,215,300	2,271	378	16.64%	$19,100	$25,700	$3,700
30	RUBBER & PLASTICS	$75,482,100	14,964	4,229	28.26%	$17,800	$24,700	$10,700
31	LEATHER PROD.	$2,579,500	2,196	822	37.43%	$3,100	$11,200	$1,600
32	STONE & CLAY	$22,542,600	13,980	3,958	28.31%	$5,700	$7,900	$3,600
33	PRIM. METAL	$40,333,600	7,640	2,744	35.92%	$14,700	$20,100	$5,500
34	FAB. METALS	$55,937,600	33,946	6,285	18.51%	$8,900	$14,800	$1,800
35	MACHINERY	$57,740,400	62,443	8,059	12.91%	$7,200	$13,300	$2,900
36	ELEC. MACH.	$31,781,400	34,370	4,436	12.91%	$7,200	$13,300	$2,900
37	TRANS. EQUIP.	$47,099,100	12,834	4,444	34.63%	$10,600	$14,400	$8,800
38	INSTRUMENTS	$13,464,700	14,561	1,879	12.91%	$7,200	$13,300	$2,900
39	MISC. MANUF.	$18,195,500	19,677	2,540	12.91%	$7,200	$13,300	$2,900
40	R.R. TRANS.	$532,200	4,798	81	1.68%	$6,600	$6,600	$0
45	AIR TRANS.	$1,828,900	16,487	277	1.68%	$6,600	$6,600	$0
47	TRANS. SERV.	$1,853,100	16,705	281	1.68%	$6,600	$6,600	$0
49	ELEC. GAS. SAN.	$22,688,400	15,935	1,409	8.84%	$16,100	$16,400	$14,400
50	WHOLESALE TRADE	$4,054,600	12,222	1,228	10.05%	$3,300	$7,700	$2,500
51	WHOLESALE, NON-DUR	$8,858,200	26,701	2,683	10.05%	$3,300	$7,700	$2,500
55	AUTO DEALERS (b)	$11,954,700	189,214	3,091	1.63%	$3,900	$6,600	$1,300
72	PERSONAL SRV. (b)	$31,287,800	161,004	12,453	7.73%	$2,500	$27,900	$1,300
73	BUSINESS SRV. (b)	$8,953,800	382,626	4,557	1.19%	$2,000	$6,600	$1,300
75	AUTO REPAIR (b)	$1,510,900	149,260	528	0.35%	$2,900	$14,600	$2,100
76	MISC. REPAIR SRV.	$4,848,500	13,856	2,388	17.23%	$2,000	$2,200	$5,000
80	HEALTH SERV. (b)	$4,439,400	313,076	1,156	0.37%	$3,800	$12,500	$2,100
TOTAL		$927,828,000	1,702,569	101,258	5.95%	$9,200	$14,400	$6,300

(a) Industry sectors not identified in this table include industries with no major cost impact expected, the construction industry, which will be the subject of a separate regulatory analysis, and industries such as mining, for which OSHA does not have jurisdiction.

(b) All data shown for these industries was derived from secondary sources and expert judgement.

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The highest costs on an average per plant basis are expected to occur in SIC 24. Average per plant costs in SIC 24 may total $52,800 in annual operating and annualized capital costs. This per plant cost is heavily weighted by the above average costs which may be incurred by small establishments to control worker exposure to wood dust. Per plant costs in SIC 24 are substantially higher than those in the next highest industry, SIC 30, Rubber and Plastics. The $17,800 per plant costs in this industry result from above average compliance costs estimated for exposure control in molding and vulcanizing in large plants and crushing and grinding operations in small plants.

Although small establishments, account for about 65.0 percent of the 101,200 affected establishments, compliance costs for small establishments are expected to account for roughly 44.9 percent of total industry compliance costs.

References

1. Dun and Bradstreet, Inc., 1985 Count of Establishments. (Database)

VII. Economic Impact, Regulatory Flexibility Analysis and Environmental Impact Assessment

Economic Impact

The economic impacts discussed in this chapter have been estimated following an analysis of data collected through a nationwide sample survey of over 5,300 affected establishments. Two alternative polar assumptions were used in this analysis.

- *Perfectly Elastic Demand or Zero Cost-Passthrough:* All compliance costs are absorbed by the firm in the form of reduced profits. This assumption is the "worst case" scenario, where the maximum reduction in profits to the firm (and industry) results.
- *Perfectly Inelastic Demand or Total Cost-Passthrough:* All compliance costs are passed on to the consumer sector in the form of higher prices. From the perspective of the firm, this is the "best case" scenario. The resulting price increase would be the maximum theoretically possible.

Two points should be noted. First, for the majority of industry sectors, neither assumed market structure would be accurate. In practice, the impacts will almost always produce a price increase smaller than the inelastic demand projection and a reduction in profits smaller than that predicted under perfectly elastic demand conditions. Second, increased firm productivity would mitigate any adverse economic effects of the proposed standard. Productivity effects would be related to reduced worker illness, absence and turnover. In addition, knowledge of improved workplace health conditions could result in higher workforce morale and productivity . The firm would enjoy lower employee training costs (due to the reduced turnover rate) and lower medical benefit and worker compensation claims. Overall productivity increases would be realized by firms that use a relatively fixed-factor production process (i.e., low elasticities of substitution between labor and other factors of production). It is difficult to estimate the magnitude of these productivity and cost reducing effects. Any estimated economic costs of compliance would have to be adjusted downward to reflect these effects. Since data were not available to make any offset estimates, the economic effects of the proposal identified in this chapter, are overstated.

For this analysis, OSHA used a percentage reduction in profits approach to obtain estimates of the short-run economic impacts under the assumption of perfect demand elasticity. These estimates were obtained by using the following formula:

$$\text{Percentage Reduction} = \frac{\text{New Profits—Old Profits}}{\text{Old Profits,}}$$

where New Profits = Old Profits—Compliance Costs, and
Old Profits = (Return on Sales)*(Total Sales).

These calculations were performed at the two-digit SIC level for firms in large and small size-class stratifications (above and below 20 employees). The data used to obtain these estimates was based on Dun and Bradstreet company files [1;2].

The potential impact on prices was used to estimate the market consequences under the second assumption of inelastic demand. This price increase was estimated for each industry at the four-digit SIC level. Total sales values for 1985 were used, the year for which the compliance costs were estimated. (Total sales represent the totality of production that leaves the establishment, whether it is sold to customers or sent to a parent company in a captive transaction. For industries in the service and trade sectors, total sales data were used. The rate of return percentage for each industry sector corrected and transformed gross sales data into more accurate and relevant industry profit estimates.)

For a given firm-size class, the potential price increase was estimated by dividing the total estimated compliance costs for a firm by the sales of that firm. These estimated price effects were then compared to recent industry price series. The intent of this comparison was to evaluate the impact of the compliance cost-generated price increase in light of recent industry price increase experience.

In this scenario, the potential for international trade implications of the proposed standard was explored. It is anticipated that any international trade effects will not be significant given the small value of domestically produced goods and services which are exported (about seven percent of GDP). Also, in recent months, the U.S. dollar has experienced a sharp decline in value relative to the yen and European currencies. Between February 1985 and December 1987, the trade-weighted value of the U.S. dollar fell 46 percent [3]. This depreciation overwhelms any potential adverse international economic effect of the standard.

In Table VII–1 and VII–2, the estimated domestic economic impacts are reported for the two polar methodologies. To derive the percentage change in profits and the costs as a percent of sales, industry sales and rate of return (R.o.R.) on sales data were obtained from Dun and Bradstreet. The total sales data are best estimates for industry sectors potentially impacted by the proposed rulemaking.

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TABLE VII-1

ECONOMIC EFFECTS: NO-COST PASSTHROUGH SCENARIO[1]

SIC	Industry	Annual Costs[2] ($ millions)	Total Sales[3] ($ millions)	R.o.R. on Sales (%)[4]	Pre-Reg Profits ($ m)	Post-Reg Profits ($ m)	% Change in Profits
20	FOOD PROD.	33.49	353,780.38	1.9	8,008.04	7,986.29	- 0.2715
21	TOBACCO	0.02	74,030.13	5.3	3,923.60	3,923.59	- 0.0003
22	TEXT. MILL	29.48	60,735.22	2.7	1,765.42	1,747.59	- 1.0100
23	APPAREL PROD.	31.74	74,474.65	2.8	1,813.22	1,793.56	- 1.0845
24	LUMBER & WOOD	196.09	57,994.48	3.9	1,974.51	1,814.21	- 8.1188
25	FURNITURE	14.72	37,648.27	3.5	1,411.02	1,400.96	- 0.7129
26	PAPER PROD.	31.26	103,694.14	3.7	3,778.20	3,761.24	- 0.4489
27	PRINTING & PUB.	75.69	134,830.21	4.8	6,471.85	6,412.25	- 0.9210
28	CHEMICAL PROD.	40.16	272,759.67	3.7	11,738.80	11,714.76	- 0.2048
29	PETRO. REFINING	7.22	196,400.57	2.7	4,964.85	4,960.84	- 0.0808
30	RUBBER & PLASTICS	75.48	86,538.58	4.3	3,423.75	3,376.10	- 1.3918
31	LEATHER PROD.	2.58	15,449.56	2.6	401.69	399.95	- 0.4328
32	STONE & CLAY	22.54	46,094.04	4.1	1,954.99	1,940.73	- 0.7300
33	PRIMARY METALS	40.33	112,564.26	3.3	3,714.62	3,691.27	- 0.6286
34	FAB. METALS	55.94	150,146.41	4.0	6,005.86	5,974.10	- 0.5288
35	MACHINERY	57.74	345,144.89	5.1	17,602.39	17,566.95	- 0.2013
36	ELEC. MACH.	31.78	245,982.70	5.0	12,299.14	12,279.63	- 0.1586
37	TRANS. EQUIP.	47.10	365,427.20	3.9	14,520.25	14,486.69	- 0.2311
38	INSTRUMENTS	13.46	83,359.57	4.9	3,373.26	3,365.00	- 0.2450
39	MISC. MANUF.	18.20	41,870.30	4.4	1,788.56	1,777.39	- 0.6245
40	R.R. TRANS.	.53	43,869.14	10.0	3,969.62	3,969.34	- 0.0072
45	AIR TRANS.	1.83	109,538.08	3.6	3,251.40	3,250.41	- 0.0304
47	TRANS. SERVICES	1.85	12,254.96	2.7	582.18	581.18	- 0.1719
49	ELEC.,GAS & SAN.	22.69	300,254.83	7.0	21,017.84	21,004.06	- 0.0655
50	WHOLESALE TRADE[5]	4.05	13,853.52	2.0	277.07	273.67	- 1.2285
51	WHOLESALE, NON-DUR	8.86	113,848.20	1.5	1,726.26	1,721.48	- 0.2771
55	AUTO DEALERS	11.95	341,574.50	1.9	6,489.92	6,482.81	- 0.1095
72	PERSONAL SERV.	31.29	24,270.74	7.3	1,771.76	1,750.02	- 1.2272
73	BUSINESS SERV.	8.95	22,165.94	6.6	1,462.95	1,455.45	- 0.5126
75	AUTO REPAIR	1.51	45,750.92	5.1	2,492.19	2,491.05	- 0.0457
76	MISC. REPAIR SERV.	4.85	2,665.52	5.5	146.60	142.69	- 2.6696
80	HEALTH SERVICES	4.44	170,234.25	4.5	7,807.72	7,804.54	- 0.0406

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

Notes:
1. All values in 1985 dollars.
2. Reproduced from Table VI-1.
3. Dun and Bradstreet, Dun's Marketing Identifiers (DMI) Database.
4. Rate of Return on Sales, Dun and Bradstreet, Industry Norms Database.
5. Consists of SIC 5093 (scrap and waste materials) only.

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TABLE VII-2.—ECONOMIC EFFECTS: TOTAL-COST PASSTHROUGH

SIC	Industry	Annual Costs (dollars millions)	Total Sales (dollars millions)	Costs as a percent of sales
20	Food prod	33.49	353,780.38	0.0095
21	Tobacco	0.02	74,030.13	.0000
22	Text. mill	29.48	60,735.22	.0485
23	Apparel prod	31.74	74,474.65	.0426
24	Lumber & wood	196.09	57,994.48	.3381
25	Furniture	14.72	37,648.28	.0391
26	Paper prod	31.26	103,694.14	.0301
27	Printing & pub	75.69	134,830.21	.0561
28	Chemical prod	40.16	272,759.67	.0147
29	Petro. refining	7.22	196,400.57	.0037
30	Rubber & plastics	75.48	86,538.58	.0872
31	Leather products	2.58	15,449.56	.0167
32	Stone & clay	22.54	46,094.04	.0489
33	Prim. metals	40.33	112,564.26	.0358
34	Fab. metals S	55.94	150,146.41	.0373
35	Machinery	57.74	345,144.89	.0167
36	Elec. mach	31.78	245,982.70	.0129
37	Trans. equip	47.10	365,427.20	.0129
38	Instruments	13.46	83,359.57	.0162
39	Misc. manuf	18.20	41,870.30	.0435
40	R.R. trans	.53	43,869.14	.0012
45	Air trans	1.83	109,538.08	.0017
47	Trans. services	1.85	12,254.96	.0151
49	Elec, gas & san	22.69	300,254.83	.0076
50	Wholesale trade [1]	4.05	13,853.52	.0293
51	Wholesale, non-dur	8.86	113,848.20	.0078
55	Auto dealers	11.95	341,574.50	.0035
72	Personal services	31.29	24,270.74	.1289
73	Business service	8.95	22,165.94	.0404
75	Auto repairs	1.51	45,750.92	.0033
76	Misc. repair serv	4.85	2,665.52	.1819
80	Health services	4.44	170,234.25	.0026

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.
NOTE.—1. Consists of SIC 5093 (scrap and waste materials) only.

Dun and Bradstreet provided OSHA with this information. The R.O.R. on sales were obtained from summary statistics found in the Dun and Bradstreet Industry Norms Database.

Industry Effects

The estmiated economic impact of the proposed rule from firms potentially affected is summarized in Table VII-1. These estimates represent the maximum industry impact within a market scenario where none of the costs can be passed onto consumers, and there is no productivity offset to costs.

Data in Table VII-1 indicate that the proposed rule will not have a significant impact on profits in most industry sectors. The estimated average change in profits is less than one percent; this amount of profit reduction should not represent a significant economic burden.

The most adversely affected industry sector is SIC 24 with an estimated 8 percent reduction in profits. The only other industry with an impact greater than 2 percent is SIC 76, Miscellaneous Repair Services (2.7 percent). However, even in the worst case, OSHA believes the proposal is economically feasible. In reality, the reduction in profits will be less because part of the costs will be passed on to consumers.

Consumer effects were estimated using a "full cost passthrough" scenario. As demonstrated by the estimates summarized in Table VII-2, the impacts on market prices will not be significant. No price increase would exceed one half of one percent. Changes of this magnitude are within general price movements recorded by producer price and other price indicies.

Regulatory Flexibility Analysis

In accordance with the Regulatory Flexibility Act (Pub. L. 96-353, 94 Stat. 1164 (5 U.S.C. 601 *et seq.*)), OSHA has assessed the impact of the proposed rulemaking on large and small establishments. For this assessment, large establishments are defined as those with 20 or more employees and small establishments as those with 19 or fewer employees. The results of this assessment are summarized in Table VII-3.

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TABLE VII-3

ECONOMIC IMPACTS BY ESTABLISHMENT SIZE

SIC	Industry	Percentage Change in Profits	
		Large	Small
20	FOOD PROD.	- 0.1526	- 3.0770
21	TOBACCO	- 0.0003	- 0.0000
22	TEXT. MILL	- 0.7442	- 7.0804
23	APPAREL PROD.	- 0.7916	- 3.4067
24	LUMBER & WOOD	- 0.6683	-47.3160
25	FURNITURE	- 0.3306	- 4.9038
26	PAPER PRODUCTS	- 0.4613	- 0.1559
27	PRINTING & PUB.	- 0.1579	- 4.1037
28	CHEMICAL PROD.	- 0.1533	- 1.2443
29	PETRO. REFINING	- 0.0754	- 0.3721
30	RUBBER & PLASTICS	- 0.8900	- 9.8232
31	LEATHER PROD.	- 0.2115	- 3.4147
32	STONE & CLAY	- 0.5342	- 1.4208
33	PRIMARY METALS	- 0.5330	- 2.3396
34	FAB. METALS	- 0.5079	- 0.7201
35	MACHINERY	- 0.1402	- 1.7854
36	ELEC. MACH.	- 0.1087	- 2.3924
37	TRANS. EQUIP.	- 0.0782	-21.2970
38	INSTRUMENTS	- 0.1704	- 2.2245
39	MISC. MANUF.	- 0.4920	- 1.3785
40	R.R. TRANS.[1]	n/a	n/a
45	AIR TRANS.[1]	n/a	n/a
47	TRANS. SERVICES[1]	n/a	n/a
49	ELEC., GAS & SAN.[1]	n/a	n/a
50	WHOLESALE, TRADE[2]	- 0.7355	- 1.8818
51	WHOLESALE, NON-DUR	- 0.1776	- 0.3964
55	AUTO DEALERS	- 0.1267	- 0.0778
72	PERSONAL SERV.	- 1.0749	- 1.3488
73	BUSINESS SERV.	- 0.3186	- 0.8749
75	AUTO REPAIR	- 0.0527	- 0.0441
76	MISC. REPAIR SERV.	- 0.8702	- 3.3812
80	HEALTH SERVICES	- 0.0736	- 0.0295

Source: U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis.

Notes: 1. Percent of profit attributable to small firms was not available.

2. Consists of SIC 5093 (scrap and waste materials) only.

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Industry sales and profit estimates were based on data from Dun and Bradstreet and the Department of Commerce 1982 Census of Manufacturers [5], Wholesalers [6], Retailers [7], and Services [8]. Sales and profit data for selected transportation sector industries (SIC 40, 45, 47, and 49) were not available for use in this preliminary assessment.

The information summarized in Table VII–3 indicates that some small establishments will experience some adverse impact. The smaller profit margins of some small establishments make it difficult for them to absorb increases in compliance costs. In particular, small establishments in SIC 24 (Lumber and Wood), SIC 37 (Transportation Equipment Manufacturers), and SIC 30 (Rubber and Plastics) show high potential changes in profits. Some of these industries are capital-intensive and the costs are not high in proportion to the capital invested. OSHA requests comments on approaches to reduce the impact on these establishments.

It should be noted that these negative effects result in part from the extreme assumption of perfectly elastic demand. An important ameliorating factor for each firm will be its ability to pass through additional costs to the consumer. The ability of individual firms to do this will be dependent upon product demand elasticities. It is expected that most impacted firms will be able to pass through some portion of their increased costs.

Environmental Impact Assessment

This assessment has been prepared in accordance with provisions of the National Environmental Policy Act (NEPA) (42 U.S.C. 4325 *et seq.*) as well as the regulations of the Council on Environmental Quality (40 CFR Part 1500), and DOL–NEPA Compliance Procedures (29 CFR Part 11).

OSHA has reviewed the proposal and the information contained in the secondary data bases as well as the information submitted by the contractors' industry experts and has concluded that no significant environmental impacts are likely to occur as a result of this action.

Two environments may be affected by an OSHA regulatory action: (1) The workplace environment; and (2) the general human environment external to the workplace, including impacts on air and water pollution, solid waste, energy, and land use. Usually OSHA regulations have their most significant impacts on the workplace environment since this environment is under the Agency's jurisdiction. Lower and new PELs would benefit the workplace environment because they would reduce worker exposure to toxic substances.

In most cases, the effects of previous OSHA regulations on the external environment have been negligible because of their limited scope and application. Similarly, there is no evidence to indicate that there would be any significant adverse impacts to the external environment as a result of this proposal. As with other OSHA regulations in the past, however, there may be a potential benefit to the environment, The potential benefits and other impacts are briefly summarized here.

Air Pollution

Because of the nature of the emission standards of the Environmental Protection Agency (EPA) (40 CFR Part 61), many industry operations already use engineering controls to reduce the amount of emissions to the atmosphere. This practice is not expected to change as a result of the proposal. OSHA anticipates that controls already in place will continue to operate effectively in reducing emissions under the proposed revisions. Fourteen of the chemicals addressed in this proposal have been recognized by EPA as air pollutants. These are listed below:

- Beryllium
- Carbon Monoxide
- Epichlorhydrin
- Ethylene dichloride
- Hexachlorocyclopentadiene
- Mercury
- Methyl chloroform
- Nitrogen dioxide
- Ozone
- Perchloroethylene
- Sulfur dioxide
- Toluene
- Trichloroethylene

Water Pollution

EPA regulates over 100 of the chemicals addressed in this proposal under the Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*). EPA's effluent limitation guidelines (40 CFR Part 427) include (1) standards of performance for all new point sources within specified categories and (2) pretreatment standards for new plants discharging to municipal sewer systems. These limitations would serve to prevent the discharge of effluents into the environment without prior treatment. Moreover, the Fedral Water Pollution Control Act Amendments of 1972 required that wastewater effluents be treated by the best practicable technology (BPT) by December 31, 1977 and that the best available technology (BAT) economically achievable be used by December 31, 1983. The EPA effluent limitations establish the degree of effluent quality necessary to meet the BPT and BAT requirements. The BAT and pretreatment standards would essentially mean no discharge of process wastewater to navigable waters and no discharge of incompatible pollutants. These requirements will not change as the result of this proposal and where they continue to be met, effluent quality will not be altered.

Solid Waste Disposal

It does not appear that there would be any significant change in present waste disposal practices for over 80 chemicals addressed by this proposal, or in the maintenance of waste disposal sites. EPA's national emissions standards will continue to provide for the control and maintenance of active and inactive disposals as well as require no visible emissions from these sites.

Energy and Land Use

The implementation of required engineering controls could result in an increase in total energy requirements or costs for general industry. This would be particularly true where controls are not in place. Where general exhaust ventilation is used, there is the expense of heating or cooling the replacement air brought in from the outside. These costs, plus the cost of vacuuming, where necessary, have been included in the annual costs estimated in Chapter VI. In terms of land use, OSHA does not project any significant impact on land use plans, policies or controls. OSHA does not anticipate any significant impact on the short term uses of man's environment or upon the maintenance of long-term productivity.

Other Impacts

The proposal could also have other impacts that may affect the external environment. The proposal could encourage the further use, research, and development of suitable substitutes for hazardous chemicals. This, in turn, would result in a positive environmental effect because fewer hazardous chemicals would be used, emitted to the air, discharged as wastewater effluent, or disposed of as solid waste. The magnitude or probability of these impacts, however, is impossible to quantify.

Overall, the projected impacts of the proposed standard on the external environment are not expected to be significant in view of EPA's regulation of air emissions, water effluents, and solid waste disposal methods.

Summary

Based on the data summarized in Tables VII–1 and VII–2 and historical information, OSHA has initially concluded that the economic impacts of the proposed rulemaking will not unduly burdensome for firms in the industries potentially affected. However, some industry sub-sectors may experience an adverse economic impact. In addition, the estimates indicate that some small establishments in SICs 24, 30, and 37 may experience a greater impact than larger entities. OSHA requests comments on approaches to reduce the impact on those small establishments. It should be emphasized that these estimates are preliminary. The proposed rule is not expected to have an adverse effect on the environment.

References

1. Dun and Bradstreet, Inc. Industry Norms and Key Business Ratios. 1985. (Database)
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Supplement 1 to Appendix B—Technical Description of the Sample Survey

1. Introduction

This appendix contains a description of the statistical methodology employed to design and implement the PEL survey. The following topics will be discussed:

- Survey objectives;
- Sampling frame selection;
- Stratification;
- Sample size determination;
- Estimation procedures;
- Data collection method;
- Variance estimation;
- Treatment of non-sampling errors; and
- Survey treatment.

Survey Objectives

Surveys are frequently designed to produce a set of estimates at a predefined level of accuracy. This requires defining the set of quantities to be estimated and specifying their levels of accuracy. Since many variables may ultimately be estimated from the survey, and since no single design can be optimal for all estimates simultaneously, it is customary to define the most important variables for estimation. For this survey, the following variables were identified as those motivating the survey design:

- Cost to industry of the proposed set of new permissible exposure limits (as a group);
- Number of workers potentially exposed to toxic substances; and
- Number of workers affected by the proposed regulations.

Statistical theory dictates that responses be concentrated both in groups which have the highest variability with respect to these variables and in groups representing the majority of establishments in the population. No hard information relating to the variability of the variables mentioned above by industry sector or other relevant breakdown was available at the outset of the survey. Hence, the variability in the number of employees was used as a variability measure. Consistent with the notion that the variability of numbers exposed as well as the variability of cost required to remedy an overexposure are highest in the largest companies, the sample was designed to include a higher proportion of larger establishments.

The sample was drawn so as to insure that the coefficient of variation of estimates (the ratio of the sample standard error to the mean) was within predetermined bounds. The coefficient of variation is a measure of the accuracy of each estimate. A coefficient of variation of.5 percent means that the standard error of the estimate is equal to 5 percent of that estimate. This can be interpreted as saying that the estimate is within two standard errors or 10 percent of the true value with 95 percent probability. Since risks were judged to be different in different sectors, OSHA selected a 5 percent coefficient of variation in the industries using the most chemicals, 7.5 percent in industries with moderate use of chemicals and 10 percent in the service sectors. A table of design specifications in included in Section 5 below.

3. Sampling Frame Selection

The Dun and Bradstreet (D&B) listing was chosen for the PEL survey sampling frame (a listing of establishments from which sample units are selected). This is a nationally based list, containing establishment names as well as each establishment's address, telephone number, SIC code, and number of employees. The Dun and Bradstreet database is regularly refined (every six months) thus minimizing the probability of obtaining out of business or out of scope (e.g., wrong SIC code) establishments when using the frame. The D&B is a commercial listing and its use does not violate any confidentially requirement associated with other frames available to particular agencies in the government.

4. Stratification

Thirty-four groupings of industries (estimation cells) were chosen to be examined for the PEL study. The cell definitions were determined by grouping together industry sectors defined by Standard Industrial Classifications (SICs) which share similar processes and procedures. The cell definitions used for the PEL survey are given in TABLE 1–1.

TABLE 1–1.—DEFINITIONS OF ESTIMATION CELLS

Cell No.	SIC codes included	Description
1	243	Millwork, Veneer, Plywood.
2	245	Wood Bldgs & Mobile Homes.
3	249	Misc. Wood Products.
4	25	Furniture.
5	26	Paper Products.
6	27	Printing & Publishing.
7	281	Indust. Inorganic Chems.
8	282	Plastics & Syn. Resins.
9	283	Drugs.
10	284	Soaps, Detergents & Cleaning.
11	285	Paints, Varnishes, Lacquers.
12	286	Indust. Organic Chems.
13	287	Agricultural Chemicals.
14	289	Misc. Chemical Products.
15	291	Petroleum Refining.
16	295	Paving & Roofing Materials.
17	299	Misc. Petroleum Products.
18	308	Misc. Plastic Products.
19	30 (not 308)	Plastics & Rubber.
20	311	Leather Tanning.
21	31 (not 311)	Leather & Leather Products.
22	32	Stone & Clay.
23	33	Primary Metals.
24	34	Fabricated Metals.
25	35	Machinery.
	36	Electrical Machinery.
	38	Instruments.
	39	Misc. Manufacturing.
26	40	R.R. Transportation.
	44	Water Transportation.
	45	Air Transportation.
	47	Transportation Services.
27	46	Pipelines.
28	49	Electrical, Gas & Sanitary.
30	5093	Misc. Durable Goods.
	5153	Grain.
	5161	Chemicals & Allied Products.

TABLE 1-1.—DEFINITIONS OF ESTIMATION CELLS—Continued

Cell No.	SIC codes included	Description
	5191	Misc. Farm Supplies.
	5198	Misc. Paints, Varnishes.
31	55	Auto Dealers.
	75	Auto Repair.
32	7211	Power Laundries, Family & Commercial.
	7213	Linen Supply.
	7215	Coin-operated Laundries & Cleaning.
	7216	Drycleaning Plants, except Rug.
	7218	Industrial Launderers.
	7219	Laundry & Garment Services, nec.
	7221	Photographic Studios, Portrait.
	7231	Beauty Shops.
	7241	Barber Shops.
	7251	Shoe Repair & Shoeshine Parlors.
	7261	Funeral Service & Crematories.
	7299	Miscellaneous Services, nec.
	7332	Blueprinting & Photocopying Services.
	7342	Disinfecting & Pest Control Services.
	7395	Photofinishing Laboratories.
33	7641	Furniture Repair.
	7692	Welding Repair.
34	80	Health Services.
99	37	Transportation Equipment.

For each estimation cell, units on the Dun and Bradstreet sampling frame were classified into one of the four size classes listed below:

Size	Number of Employees
1	0 to 19.
2	20 to 99.
3	100 to 249.
4	250 and above.

For each size class stratum within a cell, the establishments on the frame were further identified by their four digit SIC classification (within the two or three digit sample cell). A separate systematic sample was then selected in each estimation cell/size class stratum. This procedure was accomplished by first selecting one case at random in the size class for the first K units on the frame—where K is the reciprocal of the sampling fraction—and then selecting every Kth unit in the stratum thereafter. Note, from the size class definitions that establishments having zero employees were not included in the survey. Such units were assumed to be out of the scope of the survey.

5. Sample Size Determination and Allocation Within Strata

The total number of establishments selected from the Dun and Bradstreet sampling frame was determined using two stages. The first stage was to compute the target number of respondents for each estimation cell using the standard sample size formula. The formula requires the specification of a target coefficient of variation for estimates.

The coefficients of variation for this survey were set at the following levels:

SIC's	Coefficient of Variation (percent)
24 through 29	5
30 through 39	7.5
40 through 80	10

The units were then allocated to size classes within the estimation cells using Neyman allocation. This method allocates based on the number of establishments in each stratum and on the stratum variability in the key design variable (in this case employment). Size class strata having a large number of establishments on the frame or a high variability in employment (as defined by the population variance) received a greater number of sample units than other strata in the sample. Because the larger size classes often have a high variability in employment, this allocation resulted in "oversampling" the larger size classes in a cell. The required number of cases for each stratum are shown in TABLE 1-2 in the column labeled "Target Number of Respondents."

The number of units actually selected from the D&B frame in each stratum was based on the number of completed cases required for the stratum and on the expected response rate. Almost all sample surveys, especially voluntary surveys, select some number of cases which do not result in a completed interview. In some instances, these will be establishments which have gone out of business, are duplicate cases, or are companies not in the SIC category shown on the frame. Such cases are "Out of Scope". Other establishments, though in scope, refuse to participate or are not reached in the sampling protocol, defined here as a total of five telephone attempts. Experience of surveys similar to the PEL survey indicated that a completion ratio of 50–60% was expected for this survey (the ratio of completed questionnaires to total cases which must be drawn—both in and out of scope). However, to be safe, a larger number of cases were selected and held in reserve from the D&B frame so that, if additional sample units needed to be included to reach the target sample sizes, the cases could be easily obtained.

In fact, for the vast majority of cells, a 60 percent completion ratio was realized. The total number of establishments called in each of the sample strata are shown in TABLE 1-2 in the column labeled "Total Cases Called." In general, this number is equal to the target sample divided by 0.60. The number of completed responses as of May 2, 1988 is shown in TABLE 1-2

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TABLE 1-2

Number of Firms, Required Sample Sizes, Calls Made and Completes

SIC GROUPS	Size	Total Plants	Target Number Respondents	Total Cases Called	Number Completed May 1988
243	0-19	10,986	39	78	53
	20-99	1,995	32	64	34
	100-249	346	12	24	17
	>250	147	48	98	63
	Total	13,474	131	264	167
245	0-19	864	15	25	9
	20-99	385	15	40	28
	100-249	220	17	45	17
	>250	43	30	43	8
	Total	1,512	77	153	62
249	0-19	4,301	37	74	27
	20-99	888	35	70	25
	100-249	129	11	22	8
	>250	44	12	24	8
	Total	5,362	95	190	68
25	0-19	11,505	20	40	23
	20-99	3,254	26	52	35
	100-249	858	13	26	13
	>250	449	73	146	78
	Total	16,066	132	264	149
26	0-19	3,485	20	44	16
	20-99	2,830	30	62	33
	100-249	1,307	30	54	34
	>250	576	184	384	221
	Total	8,198	264	544	304
27	0-19	64,922	45	60	31
	20-99	10,656	34	122	77
	100-249	1,850	12	126	87
	>250	869	88	50	37
	Total	78,297	179	358	232
281	0-19	1,721	20	52	30
	20-99	735	20	52	34
	100-249	189	20	52	29
	>250	157	96	157	75
	Total	2,802	156	313	168

TABLE 1-2, cont'd

SIC GROUPS	Size	Total Plants	Target Number Respondents	Total Cases Called	Number Completed May 1988
282	0-19	700	20	40	26
	20-99	499	20	40	26
	100-249	184	20	40	25
	>250	175	58	116	52
	Total	1,558	118	236	129
283	0-19	1,289	25	50	28
	20-99	544	25	50	28
	100-249	179	25	50	31
	>250	205	92	184	90
	Total	2,217	167	334	177
284	0-19	3,065	20	40	23
	20-99	767	20	40	28
	100-249	184	20	40	22
	>250	155	70	140	59
	Total	4,171	130	260	132
285	0-19	1,092	20	50	37
	20-99	549	15	40	21
	100-249	100	10	30	15
	>250	45	37	45	30
	Total	1,786	82	165	103
286	0-19	860	20	54	28
	20-99	346	15	44	27
	100-249	95	15	44	26
	>250	92	50	62	35
	Total	1,393	100	204	116
287	0-19	1,306	8	31	15
	20-99	338	9	33	22
	100-249	57	4	23	15
	>250	43	44	44	18
	Total	1,744	65	131	70
289	0-19	2,562	16	38	25
	20-99	918	23	52	31
	100-249	162	9	24	11
	>250	85	51	85	37
	Total	3,727	99	199	104

TABLE 1-2, cont'd

SIC GROUPS	Size	Total Plants	Target Number Respondents	Total Cases Called	Number Completed May 1988
291	0-19	606	20	50	28
	20-99	227	20	50	25
	100-249	85	20	50	28
	>250	130	59	90	47
	Total	1,048	119	240	128
295	0-19	862	21	46	28
	20-99	237	26	56	39
	100-249	45	10	24	19
	>250	9	8	9	3
	Total	1,153	65	135	89
299	0-19	516	15	32	23
	20-99	186	22	46	31
	100-249	23	4	11	10
	>250	5	5	5	3
	Total	730	46	94	67
308	0-19	8,062	16	32	21
	20-99	4,249	13	26	19
	100-249	1,162	7	14	12
	>250	388	18	36	22
	Total	13,861	54	108	74
30 (not 308)	0-19	1,983	25	50	33
	20-99	722	25	50	37
	100-249	239	25	50	29
	>250	234	48	96	59
	Total	3,178	123	246	158
311	0-19	283	5	24	2
	20-99	125	9	21	8
	100-249	29	4	16	2
	>250	16	5	10	5
	Total	453	23	71	17
31 (not 311)	0-19	2,232	8	16	6
	20-99	610	13	26	21
	100-249	220	13	26	17
	>250	176	13	26	17
	Total	3,238	47	94	61

TABLE 1-2, cont'd

SIC GROUPS	Size	Total Plants	Target Number Respondents	Total Cases Called	Number Completed May 1988
32	0-19	14,499	15	28	9
	20-99	4,207	34	62	40
	100-249	873	35	64	45
	>250	448	29	53	34
	Total	20,027	113	207	128
33	0-19	4,983	67	201	87
	20-99	2,803	67	201	127
	100-249	1,006	42	126	83
	>250	711	25	75	48
	Total	9,503	201	603	345
34	0-19	29,005	62	113	51
	20-99	11,849	110	200	113
	100-249	2,394	86	157	77
	>250	1,080	62	113	61
	Total	44,328	320	583	302
35,36, 38,39	0-19	117,005	100	200	65
	20-99	30,820	126	188	122
	100-249	7,468	93	137	98
	>250	5,657	80	133	72
	Total	160,950	399	658	357
40,44, & 45	0-19	45,323	20	37	20
	20-99	5,612	20	37	16
	100-249	799	20	37	15
	>250	533	50	91	32
	Total	52,267	110	202	83
46	0-19	439	15	28	23
	20-99	162	15	28	20
	100-249	18	8	18	14
	>250	5	5	5	5
	Total	624	43	79	62
49	0-19	12,982	40	73	48
	20-99	4,046	40	73	57
	100-249	844	40	73	58
	>250	558	150	273	198
	Total	18,430	270	492	361

TABLE 1-2, cont'd

SIC GROUPS	Size	Total Plants	Target Number Respondents	Total Cases Called	Number Completed May 1988
50 & 51~	0-19	45,422	200	364	237
	20-99	3,464	65	142	101
	100-249	205	30	79	48
	>250	57	57	57	30
	Total	49,148	352	642	416
55 & 75	0-19	284,632	10	30	13
	20-99	20,846	10	30	16
	100-249	1,523	10	30	15
	>250	116	20	60	22
	Total	307,117	50	150	66
72 & 73~~	0-19	139,889	120	240	22
	20-99	5,511	30	60	6
	100-249	527	20	40	9
	>250	108	25	50	13
	Total	146,035	195	390	50
7641 & 7692	0-19	18,098	60	110	67
	20-99	289	20	48	32
	100-249	12	10	9	8
	>250	1	1	1	1
	Total	18,400	91	168	108
80	1	233,984	50	91	49
	2	17,174	30	55	36
	3	6,310	30	55	37
	4	3,912	220	400	272
	Total	261,380	330	601	394
37	1	9,863	10	19	6
	2	2,997	10	19	12
	3	1,026	10	19	12
	4	1,072	70	128	72
	Total	14,958	100	185	102

~ Refers to SIC Codes: 5093, 5193, 5161, 5191, 5198
~~Specifically Sic Codes: 7211,7213,7215,7216,7218,7231, 7241,7251,7261,7299,7732,7342, and 7395

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6. Data Collection Methodology

The data collection method chosen for the survey was Computer Assisted Telephone Interviewing (CATI). In this method the interviewer talks to the respondent on the telephone while sitting in front of a computer screen. Each question to be asked appears on the screen in the proper sequence. CATI systems allow for the responses to be examined during the data collection process. Answers that are out of the possible range of responses or which are not consistent with other answers received earlier in the questionnaire can be immediately identified. Another advantage is that it frees the interviewer up from using a hard copy questionnaire which requires skipping manually to different parts of the questionnaire based upon the responses. Finally, this method saves resources by creating a machine readable record of the responses at the conclusion of the interview, thereby eliminating the need for keypunching.

7. Estimation Procedures

Cost estimates for the PEL study take the form of a combined ratio estimator and can be expressed in the following manner:

$$\hat{cost}_i = \frac{\sum_j \sum_k wgt_{ij} * NRAF1_{ij} * cost_{ijk}}{\sum_j \sum_k wgt_{ij} * NRAF2_{ij} * empl_{ijk}} * (Empl/BLS202_i)$$

where

wgt_{ij} = the weight for cell i and size class j

$NRAF1_{ij}$ = nonresponse adjustment factor

$NRAF2_{ij}$ = nonresponse adjustment factor

$cost_{ijk}$ = cost associated with unit k in the cell i and class j

$empl_{ijk}$ = number of employees at unit k in cell i and class j

$Emp/BLS202_i$ = total employment in cell i from the BLS 202 database.

This estimator benchmarks the estimate obtained from the Dun and Bradstreet sample to Bureau of Labor Statistics ES–202 employment counts for each cell. The benchmarking helps to correct for any deficiencies in the D&B sampling frame. Such a procedure is particularly important in the non-manufacturing industries where establishments are frequently under-represented on the D&B sampling frame.

8. Variance Estimation

As with any sample survey, quantification of sampling error of estimates is an important function. Errors are quantified by computing the standard error of each estimate produced from the survey. Under certain assumptions, the standard error can be used to make probability statements about estimates. For example, an interval equal to two standard errors on either side of an estimate is a 95 percent confidence interval. This means that one can be 95 percent sure that the true value of the quantity being estimated lies somewhere inside that interval.

A replication technique will be used to determine standard errors for the PEL survey. For this method one resamples the original data multiple times to compute standard errors. A replication method was chosen because of two characteristics of the survey. First, some of the estimates which are planned to be produced are nonlinear such as ratio estimates. Second, we are using a nonresponse adjustment factor to adjust the final weights. In both of these situations, replication-type variance estimators are particularly useful.

9. Treatment of Non-Sampling Errors

An important component to any survey effort is the treatment of nonsampling errors. Examples of such errors are:

- Nonresponse bias—error introduced because some selected respondents either do not respond at all (unit nonresponse) or do not respond to a particular question (item nonresponse);
- Response bias—error introduced due the way questions are phrased or the way respondents interpret what is being asked (this also includes error due to deliberate misrepresentation of the answers to questions by respondents).

In the PEL survey, the nonresponse problem was dealt with using two standard methodologies. For unit nonresponse, a mean imputation procedure was used. This procedure assumes that there is no fundamental difference between respondents and nonrespondents and, therefore, usable cases can be reweighted to represent the entire universe. For item nonresponse, an imputation scheme which uses related cases in the respondent group to estimate the missing data was used.

The situation for response bias will be handled by obtaining information from site visits. OSHA will conduct 100 site visits in a cross section of industries. A large portion of these visits will be done on establishments which were also in the telephone survey. Data on key variables collected during the telephone survey will be compared with information obtained from the site visits. This analysis must be undertaken when site visits have been completed.

9.1. Unit Nonresponse Adjustment

In order to adjust the sample for those cases selected from the D&B frame which where called but were out of scope (OOS), out of business (OOB), or in scope but unwilling to participate in the survey, the following approach was used.

- All solicited sample units were assigned a response code based on the following categories:

03 Non-working telephone number
04 Incorrect SIC—out of scope
05 Out of Business (OOB)
06 Not a business or wrong business
07 Duplicate record
08 Could not reach respondent after five attempts
09 Communication barrier
10 Initial refusal
11 Mid-interview refusal (did not answer initial chemical and process questions)
12 Completed interview (completed both initial chemical and process questions)
13 Other nonresponse.

- All units having a response code equal to 08, 09, 10, 11, 12, or 13 were classified as viable sample units (in

scope, in business). Sample units having a response code equal to 12 were classified as both viable and usable. Two nonresponse adjustment weights were assigned to each usable record in the database, based on the ratio of viable to usable sample units in the record's cell and size stratum:

$$NRAF1_{ij} = \sum_{k=1}^{n_i} I(V_k) \Big/ \sum_{k=1}^{n_i} I(U_k)$$

$$NRAF2_{ij} = \sum_{k=1}^{n_i} I(V'_k) \Big/ \sum_{k=1}^{n_i} I(U'_k)$$

where,

i = number of estimation cell

j = number of the size class

$I(V_k)$ = 1 if the kth sample unit is viable,
= 0 otherwise;

$I(U_k)$ = 1 if the kth sample unit is usable,
= 0 otherwise;

V' and U' refer to the precoded employment from the D&B frame for viable and usable units.

NRAF1 is the ratio of viable to usable sample units in the cell/size class stratum. NRAF2 is a weighted ratio of viable to usable units, using the pre-coded employment on the D&B to weight the indicator variable. NRAF2 was used for estimates directly related to employment (e.g., the number of employees in a particular estimation cell). All other estimates used NRAF1 for the nonresponse adjustment weight.

As of May 2, 1988 the response rate experience was as follows:

Response rate=73.2%
Completion rate=61.5%

The response rate is defined as the number of usable cases divided by the number of viable cases. The completion rate is defined as the number of usable cases divided by the total number of cases contacted.

9.2 Item Nonresponse Adjustment/ Imputation

Often survey respondents do not know the answers to some questions or refuse to answer particular questions. In such cases, it is possible to fill in missing values using an imputation scheme. The idea is to use information from both the respondent (answers to other questions which they did supply) and information from other respondents (those answering the missing question) in order to estimate a reasonable response to the missing datum.

The imputation method chosen for the PEL survey is a hybrid method which combines the concepts of a mean imputation and a "hot-deck" imputation. A mean imputation method replaces the missing values on a certain question with the mean value from those respondents answering that question. A hot deck method attempts to find a respondent who matches the respondent having a missing value (in terms of other survey characteristics) and uses the value of the "twin" to replace the missing value. The method used here is a hybrid in the sense that it employs a mean imputation, but only over a small segment of the population which obviously matches the respondent having a missing value.

In particular, the procedure examines three or four digit SIC subgroups within the estimation cell by size class. The mean values of the responses to a particular question of interest in such sample subgroupings were used to impute the missing values in that grouping. In the case of categorical variables (for example, YES/NO questions), a randomization scheme was used which randomly supplied the appropriate set of responses to missing questions based on a probability distribution determined from those who responded.

It should be noted that the values which were placed on the database were not intended to be estimates of the missing reponses. Rather, they are meant to be substitute responses which allow the case to be used in the generation of survey estimates. In the aggregate, estimates produced using imputed data make sense, but may not for the individual establishment. Care was taken in the imputation program to be sure that imputed responses were consistent with other answers for the establishment of interest. Original responses to all questions were retained on the sample record and all responses representing imputed values were identified. One set of questions which was not imputed for was whether monitoring for the presence of certain toxic chemicals was done at the establishment. The data collected as of May 2, 1988 produced an estimate, for those establishments where chemicals or processes were found, that 14.5 percent did monitoring, 65.7 percent did not do monitoring, and 19.8 percent of respondents did not know or refused to answer the question. Of those establishments that did monitor, 25.6 percent provided the requested data.

10. Survey Instrument

As mentioned earlier, data collection for PEL survey was accomplished by Computer Assisted Telephone Interviewing. Prior to calling, a letter was sent to each selected establishment. This letter is shown in Exhibit 1–1. Also,

a hard copy version of the PEL questionnaire is given in Exhibit 1–2.

Exhibit 1–1

U.S. Department of Labor

Assistant Secretary for
Occupational Safety and Health
Washington, DC 20210

SIC Code 3479
Metal Coating & Allied Serv.
OMB Approval No. 1218–0142
February 25, 1988.

Mr. John Q. Sample,
Chairman, Anycompany, 123 Sample St., Anytown, US 12345

Dear Mr. Sample: The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor is required by law to set permissible exposure limits for chemical substances in the workplace. Current exposure limits were set 17 years ago using values established by the American Conference of Governmental Industrial Hygienists (ACGIH) and the American National Standards Institute (ANSI).

OSHA has begun a process for revising out-of-date permissible exposure limits. To ensure that any new exposure limits take into account actual workplace conditions, we are conducting a voluntary survey of U.S. business establishments. Included will be questions about specific processes which we believe are performed in your industry and a limited (no more than 10 per process) list of chemicals which we believe are involved in those processes. Your facility was selected to be included in the study.

Decisions regarding new permissible exposure limits will be improved significantly if we have input from as many firms as possible. The interview will take about 30 minutes. Names of responding firms will not be associated with their answers, and all data will be treated as confidential by our contractor.

Please help us expedite the survey process by returning to us, within one week, the enclosed postage paid card with the name and phone number of the person in your organization our contract interviewer should contact. If this card is not received, a representative of our contractor, KCA Research, Inc., will call your office directly to conduct the interview or be directed to the company official designated by you.

Enclosed is a list of the topic areas for the survey. This may help in preparing for the interview.

We appreciate your cooperation and look forward to receiving the information we need from your designated representative.

Sincerely,

John A. Pendergrass,
Assistant Secretary for OSHA.

Enclosure

Topics Covered by Survey

I. *General Firm Characteristics*
- —Primary activity at this location
- —Approximate numbers of production & maintenance workers
- —Number of shifts per day and length of shift

II. *Identification of General Processes Performed by Firm*
- —Chemicals used in specific processes or operations and estimated quantities involved
- —Approximate number of work stations or assembly lines used and number of workers at each
- —Description of process engineering controls such as ventilation and enclosures
- —Estimated frequency of process or operation performance
- —Description of personal protective equipment used, including respirators, eye, face, and skin protection
- —Information regarding exposure monitoring

Exhibit 1–2

_____, we are conducting a survey on behalf of OSHA to assess the current practices of all types of businesses in the handling of toxic and hazardous chemicals. A letter was sent to you informing you of this survey.

1. Did you receive our letter?

1=Yes
2=No

If answer "Yes", begin next paragraph with "As you know,"

If answer "No", begin next paragraph with "I'm sorry. Let me summarize what the letter said about the survey".

We are interested in understanding all significant operations or processes in your firm that generate dust, mist, fumes, gases or vapor that your employees might potentially encounter. *Of course, all responses and trade or technological secrets will be kept strictly confidential and no company-specific information will be released to OSHA.*

2. Should I direct my questions to you, or is there someone else in the firm who you feel would be better qualified to answer?

1=Yes, this person will answer survey
2=No, call:
Name _____
Title _____
Phone _____
C=Call back (Set up time for recontact)
R=Refused to answer (Terminate interview)
D=Don't Know/No Response

Let me begin by asking some general questions about your facility.

3. Our records show your firm to be engaged in _____.? Is this correct? (Interviewer will read title or brief description for this SIC code.)

1=Yes
2=No, our function here is _____.
C
R
D

4. How many production workers do you have at this location?

1=_____ production workers
C=Call back
R=Refused to answer
D=Don't know

5. How many maintenance workers (for example; painters, welders & cleaning staff) do you employ?

1=_____ maintenance workers
2=Production workers do maintenance functions
3=None, only clerical, managerial, or sales personnel
C
R
D

5a. Of these maintenance workers, how many do painting as their primary work activity?

1=_____ do painting as primary activity
2=None
C
R
D

5b. Of these maintenance workers, how many do welding as their primary work activity?

1=_____ do welding as primary activity
2=None
C
R
D

6. How many shifts per day (24 hr. period) do you have at this location?

1=_____ shifts/24 hr.
C
R
D

I now want to ask you some questions about chemicals which we believe are common among firms in your industry. [These chemicals would be selected on the basis of large volume usage, known toxicity, or known exposure problems in excess of permissable limits as identified from NOES or IMIS or from industry expert opinion].

7. Which of the following chemicals are used, processed, or emitted at your facility?

Chemical A
1=Yes
2=No
C
R
D

[The interviewer will read chemical list specified for this 4-digit SIC. If "Don't Know" (D) is the response, the interviewer will then attempt to clarify the question by reading a list of common synonyms for the chemical. The subsequent answer can then be reassessed as "Yes" or "No"]

8. Are there any other chemicals in major use in your operations that I did not list?

1=Yes (Skip to #8 and add to list)
2=No
C
R
D

9. What is the approximate quantity of chemical A that your facility purchases each week or month?

1=_____ lbs. per week purchased
2=_____ gals. per week purchased
3=_____ lbs. per month purchased
4=_____ gals. per month purchased
C
R
D

Repeat Question #9 until all identified chemicals are quantified.

10. Have exposure limits been adopted by your firm for these chemicals?
1=Yes
2=No
C
R (Skip to #12)
D

11. What exposure limits have been adopted?
1=OSHA PEL's
2=NIOSH REL's
3=ACGIH TLV's
4=Other _____
C
R
D

The next questions are about processes/operations which we believe are common among firms in your industry.

12. Are any of the following processes/operations performed in your facility?
Operation #1
1=Yes
2=No
C
R
D

[Interviewer would read list of up to 6 processes or operations specified for this 4-digit SIC code. This list would be identified from secondary data sources and industry experts. If information regarding relevant processes was not available or sufficient, then this question would be rephrased to elicit process/operation identification from the respondent]

13. Are there any other processes/operations at your facility that I did not list?
1=Yes (Skip to #12 and add to list)
2=No
C
R
D

For each identified process/operation, ask questions 14–26.

14. In Process/Operation 1:
Is Chemical A used?
1=Yes
2=No
C
R
D

REPEAT UNTIL ALL IDENTIFIED CHEMICALS HAVE BEEN ASKED ABOUT USAGE IN THIS PROCESS.

15. How many work stations (or assembly lines) are involved in this process/operation?
1=_____ work stations
2=_____ assembly lines
C
R
D

16. On average, how many workers are directly involved in this process/operation at each work station (or assembly line)?
1=_____ workers/work station
2=_____ workers/assembly line
C
R
D

17. Of these workers, what percent work exclusively at this process/operation?
1=100% (Go to #18)
2=_____%
C
R (Go to #18)
D

17a. For those workers who do not work exclusively at this process/operation, in what other processes/operations are they also employed?
1=_____
C
R
D

18. Is this process/operation a completely enclosed activity?
1=Yes (Skip to #14)
2=No
C
R
D

19. Is this process/operation located outdoors?
1=Yes (Skip to #21)
2=No
C
R
D

20. Is this process/operation ventilated?
1=Yes
2=No
C
R (Skip to #21)

20a. What is the type of ventilation?
1=Local exhaust 1=Yes 2=No
C R D
2=General dilution
3=Natural ventilation
4=Other (specify type)

---

21. How often is this process/operation performed during each shift?
1=Continuously over entire shift, every shift
2=Daily (specify #/day) _____
3=Weekly (specify #/week) _____
4=Monthly (specify #/month) _____
5=Yearly (specify #/year) _____
6=Other (specify #/period) _____
C
R
D

22. Are respirators routinely used by workers?
1=Yes
2=No (Skip to #23)
C
R
D

22a. What type of respirator?
1=Single use
2=Half-mask cartridge
3=Half-mask canister
4=Full-face cartridge
5=Full-face canister
6=Powered air purifying respirator
7=Air supplied respirator
8=Self-contained breathing apparatus
9=Escape respirator
10=Other _____
C
R
D

23. Do you provide maintenance workers who have exposure to this process with respirators?
1=Yes
2=No
C
R
D

24. Is skin, face, or eye protection used?
1=Yes
2=No (Skip to #25)
C
R
D

24a. What type(s), of skin, face, or eye protection?
1=Long sleeve shirt
2=Coverall
3=Apron
4=Gloves
5=Chemical Protective Clothing
6=Goggles
7=Face Shield
8=Other _____
C
R
D

25. Do you have a hazard communications training program for these workers?
1=Yes
2=No
C
R
D

26. Has environmental monitoring been done at or near this process/operation?
1=Yes
2=No
C
R (Skip to #14 until all processes surveyed)
D

26a. Has this monitoring been designed to evaluate control of:
1=potential short term (15 min.) exposures? (STEL)
2=potential 15 minute—4 hour exposures?
3=potential 4–8 hour exposures? (TWA)
C
R
D

26b. During this monitoring, were any chemicals found to be in excess of your adopted exposure guidelines?
1=Yes
2=No
C
R (Skip to #27)
D

26c. Which chemical(s) were found to exceed adopted guidelines?
1=_____
C
R (skip to #27)
D

26d. What activity, work process or operation do you feel is most responsible for the exposures above your adopted guidelines?

1=_____
2=Not able to specify
C
R
D

27. Can you give us your monitoring data for Process 1?

1=Yes
2=No
C
R (Skip to #14)
D

27a. What is the name of the first [next] chemical for which you have monitoring data?

1=_____
C
R
D

27b. Is the data for the work area or for the person (worker)?

1=Area
2=Person
C
R
D

27c. Is the data recorded for the individual worker or the work process?

1=Worker
2=Process
C
R
D

27d. Is the data reported for a short-term peak or an 8 hour TWA (Time Weighted Average)?

1=Short-Term Peak
2=TWA
C
R
D

27e. Is the unit of measurement parts per million or milligrams per cubic meter?

1=PPM
2=Mg/M^3
C
R
D

27f. What is the exposure data for this chemical?

1=_____
C
R
D

27g. Do you have exposure estimates for other chemicals used in this process?

1=Yes (Skip to 27a)
2=No
C
R (Skip to #14 until all processes surveyed)
D

28. What do you estimate to be the market value of plant and equipment at your facility?

1=Less than $50,000
2=$50,000–$500,000
3=$501,000–$1,000,000
4=$1 to $5 million
5=$5 to $50 million
6=More than $50 million
C
R
D

29. Can you estimate the annual value of shipments from your facility?

1=Less than $50,000
2=$50,000–$500,000
3=$500,000–$1,000,000
4=$1–$5 million
5=$5–$50 million
6=More than $50 million
C
R
D

Thank you for cooperating with us in our survey.

Supplements Nos. 2, 3, 4, 5, and 6

Copies of these Supplements are available upon request by calling or writing: Ms. Regina Flahie, Office of Regulatory Analysis, Room N3627, U.S. Department of Labor-OSHA, 200 Constitution Avenue NW., Washington, DC 20210, (202) 523–7283.

No. 2—Industry Processes and Chemicals, by Four Digit SIC, Identified in the 1988 Sample Survey

No. 3—Employee Exposures by Chemical and Industry, Based on Combined Data from OSHA's Integrated Management Information System and the 1988 Sample Survey

No. 4—Employee Exposures, by Chemical and Industry, Based Upon Data Collected in the 1988 Sample Survey

No. 5—Employee Exposures, by Chemical and Industry, Based Upon Data Contained in OSHA's Integrated Management Information System

No. 6—Hazardous Substance Exposure Data Linked to Industrial Processes Identified in the 1988 Sample Survey.

[FR Doc. 88–12213 Filed 6–6–88; 8:45 am]
BILLING CODE 4510–26–M

Federal Register

Tuesday
June 7, 1988

Part III

Department of Transportation

Federal Aviation Administration

14 CFR Part 71

Alteration of the San Diego Terminal Control Area, CA; Correction to Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 71

[Airspace Docket No. 85-AWP-38]

Alteration of the San Diego Terminal Control Area, CA

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Correction to final rule.

SUMMARY: This action corrects the description of the San Diego, CA, Terminal Control Area (TCA). Several typographical errors were made in the radials which described the subareas. In addition, some minor editorial changes were made for purposes of clarification.

EFFECTIVE DATE: 0901 UTC, July 28, 1988.

FOR FURTHER INFORMATION CONTACT: Joe Gill, Airspace Branch (ATO-240), Airspace-Rules and Aeronautical Information Division, Air Traffic Operations Service, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; telephone: (202) 267-9252.

SUPPLEMENTARY INFORMATION:

History

Federal Register Document 88-2599 published February 8, 1988, revised the TCA at San Diego, CA (53 FR 3714). Errors were made in the radials which described the subareas. The errors were made in converting from true to magnetic hearings which created boundary lines that did not match. This action corrects that oversight. In addition, some editorial changes, for purposes of clarification, have been made to make the description easier to read and understand.

The FAA has determined that this regulation only involves an established body of technical regulations for which frequent and routine amendments are necessary to keep them operationally current. it, therefore: (1) is not a "major rule" under Executive Order 12291; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and (3) does not warrant preparation of a regulatory evaluation as the anticipated impact is so minimal. Since this is a routine matter that will only affect air traffic procedures and air navigation, it is certified that this rule will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

List of Subjects in 14 CFR Part 71

Aviation safety, Terminal control areas.

Adoption of the Correction

Accordingly, pursuant to the authority delegated to me, **Federal Register** Document 88-2599, as published in the **Federal Register** on February 8, 1988 (53 FR 3714), is corrected as follows:

PART 71—DESIGNATION OF FEDERAL AIRWAYS, AREA LOW ROUTES, CONTROLLED AIRSPACE, AND REPORTING POINTS

1. The authority citation for Part 71 continues to read as follows:

Authority: 49 U.S.C. 1348(a), 1354(a), 1510; E.O. 10854; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); 14 CFR 11.69.

§ 71.401 [Amended]

2. Section 71.401(b) is amended as follows:

San Diego, CA [Revised]

Primary Airports

San Diego, CA, (Lindbergh Field), (lat. 32°43'58"N., Long. 117°11'14"W.).

Miramar NAS, Miramar, CA, (lat. 32°52'30"N., long. 117°08'15"W.).

Boundaries

Southern TCA Boundary. A straight line beginning at the intersection of Julian 185° radial and a point 3 miles north of the Mexico Border to lat. 32°33'07"N., long. 117°30'45"W.

Western Boundary. Eastern edge of Warning Area 291 (W-291).

Area A. That airspace extending upward from 4,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Julian VORTAC 262° radial and the eastern edge of Warning Area W-291; then east via the Julian 262° radial to intercept the Mission Bay VORTAC 325° radial, then southeast via the Mission Bay 325° radial to the Julian VORTAC 257° radial, then west via the Julian VORTAC 257° radial to the Oceanside VOR 200° radial, then southwest via the Oceanside 200° radial to the eastern edge of W-291, then north via the eastern edge of W-291 to the point of beginning.

Area B. That airspace extending upward from 2,000 feet MSL to and including 12,500 feet MSL beginning at the intersection of the eastern edge of W-291 and the Oceanside 200° radial; then northerly via the Oceanside 200° radial to intercept the Julian 257° radial; then easterly via the Julian 257° radial to intercept the Oceanside 182° radial; then southerly via the Oceanside 182° radial to intercept the Poggi VORTAC 291° radial; then southeasterly via the Poggi 291° radial to intercept the extension of the control zone division line that separates San Diego Lindbergh Field, CA, and San Diego NAS North Island, CA, Control Zones; then via this line on an easterly heading to intercept the Oceanside 171° radial, then southerly via the Oceanside 171° radial to the Poggi 280° radial; then westerly via the Poggi 280° radial to the eastern edge of W-291; then northerly along the eastern edge of W-291 to the point of beginning.

Area C. That airspace extending upward from 1,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Oceanside 182° radial and the Julian 257° radial; then easterly via the Julian 257° radial to intercept the Mission Bay 325° radial; then southeasterly via the Mission Bay 325° radial to intercept the Oceanside 167° radial; then southerly via the Oceanside 167° radial to intercept the Mission Bay 310° radial; then southeasterly via the Mission Bay 310° radial to the Mission Bay VORTAC; then westerly via the Mission Bay 279° radial to intercept the Oceanside 171° radial; then southerly via the Oceanside 171° radial to intercept the extension of the control zone division line between San Diego Lindbergh Field and San Diego NAS North Island Control Zones; then westerly via the extension line to intercept the Poggi 291° radial; then westerly via the Poggi 291° radial to intercept the Oceanside 182° radial; then northerly via the Oceanside 182° radial to the point of beginning.

Area D. That airspace extending upward from 1,500 feet MSL to and including 2,500 feet MSL and that airspace extending upward from 6,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of Mission Bay 325° radial and the visual extension of the Miramar Runway 28 centerline then easterly via the Runway 28 centerline extension to intercept the Miramar Control Zone 5 SM arc; then southerly via the 5 SM control zone arc to intercept a visual extension of Montgomery Field Runway 28R centerline; then westerly via the Runway 28R centerline to intercept the Oceanside 167° radial; then northerly via the Oceanside 167° radial to the Mission Bay 325° radial; then northwesterly via the mission Bay 325° radial to the point of beginning.

Area E. That airspace extending upward from 3,000 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Mission Bay 008° radial and the Julian 257° radial; then easterly via the Julian 257° radial to intercept the Oceanside 135° radial; then southeasterly via the Oceanside 135° radial to intercept the Julian 247° radial; then southwesterly via the Julian 247° radial to intercept the Mission Bay 008° radial; then northerly via the Mission Bay 008° radial to the point of beginning.

Area F. That airspace extending upward from the surface to and including 3,200 feet MSL and that airspace extending upward from 4,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Miramar NAS Runway 28 centerline extension and Miramar Control Zone 5 SM arc; then easterly via the visual extension of Miramar NAS Runway 28 centerline to the approach end of Miramar Runway 28; then southeasterly via a stright line to a point intercepting the Miramar Control Zone 5 SM arc at the point where the control zone arc intersects the southern boundary of the Miramar Control Zone extension; then clockwise via the Miramar Control Zone 5 SM arc to intercept the division line of the Miramar and San Diego Montgomery Field Control Zones; then westerly via this separation line to intercept a visual extension

of the Montgomery Field Runway 28R centerline; then westerly via the Montgomery Field Runway 28R centerline extension to intercept the Miramar Control Zone 5 SM arc; then clockwise via the Miramar Control Zone 5 SM arc to the point of beginning.

Area G. That airspace extending upward from the surface to and including 12,500 feet MSL beginning at the intersection of the Oceanside 135° radial and the Julian 247° radial; then southeasterly via the Oceanside 135° radial to intercept the south boundary of the Miramar Control Zone extension; then westerly via the Miramar Control Zone extension southern boundary line to a point intersecting the Miramar Control Zone 5 SM arc; then via a direct line to the approach end of Miramar Runway 28 approach end; then northwesterly via the Miramar Runway 28 centerline and Runway 28 centerline extension to intercept the Miramar Control Zone 5 SM arc; then clockwise via the Miramar Control Zone 5 SM arc to intercept the Julian 247° radial; then northeasterly via the Julian 247° radial to the point of beginning.

Area H. That airspace extending upward from 1,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Oceanside 135° radial and the Julian 247° radial; then northeasterly via the Julian 247° radial to intercept the Oceanside 130° radial; then southeasterly via the Oceanside 130° radial to the Poggi 007° radial; then southerly via the Poggi 007° radial to the southern boundary line of the Miramar Control Zone extension; then westerly along the southern boudnary line of the Miramar Control Zone extension to intercept the Oceanside 135° radial; then northwesterly via the Oceanside 135° radial to the point of beginning.

Area I. That airspace extending upward from 3,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Oceanside 130° radial and the Julian 247° radial; then northeasterly via the Julian 247° radial to the Oceanside 121° radial; then southeasterly via the Oceanside 121° radial to intercept the Poggi 020° radial; then southerly via the Poggi 020° radial to intercept an extension of the southern boundary line of the Miramar Control Zone extension; then southwest along this extension line to intercept the Poggi 007° radial; then northerly via the Poggi 007° radial to the Oceanside 130° radial; then northwesterly via the Oceanside 130° radial to the point of beginning.

Area J. That airspace extending upward from 4,800 feet MSL to and including 12,500 feet MSL beginning at the Mission Bay VORTAC; then northwesterly via the Mission Bay 310° radial to the Oceanside 167° radial; then northerly via the Oceanside 167° radial to the westerly extension of the Montgomery Field Runway 28R centerline; then easterly via the Runway 28R centerline to the separation line between San Diego Montgomery Field and Miramar Control Zones; then easterly via the control zone separation line to intercept the Miramar Control Zone 5 SM arc; then counterclockwise via the Miramar Control Zone 5 SM arc to intercept the southern boundary of the Miramar Control Zone extension; then easterly along the Miramar Control Zone extension southern boundary line extended to intercept the Oceanside 130° radial; then southeasterly via the Oceanside 130° radial to the Julian 207° radial; then southerly via the Julian 207° radial to the Mission Bay 099° radial; then westerly via the Mission Bay 099° radial to the point of beginning.

Area K. That airspace extending upward from 5,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Mission Bay 085° radial and the Oceanside 130° radial; then easterly via the Mission Bay 085° radial to intercept the Julian 191° radial; then southerly via the Julian 191° radial to intersect a line that is 3 NM north and parallel to the U.S./Mexican Border; then westerly via this line to the Poggi 121° radial; then northwesterly via the Poggi 121° radial to Poggi VORTAC; then northeasterly via the Poggi 070° radial to intercept the Julian 207° radial; then northeasterly via the Julian 207° radial to intercept the Oceanside 130° radial; then northwesterly via the Oceanside 130° radial to the point of beginning.

Area L. That airspace extending upward from the surface to and including 12,500 feet MSL beginning at the intersection of the Oceanside 171° radial and the Mission Bay 279° radial; then easterly via the Mission Bay 279° radial and the Mission Bay 099° radial to the Mission Bay 10 DME, then clockwise via the Mission Bay 10 DME arc to the Poggi 301° radial; then northwesterly via the Poggi 301° radial to intersect the division line that separates the San Diego Lindbergh Field and San Diego NAS North Island Control Zones; then westerly along this line extended to intercept the Oceanside 171° radial; then northerly via the Oceanside 171° radial to the point of beginning; excluding that airspace (the VFR Corridor in this area and the area Q) extending upward from 3,301 feet to but not including 4,700 feet MSL in an area beginning at the Mission Bay VORTAC; then southeasterly on a line direct to the Hotel del Coronado (south end of Coronado Island); then via the Silver Strand Boulevard to the Mission Bay 10 DME; then counterclockwise via the Mission Bay 10 DME to intersect Interstate 5 (I–5); then northerly via I–5 to the intersection of Highway 94; then on a northerly heading direct to the intersection of the interchange of I–5 and I–805 to intersect the Mission Bay 099° radial; then westerly via Mission Bay 099° radial to Mission Bay to the point of beginning.

Area M. That airspace extending upward from 1,800 feet MSL to and including 12,500 feet MSL beginning at the Mission Bay 099° radial/10 DME; then easterly via the Mission Bay 099° radial to the Mission Bay 13 DME; then clockwise via the 13 DME arc to the Poggi 301° radial; then northwesterly via the Poggi 301° radial to the Mission Bay 10 DME; then northerly via the 10 DME arc to the point of beginning.

Area N. That airspace extending upward from 3,000 feet MSL to and including 12,500 feet MSL beginning at the Mission Bay 099° radial/13 DME; then easterly via the Mission Bay 099° radial to the mission Bay 15 DME; then clockwise via the Mission Bay 15 DME arc to the Poggi 301° radial; then northwesterly via the Poggi 301° radial to the Mission Bay 13 DME; then northerly via the 13 DME to the point of beginning.

Area O. That airspace extending upward from 3,500 feet MSL to and including 12,500 feet MSL beginning at the Mission Bay 099° radial/15 DME; then easterly via the Mission Bay 099° radial to the Julian 207° radial; then southerly via the Julian 207° radial to the Poggi 070° radial; then southwesterly via the Poggi 070° radial to the Poggi VORTAC; then northwesterly via the Poggi 301° radial to the Mission Bay 15 DME; then northerly via the Mission Bay 15 DME arc to the point of beginning.

Area P. That airspace extending upward from 4,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Poggi 280° radial and the eastern edge of W–291; then easterly via the Poggi 280° radial to intercept the mission Bay 10 DME; then northeasterly via the Mission Bay 10 DME to the Poggi 301° radial; then southeasterly via the Poggi 301°/121° radials to intercept a line that is 3 NM north and parallel to the U.S./Mexican Border; then westerly via this line to the eastern edge of W–291; then northerly via the eastern edge of W–291 to the point of beginning.

Area Q. That airspace extending upward from 2,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Oceanside 171° radial and an extension of the division line separating the San Diego Lindbergh Field and San Diego NAS North Island Control Zones; then easterly along that division line to intercept the Poggi 301° radial; then southeasterly via the Poggi 301° radial to intercept the Mission Bay 10 DME; then clockwise via the Mission Bay 10 DME arc to intercept the Poggi 280° radial; then westerly via the Poggi 280° radial to the Oceanside 171° radial; then northerly via the Oceanside 171° radial to the point of beginning, excluding airspace contained in the VFR Corridor (See Area L).

Area R. That airspace extending upward from 4,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Oceanside 135° radial and the Julian 257° radials; then easterly via the Julian 257° radial to intercept the Oceanside 115° radial; then southeasterly via the Oceanside 115° radial to intercept the Poggi 020° radial; then southerly via the Poggi 020° radial to intercept the Oceanside 121° radial; then northwesterly via the Oceanside 121° radial to intercept the Julian 247° radial; then southwesterly via the Julian 247° radial to intercept the Oceanside 135° radial; then northwesterly via the Oceanside 135° radial to the point of beginning.

Area S. That airspace extending upward from 6,800 feet MSL to and including 12,500 feet MSL beginning at the intersection of the Julian VORTAC 262° radial and the Mission Bay 325° radial; then easterly via the Julian 262° radial to intercept the Oceanside VORTAC 115° radial; then southeasterly via the Oceanside 115° radial to intercept the Julian 257° radial; then westerly via the Julian 257° radial to the Mission Bay VORTAC 008° radial; then southerly via the Mission Bay 008° radial to intercept the Julian 247° radial; then southwesterly via the Julian 247° radial to intercept the Miramar, CA, Control Zone 5 SM boundary; then southerly via the 5 SM control zone arc to intercept the Miramar

Runway 28 centerline extended; then westerly via the Miramar Runway 28 centerline extension to intercept the Mission Bay 325° radial, then northwest via the Mission Bay 325° radial to the point of beginning.

Issued in Washington, DC on May 26, 1988.

Shelomo Wugalter,

Manager, Airspace-Rules and Aeronautical Information Division.

[FR Doc. 88-12724 Filed 6-6-88; 8:45 am]

BILLING CODE 4910-13-M

Federal Register

Tuesday
June 7, 1988

Part IV

Department of Education

Office of Bilingual Education and Minority Language Affairs

34 CFR Part 562

Bilingual Education; Fellowship Program; Final Regulations

DEPARTMENT OF EDUCATION

Office of Bilingual Education and Minority Languages Affairs

34 CFR Part 562

Bilingual Education; Fellowship Program

AGENCY: Department of Education.

ACTION: Final regulations.

SUMMARY: The Secretary issues final regulations for the Bilingual Education: Fellowship Program. The Fellowship Program provides financial assistance to full-time students at participating schools, who are in pursuit of a degree above the bachelor's level in areas related to programs for limited English proficient persons such as teacher training, program administration, research and evaluation, and curriculum development. Institutions of higher education (IHEs) are eligible to apply for participation in the Fellowship Program.

EFFECTIVE DATE: These regulations take effect either 45 days after publication in the **Federal Register** or later if the Congress takes certain adjournments. If you want to know the effective date of these regulations, call or write the Department of Education contact person.

FOR FURTHER INFORMATION CONTACT: Joyce Brown, Office of Bilingual Education and Minority Languages Affairs, U.S. Department of Education, 400 Maryland Avenue SW. (Room 421, Reporters Building), Washington, DC 20202. Telephone: (202) 245–2595.

SUPPLEMENTARY INFORMATION: The authority for the Fellowship Program is under section 743 of Part C of the Bilingual Education Act, Title VII of the Elementary and Secondary Education Act of 1965, as amended by Pub. L. 98–511, enacted on October 19, 1984 (20 U.S.C. 3221–3262.

An individual submits an application for a fellowship to an IHE that is approved for participation in the Fellowship Program. Although not eligible for funds, an IHE may apply for participation in the Fellowship Program. A participating IHE forwards to the Secretary names of individuals nominated for fellowships. The Secretary selects Fellows from among the individuals nominated.

On August 16, 1985, the Secretary published final regulations with invitation to comment for the Fellowship Program in the **Federal Register** (50 FR 33308). These regulations included a discussion of the significant comments received. Only minor technical changes have been made in these regulations to conform with 34 CFR Part 500—Bilingual Education: General Provisions.

Analysis of Comments and Changes

In response to the Secretary's invitation to comment in the final regulations, five parties submitted comments. An analysis of the comments and of the changes in the regulations follows.

Substantive issues are discussed under the section of the regulations to which they pertain. Technical and other minor changes—and suggested changes the Secretary is not legally authorized to make under the applicable statutory authority—are not addressed.

Purpose of the Fellowship Program (Section 562.1)

Comment: One commenter suggested that the program should train teachers (who can also conduct in-service training of other teachers), but not administrators.

Discussion: In order to ensure consistency with the statute, the Secretary believes that the regulations should provide for training of teachers and administrators.

Change: None.

Stipend Restriction (Section 562.5(b)(ii))

Comment: One commenter suggested that there be no requirement concerning the amount of time that a fellowship recipient is gainfully employed.

Discussion: A fellowship recipient may work unlimited hours and still receive assistance for his or her tuition, books, fees, and travel. However, in allocating available funds, the Secretary has concluded that the portion of the award which provides a stipend is appropriately based upon the amount of time that Fellows are gainfully employed.

Change: None.

Evidence of Local or National Need (§ 562.11(e))

Comment: One commenter suggested that universities should survey the potential job market for the graduates of their programs.

Discussion: The Secretary recognizes the potential job market as an important consideration in determining the number of graduates required and has assumed responsibility for conducting such surveys. Fellowship grant funds are only available to Fellows in order to participate in approved university programs. Universities do not receive a portion of the grant funds to conduct any program activities.

Change: None.

Use of Language Proficiency as Selection Criteria (§ 562.30(c)(2))

Comment: One commenter suggested that proficiency in English and another language should be an essential qualification for a fellowship.

Discussion: It is the Secretary's view that since the fellowship assistance is provided to students pursuing graduate degrees in such areas as teacher training, program administration, research and evaluation, curriculum development, and teaching in special alternative instructional programs, language proficiency other than in English may not be necessary in all instances.

Change: None.

Obligation Accountability (§ 562.47)

Comment: One commenter suggested that the university should report on the job performance and career ladder status of the graduates.

Discussion: Graduates frequently find employment at sites other than those where they received training. Therefore, the Secretary concludes that it would be difficult, if not impossible, for the university to report on the job performance and career ladder status of its graduates. Fellowship recipients are required by contractual agreement to report on their employment status.

Change: None.

Executive Order 12291

These regulations have been reviewed in accordance with Executive Order 12291. They are not classified as major because they do not meet the criteria for major regulations established in the order.

Assessment of Educational Impact

In the Final Regulations with Invitation to Comment, the Secretary requested comments on whether the regulations would require transmission of information that is being gathered by or is available from any other agency or authority of the United States.

Based on the response to the rules and on its own review, the Department has determined that the regulations in this document do not require transmission of information that is being gathered by or is available from any other agency or authority of the United States.

List of Subjects in 34 CFR Part 562

Bilingual education, Education, Elementary and secondary education, Grant programs—education, Reporting and recordkeeping requirements, Scholarships and fellowships.

Dated: April 6, 1988.

(Catalog of Federal Domestic Assistance Number 84.003, Bilingual Education)

William J. Bennett,

Secretary of Education.

The Secretary amends Title 34 of the Code of Federal Regulations by revising Part 562 to read as follows:

PART 562—BILINGUAL EDUCATION: FELLOWSHIP PROGRAM

Subpart A—General

Sec.

Subpart B—How Does an Institution of Higher Education (IHE) Obtain Approval of Its Application for Participation?

Subpart C—How Does an Individual Apply for a Fellowship?

Subpart D—How does the Secretary Select New Fellows?

Subpart E—What Conditions Must be Met by Fellows?

Authority: 20 U.S.C. 3221–3262, unless otherwise noted.

Subpart A—General

§ 562.1 Fellowship Program.

The Fellowship Program provides financial assistance to full-time students who are in pursuit of a degree above the bachelor's level in areas related to programs for limited English proficient persons (as defined in 34 CFR 500.3) such as teacher training, program administration, research and evaluation, and curriculum development.

(Authority: 20 U.S.C. 3253)

§ 562.2 Who is eligible to apply for assistance under the Fellowship Program?

(a) An institution of higher education (IHE) that offers a program of study leading to a degree above the bachelor's level as described in § 562.1 may apply for participation in the Fellowship Program.

(b) An individual is eligible to apply for a fellowship under this program if the individual—

(1)(i) Is a citizen, a national, or a permanent resident of the United States;

(ii) Is in the United States for other than a temporary purpose and can provide evidence from the Immigration and Naturalization Service of his or her intent to become a permanent resident; or

(iii) Is a permanent resident of the Commonwealth of Puerto Rico, Guam, American Samoa, the Virgin Islands, the Northern Mariana Islands, or the Trust Territories of the Pacific Islands, Republic of Palau; and

(2) Has been accepted for enrollment as a full-time student in a course of study offered by an IHE approved for participation in the program.

(Authority: 20 U.S.C. 3253)

§ 562.3 What regulations apply to the Fellowship Program?

The following regulations apply to the Fellowship Program:

(a) The regulations identified in 34 CFR 500.3.

(b) The regulations in this Part 562.

(Authority: 20 U.S.C. 3253)

§ 562.4 What definitions apply to the Fellowship Program?

The definitions in 34 CFR 500.4 apply to awards made subsequent to Fiscal Year 1985.

(Authority: 20 U.S.C. 3231–3262)

§ 562.5 What does a fellowship award include?

(a) *Allowable costs.* A student may use Fellowship funds under the program for—

(1) Tuition and fees—the normal and usual costs associated with the course of study;

(2) Books—up to $250;

(3) Travel—up to $250 for travel to field-study site; and

(4) A stipend, subject to the restrictions in paragraph (b) of this section.

(b) *Stipends.* (1) An individual may receive a Fellowship stipend if he or she is—

(i) A full-time student in a program of study which was approved by the Secretary in accordance with § 562.10; and

(ii) Not gainfully employed more than 20 hours a week or the annual equivalent.

(2) A stipend for an individual participating in the Fellowship Program may not exceed $450 per month.

(Authority: 20 U.S.C. 3255)

Subpart B—How Does an Institution of Higher Education (IHE) Obtain Approval of Its Application for Participation?

§ 562.10 How does the Secretary approve IHEs for participation?

(a)(1) The Secretary determines whether to approve an IHE for participation with regard to each proposed language curriculum based on the quality of the application using the criteria listed in § 562.11.

(2) The Secretary awards up to a maximum of 100 points for all the criteria.

(3) The maximum possible score for each criterion is indicated in parentheses following the heading for each criterion.

(b) After the IHE's application has been evaluated according to the selection criteria, the Secretary rank orders the application.

(c) Following the rank order, the Secretary then designates the maximum number of fellowships by language curriculum that may be awarded at each IHE—

(1) Based on the IHE's capacity to provide graduate training in the areas proposed for fellowship recipients; and

(2) To the extent feasible, in proportion to the needs of various groups of individuals with limited English proficiency within the geographic area.

(Authority: 20 U.S.C. 3253(a), 3254)

(Approved by the Office of Management and Budget under control number 1885–0001)

§ 562.11 What criteria does the Secretary use in reviewing applications for participation?

(a) *Institutional commitment.* (25 points)

(1) The Secretary reviews each application to determine the quality of the IHE's graduate program of study.

(2) The Secretary considers—

(i) The extent to which the program has been adopted as a permanent graduate program of study;

(ii) The organizational placement of the program;

(iii) The staff and resources which the IHE has committed to the program; and

(iv) The IHE's demonstrated competence and experience in programs and activities such as those authorized under the Act.

(b) *Quality of faculty members.* (20 points)

(1) The Secretary reviews each application to determine the qualifications of the faculty in the academic area.

(2) The Secretary considers the extent to which the background, education, research interests, and relevant experience of the faculty qualify them to plan and implement a successful program of high academic quality.

(c) *Quality of the instructional program.* (20 points)

(1) The Secretary considers the quality of the applicant's program of instruction.

(2) The Secretary considers—

(i) In the case of projects designed to prepare educational personnel for programs for limited English proficient persons that use English and a language other than English, the project incorporates the use of both English and a language other than English, to the extent necessary to develop the participants' competencies as bilingual education personnel;

(ii) The quality of the standards used to determine satisfactory progress in and completion of the program; and

(iii) The interdisciplinary aspects of the program.

(d) *Field based experience.* (15 points)

The Secretary reviews each application to determine the extent to which the program provides field based experience through arrangements with local educational agencies (LEAs), State educational agencies (SEAs) and persons or organizations with expertise in programs for limited English proficient persons.

(e) *Evidence of local or national need.* (10 points)

The Secretary reviews each application to determine the need for more individuals trained above the bachelor's level in proportion to the needs of various groups of individuals with limited English proficiency in the local area, and throughout the country.

(f) *Recruitment plan.* (10 points)

The Secretary considers the IHE's plans for recruiting and selecting nominees using the criteria listed in § 562.30 (b) and (c).

(Authority: 20 U.S.C. 3253(a))

(Approved by the Office of Management and Budget under control number 1885-0001)

Subpart C—How Does An Individual Apply for a Fellowship?

§ 562.20 Where does an individual apply?

(a) An individual shall submit an application for a fellowship to a participating IHE.

(b) Each participating IHE may establish procedures for receipt of applications from individuals.

(Authority: 20 U.S.C. 3253(a))

Subpart D—How Does the Secretary Select New Fellows?

§ 562.30 How does the Secretary select new Fellows?

(a) The Secretary selects Fellows taking into consideration the rank orders prepared by the IHE, subject to the maximum number of fellowships per language curriculum designated for that IHE.

(b) The Secretary gives preference to individuals intending to study programs for limited English proficient persons in the following specialized areas:

(1) Vocational education.
(2) Adult education.
(3) Gifted and talented education.
(4) Special education.
(5) Education technology.
(6) Literacy.
(7) Mathematics and science education.

(c) In recommending nominees, an IHE shall consider the following criteria:

(1) *Academic record.* The quality of the academic record of the applicant.

(2) *Language proficiency.* The applicant's proficiency in English and, if applicable, the language(s) to be studied.

(3) *Experience.* The extent of the applicant's experience in providing services to, teaching in, or administering programs for limited English proficient persons.

(Authority: 20 U.S.C. 3253(a))

(Approved by the Office of Management and Budget under control number 1885-0001)

§ 562.31 What is the period of a fellowship?

(a) Except as provided in paragraph (b) of this section—

(1) Fellowships may be awarded for a maximum of two one-year periods to a student who maintains satisfactory progress in a post-baccalaureate program of study; and

(2) Fellowships may be awarded for a maximum of three one-year periods to a student who maintains satisfactory progress in a doctoral program of study.

(b) Subject to the availability of funds and where adequate justification is provided by an IHE, the Secretary may extend a fellowship beyond the maximum period to a recipient who, for circumstances beyond his or her control, is not able to complete the program of study in that period.

(c) A recipient of a fellowship who seeks assistance beyond the initial one-year period must be renominated by the participating IHE.

(d) The Secretary may give preference to recipients in their second or third year who maintain satisfactory progress in the program of study prior to approving nominations of new students.

(Authority: 20 U.S.C. 3253(a))

Subpart E—What Conditions Must Be Met by Fellows?

§ 562.40 What is the service requirement for a fellowship?

(a) Upon selection for a fellowship, the recipient shall sign an agreement provided by the Secretary to work for a period equivalent to the period of time that the recipient receives assistance under the fellowship in one or more of the following activities:

(1) Training personnel to develop and conduct programs for limited English proficient persons or teacher training programs at IHEs.

(2) Conducting research related to programs for limited English proficient persons.

(3) Administering programs for limited English proficient persons.

(4) Conducting evaluations of programs for limited English proficient persons.

(5) Developing curriculum materials designed for programs for limited English proficient persons.

(6) Working in any other activity, approved in advance by the Secretary, in accordance with the procedures in § 562.47, which is related to programs and activities such as those authorized under the Act.

(b) A recipient shall begin working in one or more of the activities listed in paragraphs (a) (1) through (6) of this section within six months of the date the recipient ceases to be enrolled at an IHE as a full-time student.

(Authority: 20 U.S.C. 3253(c))

§ 562.41 What are the requirements for repayment of the fellowship?

(a) If a recipient does not work in one of the activities described in § 562.40(a) (1) through (6), he or she shall repay the full amount of the fellowship.

(b) The Secretary prorates the amount a recipient is required to repay based on the length of time the recipient worked in an authorized activity compared with the length of time during which he or she received assistance.

(Authority: 20 U.S.C. 3253(c))

§ 562.44 What is the repayment schedule?

(a) A recipient required to repay all or part of the amount of the fellowship shall—

(1) Begin repayments within six months of the date he or she ceases to be enrolled as a full-time student at an IHE in the Fellowship Program; or

(2) Begin repayments on a date and in a manner established by the Secretary, if he or she ceases to work in an authorized activity, of the prorated amount of his or her obligation.

(b) A recipient must repay the required amount, including interest, in a lump sum or installment payments approved by the Secretary. This period may be extended if the Secretary grants a deferment under § 562.44.

(Authority: 20 U.S.C. 3253(c))

§ 562.43 What interest is charged?

(a) The Secretary charges a recipient interest on the unpaid balance owed by the recipient in accordance with 31 U.S.C. 3717.

(b) No interest is charged for the period of time—

(1) That precedes the date on which the recipient is required to commence repayment; or

(2) During which repayment has been deferred under § 562.44.

(Authority: 20 U.S.C. 3253(c))

§ 562.44 Under what circumstances is repayment deferred?

The Secretary may defer repayment if the recipient—

(a) Suffers from a serious physical or mental disability that prevents or substantially impairs the recipient's employability in one of the activities described in § 562.40(a)(1)-(6);

(b) Demonstrates to the Secretary's satisfaction that he or she is conscientiously seeking but unable to secure employment in one of the activities described in § 562.40(a)(1)-(6);

(c) Re-enrolls as a full-time student at an IHE;

(d) Is a member of the Armed Forces of the United States on active duty;

(e) Is in service as a volunteer under the Peace Corps Act; or

(f) Demonstrates to the Secretary's satisfaction the existence of extraordinary circumstances that prevents him or her from making a scheduled payment.

(Authority: 20 U.S.C. 3253(c))

§ 562.45 What is the length of the deferment of repayment?

(a) Unless the Secretary determines otherwise, a recipient shall renew a deferment on a yearly basis.

(b) Deferments for military or Peace Corps service may not exceed three years.

(Authority: 20 U.S.C. 3253(c))

§ 562.46 Under what circumstances is repayment waived?

The Secretary may waive repayment if the recipient demonstrates the existence of extraordinary circumstances that justify a waiver.

(Authority: 20 U.S.C. 3253(c))

§ 562.47 How shall the recipient account for his or her obligation?

(a) Within six months of the date a recipient ceases to be enrolled as a full-time student at an IHE, the recipient shall submit to the Secretary one of the following items:

(1) A description of the employment in an activity listed in § 562.40(a)(1) through (6) in which he or she is employed.

(2) Repayment required under §§ 562.41 and 562.42.

(3) A request to repay the obligation in installments.

(4) A request for a deferment or waiver as described in §§ 562.44 through 562.46 accompanied by a statement of justification.

(b) A recipient who submits a description of employment under paragraph (a)(1) of this section shall notify the Secretary on a yearly basis of the period of time during the preceding year that he or she was employed in the activity.

(c) A recipient shall inform the Secretary of any change in his or her employment status.

(d) A recipient shall inform the Secretary of any change in his or her address.

(e) A recipient's failure to timely satisfy the requirements in paragraphs (b) and (d) of this section shall result in the recipient being in non-compliance or default status subject to collection action. Interest and costs of collection may be collected in accordance with 31 U.S.C. 3717 and 34 CFR Part 30.

(Authority: 20 U.S.C. 3253(c))

(Approved by the Office of Management and Budget under control number 1885-0001)

[FR Doc. 88-12752 Filed 6-6-88; 8:45 am]

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