

ENVIRONMENTAL PROTECTION AGENCY**40 CFR Parts 148, 261, 266, 268, 271, and 302**

[SWH-FRL-6122-7]

RIN 2050-AD88

Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Petroleum Refining Process Wastes; Land Disposal Restrictions for Newly Identified Wastes; And CERCLA Hazardous Substance Designation and Reportable Quantities

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is amending the regulations for hazardous waste management under the Resource Conservation and Recovery Act (RCRA) to reduce hazards to human health and the environment from wastes generated from petroleum refining. EPA is listing as hazardous four wastes generated during petroleum refining and is issuing a decision not to list ten other petroleum refining wastes.

This action is taken under the authority of RCRA 3001(b)(1), which authorizes EPA to list wastes as hazardous, and 3001(e)(2), which directs EPA to make a decision whether to list as hazardous the various petroleum refining wastes. The effect of listing these four wastes will be to subject them to stringent management and treatment standards under RCRA and to emergency notification requirements for releases of hazardous substances to the environment. These notifications are required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) and the Emergency Planning and Community Right to Know Act (EPCRA). EPA is also issuing Reportable Quantity (RQ) adjustments for these notifications.

This action also makes certain changes to the RCRA regulations to promote the environmentally sound recycling of oil-bearing residuals. Specifically, the Agency is excluding certain recycled secondary materials from the definition of solid waste. These materials include oil-bearing residuals from petroleum refineries when they are inserted into the petroleum refining process, oil from associated petrochemical facilities inserted into the petroleum refining process, and spent caustic from liquid treating operations

when used as a feedstock to make certain chemical products. This rule also clarifies an existing exclusion for recovered oil from certain petroleum industry sources.

Finally, EPA is applying universal treatment standards (UTS) under the Land Disposal Restrictions program to the petroleum refining wastes listed in this rulemaking. The listed wastes must be treated to meet these treatment standards for specific constituents prior to land disposal.

EFFECTIVE DATES: This final rule is effective February 8, 1999, except for the amendments to §§ 261.3(c)(2)(ii)(B), 261.4(a), 261.6(a)(3)(iv)(C) and 261.100(b)(3) and the removal of § 261.6(a)(3)(v) which are effective August 6, 1998.

ADDRESSES: Supporting materials are available for viewing in the RCRA Information Center (RIC), located at Crystal Gateway I, First Floor, 1235 Jefferson Davis Highway, Arlington, VA. The Docket Identification Number is F-98-PRLF-FFFFF. The RIC is open from 9 a.m. to 4 p.m., Monday through Friday, excluding federal holidays. To review docket materials, it is recommended that the public make an appointment by calling 703 603-9230. The public may copy a maximum of 100 pages from any regulatory docket at no charge. Additional copies cost \$0.15/page. The index and some supporting materials are available electronically. See the beginning of the Supplementary Information section for information on accessing them.

FOR FURTHER INFORMATION CONTACT: The RCRA/Superfund Hotline, toll-free, at (800) 424-9346 or at (703) 920-9810. The TDD Hotline number is (800) 553-7672 (toll-free) or (703) 486-3323 in the Washington, DC., metropolitan area.

For technical information on the RCRA hazardous waste listings, contact Maximo (Max) Diaz, Jr., or Robert Kayser, Office of Solid Waste (5304W), U.S. Environmental Protection Agency, 1235 Jefferson Davis Highway, Arlington, VA, (703) 308-0439. [E-mail addresses and telephone numbers: diaz.max@epamail.epa.gov, (703) 308-0439; kayser.robert@epamail.epa.gov, (703) 308-7304.] For information related to the exclusions from the definition of solid waste, contact Ross Elliott at the same address. [elliott.ross@epamail.epa.gov; (703) 308-8748.]

For technical information on the CERCLA aspects of this rule, contact: Ms. Elizabeth Zeller, Office of Emergency and Remedial Response (5204G), U.S. Environmental Protection

Agency, 401 M Street, SW, Washington, D.C., 20460, (703) 603-8744.

SUPPLEMENTARY INFORMATION: The index and the supporting materials are available on the Internet. Follow these instructions to access the information electronically:

www:<http://www.epa.gov/epaoswer/osw/hazwaste.htm#id>

FTP: [ftp.epa.gov](ftp://ftp.epa.gov)

Login: anonymous

Password: your Internet address

Files are located in /pub/epaoswer

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I. Affected Entities

Entities potentially affected by this action are those which handle either the waste streams being added to EPA's list of hazardous wastes under RCRA and to the CERCLA list, or entities which need to respond to releases. Affected entities include:

| Category | Affected entities |
|---------------------------------|---|
| Industry | Generators of the following listed wastes, or entities that treat, store, transport, or dispose of these wastes. K169—Crude oil storage tank sediment from petroleum refining operations. K170—Clarified slurry oil storage tank sediment and/or in-line filter/separation solids from petroleum refining operations. K171—Spent hydrotreating catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic units (this listing does not include inert support media). K172—Spent hydrorefining catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic units (this listing does not include inert support media). |
| State, Local, Tribal Govt | State and local emergency planning entities. |
| Federal Govt | National Response Center, and any Federal Agency that handles the listed waste or chemical. |

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. This table lists those entities of which EPA now is aware that potentially could be affected by this action. Other entities not listed in the table also could be affected. To determine whether your facility is regulated by this action, you should examine 40 CFR Parts 260 and 261 carefully in concert with the amended rules found at the end of this **Federal Register** notice. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

II. Legal Authority and Background

These regulations are being promulgated under the authority of

sections 2002(a) and 3001(a), (b) and (e)(2), 3004 (g) and (m) of the Solid Waste Disposal Act (commonly referred to as RCRA), as amended, 42 U.S.C. 6912(a), and 6921(b) and (e)(2), and section 102(a) of CERCLA, 42 U.S.C. 9602(a).

A. Listing Decisions

Section 3001(a) of RCRA requires EPA to promulgate criteria for identifying characteristics of hazardous wastes and for listing hazardous wastes. Section 3001(b) authorizes EPA to promulgate regulations, based on these criteria, identifying and listing hazardous wastes. Section 3001(e)(2) of RCRA requires EPA to determine whether to list, as hazardous, wastes generated by specific industries and production processes, including petroleum refining wastes. Hazardous waste, for purposes

of this rule, is defined at section 1004(5)(B) of RCRA as solid waste which may pose a substantial present or potential hazard to human health or the environment when improperly managed.

Hazardous wastes are subject to management and treatment requirements of RCRA Subtitle C, which establishes stringent federal requirements, including the need to obtain facility operating permits for persons who generate, transport, treat, store, or dispose of such waste. Solid wastes which are not hazardous may be disposed of at facilities which are overseen by state and local governments. These are the so-called RCRA subtitle D facilities, which generally impose less stringent requirements on management of wastes.

EPA's regulations at 40 CFR 261.20 provide that hazardous wastes may be classified as "characteristic" wastes if they have the properties described at 40 CFR 261.21 through 261.24, which would cause them to be classified as having the characteristics of ignitability, corrosivity, reactivity, or toxicity. Characteristic wastes are identified by sampling a waste, or using appropriate company records concerning the nature of the waste, to determine whether a waste has the relevant properties. There is no regulatory requirement to conduct sampling, but persons managing materials that are found to be characteristic hazardous wastes are subject to enforcement actions under RCRA.

Criteria for listing hazardous wastes are found at 40 CFR 261.11(a)(3), which provides that wastes may be listed as hazardous if they contain hazardous constituents identified in appendix VIII of 40 CFR part 261 and the Agency concludes, after considering eleven factors enumerated in § 261.11(a)(3), that the waste is capable of posing a substantial present or potential hazard to human health or the environment when improperly managed. A substance is listed in appendix VIII if it has been shown in scientific studies to have toxic effects on life forms.

EPA's regulations at 40 CFR 261.31 through 261.33 contain the various hazardous wastes the Agency has listed from time to time. Section 261.31 lists wastes generated from non-specific sources, known as "F-wastes," and § 261.32 lists hazardous wastes generated from specific sources, known as "K-wastes." Pursuant to the requirement of RCRA section 3001(e)(2) to list refinery wastes, EPA has previously listed various petroleum refinery wastes designated as F037, F038, and K048 through K052. Section 261.33 lists as hazardous discarded commercial chemical products and other materials that become hazardous wastes, known as "P-wastes" or "U-wastes," when they are discarded or intended to be discarded.

Therefore, newly listed wastes in this rule will be added to the K-waste list. Once listed, wastes must be managed as RCRA Subtitle C hazardous wastes. No testing of waste samples is required as for characteristic hazardous wastes.

On June 12, 1997, EPA entered into a proposed amended consent decree in a lawsuit filed by the Environmental Defense Fund (EDF)—*EDF v. Browner*, Civ. No. 89-0598 (D.D.C.). The consent decree sets out a series of deadlines for promulgating RCRA rules. Paragraph 1.k. of the proposed amended consent decree obligated EPA to promulgate a

final listing determination on or before May 29, 1998 (EPA and EDF have since agreed to extend this date to June 29, 1998), for 14 additional petroleum refining process residuals. Today, EPA is issuing final listing determinations for these residuals (hereafter, "listing residuals") in accordance with the proposed consent decree's deadline. The consent decree also identified another 15 petroleum refining residuals for which EPA agreed to conduct a study (hereafter, "study residuals"). EPA published the study in 1996. (See *Study of Selected Petroleum Refining Residuals-Industry Study*, August 1996; EPA530-R-96-018.)

All hazardous wastes listed under RCRA and codified in 40 CFR 261.31 through 261.33, as well as any solid waste that exhibits one or more of the characteristics of a RCRA hazardous waste, described in 40 CFR 261.20 through 261.24, are also hazardous substances under CERCLA, as provided in CERCLA section 101(14)(C). CERCLA hazardous substances are listed in Table 302.4 at 40 CFR 302.4 along with their reportable quantities (RQs). Today's rule also establishes RQs for the newly listed wastes.

Today's listing determination follows the elements of EPA's hazardous waste listing policy presented in the dyes and pigments listing determination proposal (59 FR 66072, December 22, 1994). A description of how elements of EPA's listing policy were applied in today's listing determination is found in Section III.F.2., "Risk Analysis," of the preamble for the proposed rule. Section V.C of this preamble discusses EPA's responses to comments and final decisions as they relate to the various elements of the listing policy and their applicability to this rule.

B. Definition of Solid Waste and Exclusions

The jurisdictional boundaries of RCRA are established primarily by the definition of solid waste. When hazardous sludges, by-products, and spent materials (often referred to as a group as "secondary materials") are recycled, a question exists as to whether such materials are "solid wastes" and so potentially within EPA's subtitle C jurisdiction. The regulatory definition of solid waste, found at 40 CFR 261.2, answers these questions, since only materials which meet this definition are even potentially subject to the subtitle C regulatory program set out at 40 CFR Parts 262-268. Secondary materials may be excluded from the definition of solid waste, and therefore from regulation under this regulatory program, if they are recycled in certain ways. The

current definition of solid waste at 40 CFR 261.2 excludes secondary materials from the definition of solid waste that are used directly (i.e., without reclamation) as ingredients in manufacturing processes to make new products, used directly as effective substitutes for commercial products, or returned directly to the original process from which they are generated as a substitute for raw material feedstock. (See 40 CFR 261.2(e)(1)). As discussed in the January 4, 1985, rulemaking that promulgated this regulatory framework, these are activities which, as a general matter, resemble ongoing manufacturing operations more than conventional waste management and so are more appropriately classified as not involving solid wastes. (See 50 FR at 637-640).

However, these exclusions do not apply to materials that are either contained in, or used to produce, fuels and, therefore, do not generally apply to secondary materials recycled as part of the petroleum refining process (see 40 CFR 261.2(e)(2)(ii)). Petroleum industry representatives have long argued that oil-bearing secondary materials used as ingredients in a petroleum refining process to make fuel should be excluded from the definition of solid waste under RCRA.¹

While these exclusions from the definition of solid waste are not available to hazardous secondary materials generated by, and used as ingredients in, the petroleum refining industry, these hazardous secondary materials, or the fuels produced from them, may be exempt from all regulatory requirements under 40 CFR 261.6(a)(3)(iii)-(v). These exemptions from regulatory requirements, however, did not resolve the jurisdictional debate involving the continued processing of hazardous secondary materials into fuels.

Regarding this debate, the plain reading of the statute has been supplemented by case law providing parameters within which to determine whether secondary materials being recycled are or are not solid wastes. In its decision in *American Mining Congress v. EPA*, (824 F. 2d 1177 (D.C. Cir. 1987) (AMC I)), the D.C. Circuit Court held that EPA's rules defining the statutory term "solid waste" (RCRA Section 1004(27)) exceeded the Agency's statutory authority to the extent that the rules asserted jurisdiction over "materials that are recycled and reused in an ongoing manufacturing or industrial process"

¹ See the proposed rule (specifically 60 FR 57752 to 57753) for a detailed discussion on the background to these regulatory issues.

(Id. at 1186 (emphasis original)). The Court held that “[b]ecause these materials have not yet become part of the waste disposal problem” (Id.), they are not yet “discarded” within the meaning of Section 1004(27) and so cannot be considered to be “solid wastes.”

On January 8, 1988, EPA responded to the AMC I decision by proposing to exclude, from the regulatory definition of solid waste, oil-bearing petroleum residuals that are returned for further refining “as part of one continuous and ongoing process.” (see 53 FR FR 525, Jan. 8, 1988). More specifically, EPA proposed to exclude oil-bearing residues from the refining process when those residues are generated on-site and reinserted on-site into the petroleum refining process (including the coker), provided that the residues were not speculatively accumulated or stored in a manner involving land placement.

Subsequent decisions have established that the decision in AMC I is relatively narrow. In particular, courts have rejected the argument that “potential reuse of a material prevents the Agency from classifying it as ‘discarded’” (see, *American Mining Congress v. EPA*, 907 F. 2d 1179, 1186 (D.C. Cir. 1990) (AMC II)). The proper test as to when, as a matter of law, the Agency is foreclosed from classifying a material as a solid waste is when a material is “destined for immediate reuse in another phase of the industry’s ongoing production process” and that has “not yet become part of the waste disposal problem” (Id. at 1186 (emphasis original)). EPA retains considerable discretion in ascertaining how to apply this standard.

For example, secondary materials generated by one industry and sent to another industry for reclamation could be classified as solid wastes (although EPA retains some discretion as to whether to make that determination) (see, *American Petroleum Inst. v. EPA*, 906 F. 2d 726, 740–41 (D.C. Cir. 1990); *Ilco v. EPA*, 996 F. 2d 1126 (11th Cir. (1993); *Owen Electric Steel v. Browner*, 37 F. 3d 146 (4th Cir. 1994)). Similarly, secondary materials generated onsite, stored in surface impoundments, and reclaimed within the process which generated them could also be classified as solid wastes (see AMC II). EPA must normally justify determinations that a secondary material being recycled is not a solid waste by showing how the determination is consistent with RCRA’s objective to “establish a cradle-to-grave regulatory structure for the safe handling of hazardous wastes” (see *API*, 906 F. 2d at 741).

On July 28, 1994, EPA finalized parts of the January 8, 1988, proposal pertaining to petroleum refining industry operations. As noted in that final rule, post-AMC I decisions make clear that the statute affords EPA great latitude to set the jurisdictional parameters of RCRA. As a consequence, the July 28, 1994, final rule excluded a more limited set of materials and imposed greater restrictions on where the materials can be inserted within the petroleum refining process, than what was proposed on January 8, 1988. Specifically, in its January 1988 proposal, EPA did not distinguish between recovered oil (i.e., oil reclaimed from secondary materials, such as wastewater, generated from normal petroleum refining, exploration and production, and transportation practices) and oil-bearing hazardous sludges, nor did it distinguish between the petroleum coker and other petroleum process units in defining the scope of the proposed petroleum refining exclusion. In the July 28, 1994, final rule, EPA limited the exclusion to recovered oil that is inserted into the petroleum refining process prior to distillation and catalytic cracking. Thus, it did not apply to recovered oil reinserted into the petroleum coker (see 40 CFR 261.4(a)(12) and 59 FR at 38541–38542, July 28, 1994). In at least one respect, the July 28, 1994, final rule was somewhat broader than what was proposed. The final exclusion applied to materials generated from petroleum industry sources other than refineries, while the January 8, 1988, rule proposed to exclude only oil-bearing materials generated at a refinery and reinserted into that refinery’s refining process.

After promulgation of the July 28, 1994, final rule excluding certain recovered oil, the EPA published a direct final rule on March 26, 1996, to correct an inadvertent error in the regulatory text of the exclusion (see 61 FR 13103). Specifically, the direct final rule amended the words describing the point of insertion for recovered oil into the petroleum refining process (i.e., “prior to crude distillation or catalytic cracking”) that was a condition of the exclusion. The original intent was to exclude recovered oil inserted into the refining process where the process removes at least some contaminants (which does not include cokers). After promulgating the exclusion, the Agency learned that delineating where recovered oil could or could not be inserted (and be excluded) using the words “prior to crude distillation or catalytic cracking” was unintentionally restrictive, i.e., those operations were

common examples but there were other refinery units where contaminants were removed as well. In addition to the amended regulatory text, the Agency also clarified that the recovered oil exclusion applied to oil recovered from shared wastewater treatment systems at petroleum refineries co-located with petrochemical facilities (see 61 FR 13104). Because the Agency received no adverse comment as of April 9, 1996, on the amended regulatory text, the direct final rule became effective on May 28, 1996.

Today’s final rule, which deals specifically with petroleum residuals, gives EPA the opportunity to address some larger, longstanding issues involving where the boundaries of RCRA should be drawn regarding jurisdiction over oil-bearing hazardous secondary materials which are generated by, and recycled within, the petroleum industry. Therefore, in addition to addressing specific regulatory issues that may arise as a result of a decision to list an individual petroleum waste stream, the Agency is issuing more comprehensive revisions to the RCRA regulations relating to regulatory jurisdiction over these materials when this type of intra-industry recycling occurs.

III. Summary of Proposal and Notice of Data Availability

A. Proposed Exclusions

The proposed rule discussed the applicability of the definition of solid waste to the waste streams being evaluated for listing, but also related to a broader class of petroleum wastes. This is discussed briefly below.

1. Exclusion of Oil-Bearing Hazardous Secondary Materials Inserted Into Petroleum Refining, Including Petroleum Coking

In the November 20, 1995, proposal, the Agency proposed to exclude oil-bearing secondary materials generated within the petroleum industry that are inserted into the petroleum coker (see 60 FR at 57754–57755). Generally, these secondary materials are generated as either residues of various refining processes or wastewater treatment systems which collect process waters (and oil) from the entire facility. (Note that these secondary materials, primarily wastewater treatment sludges, do not meet the definition of “recovered oil” because the contained oil is a small percentage of the total.) Secondary materials, such as wastewater treatment sludges, that contain a high percentage of oil are often processed to recover the oil for further refining (e.g., when there

is free oil). However, the typical oil recovery process (e.g., centrifugation) cannot recover all of the oil from these secondary materials, leaving a not insignificant amount of oil in the secondary materials that can only be recovered thermally.

In conventional petroleum coking operations (also known as "delayed coking"), heavy oil-bearing feedstocks, typically bottoms from crude oil distillation or vacuum distillation (also referred to as "resids," representing the heaviest oil fraction of the crude oil feedstock) are placed into a coke drum. This material is then heated to high temperatures, thermally breaking or "cracking" the long-chain hydrocarbon molecules found in heavy oil feedstock into short-and middle-chain oil fractions that are then recovered, condensed, and sent for further refining into high-value fuel products. The remains of the heavy oil-bearing feedstock (which is primarily carbon and some inorganic contaminants) forms the coke product, typically used as a fuel.

The last step of the conventional coking operation involves the injection of water to quench the coke product. Water is injected in the base of the coke drum and works its way up through the coke product, cooling the coke as it goes. This quenching also serves to remove light ends entrained within the coke product, similar to steam stripping. (The light ends recovered during the quenching process are likewise condensed and further refined into high-value fuel products.) Once cool enough, the coke product is typically removed from the coke drum using high pressure water drilling. For the purposes of this preamble discussion, it is important to distinguish between the two aspects of the coking operation. The first aspect, referred to in this preamble as "conventional coking," involves the recovery of light-end hydrocarbons from the resids feedstock and produces the coke product. The second aspect, referred to here as the "quenching process," involves the injection of water into the high-temperature coke to cool it down after the conventional coking process.

In the preamble discussion in the November 20, 1995, proposal, the Agency presented its determination that the petroleum coker is an integral part of the petroleum refinery process, with recovered middle-and light-end hydrocarbons as its primary product and petroleum coke as a co-product. Based on the information on hand comparing the composition of oil-bearing hazardous secondary materials to typical feedstocks to the coker, and

the fact that the coke produced using oil-bearing hazardous secondary materials demonstrated no significant increase in hazardous metals concentrations, the Agency proposed to exclude such oil-bearing secondary materials when used in the production of petroleum coke. EPA believed this exclusion was further justified because the hazardous secondary materials are managed in a manner to prevent release, commensurate with management of nonhazardous oil-bearing feedstocks. (See 60 FR 57754-57755). In addition, the proposed exclusion was conditioned on there being no speculative accumulation or land placement (thus ensuring that the secondary materials would not be stored such that they could become part of the waste disposal problem), and that the coke product itself not exhibit a characteristic of hazardous waste, which, along with existing product specifications, would serve to ensure that the quality of the coke product would not degrade through the use of hazardous secondary materials such that it would become part of the waste disposal problem.

At the time of the proposal, the Agency did not distinguish between oil-bearing hazardous secondary materials used in either of the two aspects of the coking operations, i.e., in the conventional coking process (where secondary materials would be used as feedstocks) or during the quenching process (where secondary materials are mixed with water and injected into the coke during the quenching process). While the Agency was aware that oil-bearing hazardous secondary materials were being used in the quenching process at some refineries, the primary focus and intent of EPA's proposed exclusion was for secondary materials used as feedstock in the conventional coking process, with a secondary consideration being whether these secondary materials legitimately could be used in the quenching process. As the Agency learned through comments received, the hazardous secondary materials in question (i.e., listed hazardous wastes generated by petroleum refineries) are rarely, if indeed ever, used as feedstock along with the resids. EPA, therefore, has since focused its attention on the role of oil-bearing hazardous secondary materials in the quenching process, maintaining the key consideration that the exclusion is only intended for oil-bearing hazardous secondary materials used in a manner consistent with the main production purpose of the coking process, i.e., the recovery of light-end hydrocarbons for further refining and

the production of a marketable coke product.

2. Recovered Oil From Associated Petrochemical Facilities

In the November 20, 1995 proposal, EPA proposed to add an exclusion at 40 CFR 261.4(a)(13) for recovered oil² that is generated by certain organic chemical industry facilities and inserted into petroleum refining processes provided that certain conditions are met (i.e., the petrochemical recovered oil is not stored in a manner involving placement on the land, or accumulated speculatively before being recycled) (see 60 FR at 57755. The proposed exclusion only applied to petrochemical recovered oil from organic chemical manufacturing facilities that were within the SIC code 2869, and was further limited to situations where the petrochemical and petroleum refinery facilities were either co-located, or under common ownership (co-owned). (Id).

As described in the proposed rule, the recovered oil exclusion that was promulgated in the July 28, 1994, final rule did not apply to oil from organic chemical industry operations except in cases where petrochemical and petroleum refining operations share a common wastewater treatment system. In these instances, because a portion of the oil recovered during wastewater treatment and returned to petroleum refining originates from organic chemical manufacturing, some industry representatives questioned whether a "petroleum industry" exclusion would apply. However, because of the predominance of petroleum refining wastewaters in the shared wastewater treatment systems, and the degree of integration between these facilities, the Agency believed that it was appropriate to apply the July 28, 1994, recovered oil exclusion to the oil recovered from *shared* petrochemical and petroleum refining wastewater treatment systems. (see 61 FR at 13104). The EPA subsequently became aware that some petrochemical facilities recover oil from their process streams in a manner distinct from wastewater treatment operations and send this material (so-called "dry" hydrocarbon streams) to

² Recovered oil, as defined within the context the exclusion from the definition of solid waste promulgated in the July 28, 1994, final rule, includes materials that are primarily oil and that are recovered from any phase of petroleum exploration, production, refining, and transportation related thereto. Oil recovered from petrochemical facilities associated with petroleum refineries, whether from shared wastewater treatment systems at co-located facilities, or from other "dry" streams recovered from petrochemical process units, are referred to here as "petrochemical recovered oil."

petroleum refineries for insertion into the refining process. In some cases these hydrocarbon materials might or might not be viewed as solid wastes when returned to petroleum refining operations as feedstocks in producing the normal slate of refinery produced fuels. After promulgation of the July 28, 1994, rule, EPA received information from the chemical manufacturing industry indicating that these "dry" hydrocarbon streams recovered from their operations are comparable to oil recovered from petroleum refining operations, i.e., are chemically comparable to the recovered oil already excluded from being a solid waste. As explained in more detail in the proposed rule, the exclusion for petrochemical recovered oil was therefore based upon two specific arguments raised by both the chemical manufacturing and petroleum refining industries. First, knowledge of the composition of these petrochemical recovered oil streams is very important because of the potential for adverse impacts on both refinery operations (e.g., equipment corrosion, catalyst fouling) and product quality (e.g., introduction of contaminants that degrade motor fuels) if these streams contain constituents not typically encountered in normal refinery feedstocks. Second, analytical data the Agency received prior to proposal supported industry's premise that recovered oil from petrochemical operations is similar in composition to that from petroleum refining, and is therefore suitable for insertion into the petroleum refining process.³ EPA based the proposed exclusion for petrochemical recovered oil on a very limited set of data from integrated petrochemical and petroleum refineries that were either co-located or co-owned, and EPA believed that this was a typical arrangement for the return of these hydrocarbon streams to petroleum refineries (see 60 FR at 57756). In the proposal, EPA solicited additional data which could support broadening the exclusion to recovered oil from other SIC codes representing other types of associated chemical manufacture (e.g., plastics and resins, synthetic rubber, cyclic crude and intermediate producers). (Id).

3. Use of Spent Caustics as Feedstock

EPA proposed an exclusion from the definition of solid waste that would clarify that spent liquid treating caustics from petroleum refineries used as

feedstock in the manufacture of naphthenic and cresylic acid products are not solid wastes. EPA believed that, when used in this manner, spent caustic is a valuable commercial feedstock that is used in the manufacture of commercial chemical products. Therefore, EPA proposed to add a new § 261.4(a)(14) to exclude spent caustic when used in this manner.

B. Proposed Listing Decisions

1. Summary of Proposed Decisions

EPA evaluated 14 wastes (the consent decree "listing residuals") in the petroleum refining industry, proposing to list 3 of these wastes as hazardous and not the other 11 wastes. Further general background for this rule is provided in the preamble to the proposed rule at 60 FR 57748-57749. As a result of numerous comments on the proposed rule, EPA conducted additional analyses for these wastes, resulting in the Agency's publishing a Notice of Data Availability (NODA) on April 8, 1997 (62 FR 16747). This Section summarizes the issues raised in the proposed rule and the following Section describes the NODA.

The Agency proposed to list as hazardous the following three wastes:

K170—Clarified slurry oil storage tank sediment and/or in-line filter/separation solids from petroleum refining operations.

K171—Spent hydrotreating catalysts from petroleum refining operations. (This listing does not include ceramic support media.)

K172—Spent hydrorefining catalysts from petroleum refining operations. (This listing does not include ceramic support media.)

The Agency proposed not to list as hazardous the following eleven residual categories:

- Crude oil storage tank sediment
- Unleaded gasoline storage tank sediment
- Off-specification product and fines from thermal processes
- Catalyst from reforming
- Catalyst from sulfuric acid alkylation
- Sludge from sulfuric acid alkylation
- Hydrofluoric acid alkylation sludge
- Spent caustic from liquid treating
- Catalyst and fines from catalytic cracking
- Catalyst from sulfur complex and hydrogen sulfide removal facilities
- Sludge from sulfur complex and hydrogen sulfide removal facilities.

EPA also noted that its decision not to list crude oil storage tank sediment was a close call, and that the Agency may choose to list this waste as K169, depending on further evaluation of the data and comments.

The proposed listing determinations were based on the Agency's evaluations at the time as to whether the wastes met the criteria in 40 CFR 261.11(a) for listing wastes as hazardous. EPA assessed and considered the factors contained in these criteria primarily by incorporating them as elements in a risk assessment. A detailed summary of the risk assessment methodology is found in the preamble to the proposed rule, Section III.F, "Description of Health and Risk Assessments" (60 FR 57756-57762). EPA's view at the time of proposal, the applicability of the risk assessment to particular waste streams, and the proposed reasoning for the listing decisions are found in Section III.G., "Waste-Specific Listing Determination Rationales" (60 FR at 57762-57776).

EPA also proposed a number of exemptions for the wastes proposed for listing, described below.

Headworks Exemption

In the proposal, EPA noted that some refineries manage the wastes EPA proposed for listing in their wastewater treatment system, while others may scour residual sludge of the wastes proposed for listing during vessel cleaning or tank washing into the refinery wastewater treatment system. A consequence of listing these wastes as hazardous would be to cause all wastewaters and wastewater treatment sludges to be derived from those wastes.

The Agency noted in the proposal that, provided the residuals derived from the wastes proposed for listing are discharged to the oil recovery sewer system, the residuals carried into the wastewater system would be removed during primary treatment as sludges or other wastes that are already regulated hazardous wastes (e.g., K048, K051, F037, or F038). Accordingly, the Agency proposed not to include these wastewaters in its listing determinations and to modify an existing regulation at 40 CFR 261.3(a)(2)(iv) to provide that these wastewaters would not be considered hazardous wastes. This exemption, known as the "headworks exemption," was discussed in the preamble for the proposed rule at 60 FR 57750 and 57781. The proposal noted that the exemption would apply to wastewaters containing clarified slurry Oil (CSO) sediment and, if EPA decided to list crude oil storage tank sediment in the final rule, this waste as well.

Exemption for Catalyst Support

Upon removal from catalyst beds and/or during catalyst regeneration or reclamation, spent catalysts are separated from the support media that

³September 13, 1995, letter to Becky Daiss (EPA Office of Solid Waste) from Michael W. Steinberg (Morgan, Lewis & Bockius).

are used in the catalytic reactors to optimize mixing and flow within the reactor beds. The Agency proposed an exclusion from RCRA regulation (under 40 CFR 261.3(c)(2)(ii)) for these support media because the support media are generally inert ceramics, separate from the catalyst, and commonly managed separately.

Third Party Recycling of Spent Petroleum Catalysts

Spent hydrotreating and hydrorefining catalysts, two of the wastes proposed for listing (as K171 and K172, respectively), are frequently regenerated for reuse or reclaimed off-site to recover nonprecious metals (e.g., nickel, molybdenum, cobalt, and vanadium) and other compounds sold as products (i.e., aluminum sulfate derived from the alumina substrate material).

In the proposed rule preamble in Section III.J.1., "Third Party Regeneration/Reclamation of Spent Petroleum Catalysts" (60 FR 57781), EPA proposed to clarify the regulatory status of units that regenerate or reclaim these catalysts. The proposal would have clarified that these units are specifically excluded from regulation as industrial furnaces under EPA's boiler and industrial furnace (BIF) rules at 40 CFR Part 266, Subpart H. The proposed clarification was based on a number of factors, including EPA's view that the units differed from those considered for the BIF rule and the Agency's general view that it did not want to impose an unnecessary regulatory burden that may serve to discourage environmentally safe recycling of spent petroleum catalysts.

The proposal also stated, however, that EPA had not fully evaluated the prevalence and adequacy of existing emission controls and the potential for uncontrolled emissions of toxic organic compounds, toxic metals, and particulate matter from spent hydrotreating and hydrorefining catalysts. Accordingly, the Agency stated that if it found that emissions from these units pose a threat to human health and the environment, it would reconsider the proposed clarification of the BIF rule and even could determine that the rule should, instead, be amended to specifically *apply* to spent petroleum catalyst recovery units. Thus, EPA solicited comment on the adequacy/efficiency of existing controls and data quantifying the levels emitted of hazardous air pollutants (HAPs) regulated under RCRA and/or section 112 of the Clean Air Act Amendments. The Agency indicated that it had made a preliminary finding that these units

are already equipped with pollution controls comparable to those required under the BIF rule such that further regulation may be unnecessary.

Application of the Existing Exclusion for Spent Sulfuric Acid

As described in the proposal, EPA previously excluded from the definition of solid waste spent sulfuric acid used to produce virgin sulfuric acid (40 CFR 261.4(a)(7)). The Agency reexamined this exclusion as it pertains to sulfuric acid used as a catalyst in refinery alkylation processes and found no reason to change the existing regulatory structure.

2. Summary of Proposed Risk Assessment Approach

The proposed rule preamble describes in detail the various risk assessment analyses EPA carried out to determine the potential risk that might arise from the disposal of the refining wastes under consideration in this rule (see 60 FR at 57756-57762). In carrying out the modeling for these assessments, EPA used available data it collected for this industry, supplemented by data gathered from surveys of waste management practices (e.g., EPA's National Survey of Solid Waste (Municipal) Landfill Facilities, 1988, in the docket). The Agency also used information gathered in a questionnaire prepared under RCRA 3007, hereafter referred to as the "3007 Questionnaire," and site visits designed to examine the waste characteristics, waste management practices, and potential pathways for release and exposure.

While EPA used this empirical data as much as possible in its risk assessment, the Agency nevertheless found that data gaps existed in the available information. Therefore, EPA also used other generic input parameters in the fate and transport models used to estimate the risk a waste might present under management scenarios known or likely to occur. The Agency used available data to develop input parameters for the concentrations and toxicity of constituents in the waste, the mobility and fate of such constituents in different disposal scenarios, likely exposure routes under these scenarios, and the location of various persons ("receptors") that might be exposed. These receptors might be persons who consume contaminated groundwater, breathe air containing contaminants, or ingest contaminated soil or food.

EPA considered what waste management scenarios to model, based on existing and potential practice in the refinery industry. Also important to the risk analyses are the volumes of wastes

disposed and the potential for constituents in the waste to be released. Total volumes of waste were derived by multiplying the amount of wastes disposed in any given year times the active life for the disposal unit (how long a disposal unit accepts waste before closure). The fraction of the waste in the disposal unit (waste fraction) was derived from the total volume of a waste placed in the unit and the unit's capacity. While various waste management practices were considered, the Agency's modeling focused primarily on potential releases from waste volumes sent to nonhazardous (Subtitle D) landfills and land treatment units (LTUs), both on and off the refinery site (on-site and off-site units). For on-site, units EPA used the data on unit size available from the 3007 Questionnaire. For off-site landfills, EPA used generic data available for Subtitle D unit size available from surveys of industrial and municipal waste management facilities.

To estimate the significance of any potential releases of constituents from the disposal units and the potential for exposure to people or the environment, EPA first considered the mode of migration out of the landfill or LTU. The exposure of most concern for landfills arises from the release of constituents from the waste to groundwater. Other exposure routes were considered only in preliminary analyses, and did not present significant risks. EPA used the Toxicity Characteristic Leaching Procedure (TCLP) to estimate the mobility of constituents in leachate that may be released from a landfill to groundwater. EPA also considered the potential for oil in the wastes to facilitate release and transport of constituents from landfills by "oil-phase flow." Such facilitated release might occur if free oil in wastes, potentially containing hazardous constituents, migrated from landfills to groundwater. However the Agency's analysis showed this type of facilitated release was not likely. For LTUs, the wastes are mixed with soils on the surface of the unit. Potential exposure routes of most concern for land treatment arose from the transport of contaminated soils to receptors by both wind-borne air releases, and the erosion/run-off caused by precipitation. Groundwater risks from LTUs were not found to be significant.

To model the transport of constituents to receptors, EPA typically used data available from surveys to locate the likely exposure point. Thus, to assess potential groundwater exposures near landfills, EPA used national surveys of landfills, which included data regarding

the distance from landfill units to nearest drinking water well. For LTUs, EPA used surveys of the distance of residences from such disposal units. Where appropriate, EPA attempted to consider information related to the biodegradation some constituents may undergo in the unit or after release into the environment.

The Agency used comparisons between concentrations in the environment and health-based levels (HBLs) to evaluate the potential health impacts of toxic constituents in environmental media, such as soil or groundwater. For noncarcinogenic constituents, the HBL is the concentration in the media which results in an exposure level equal to the "reference dose;" the reference dose is EPA's measure of an acceptable daily intake for a specific chemical. For carcinogenic constituents, the HBL is the concentration in the media that results in an exposure level corresponding to a specified cancer risk level. EPA applied carcinogenic potency estimates (Carcinogenic Slope Factors) to calculate specific risk levels. The risk assessment results are given in terms of individual risk, i.e., the carcinogenic risk is described in terms of the additional incidence of cancer that may occur in an exposed population. A risk of 1×10^{-5} (which will be presented in this document as $1E-5$), for example, corresponds to a probability of one additional case of cancer for every 100,000 people exposed. The Agency also evaluates carcinogenic constituents by directly calculating the estimated cancer risk level resulting from a given concentration of the constituent in the environmental media.

In the modeling for risk assessment, EPA varied some of the more sensitive parameters to examine the range or potential risks presented by the wastes studied. Key parameters included the area of the waste disposal units, waste volumes disposed, constituent concentrations in the wastes, and the distances to receptors. Varying several of these key parameters at one time can have a large cumulative impact on the risk results. In view of the variation in individual exposure risks that could exist for the wastes, EPA performed a number of different types of risk and sensitivity analyses. First, the Agency completed a "bounding analysis" in which the key input parameters were set to produce a worst-case scenario. This analysis was intended to purposely overestimate exposure to establish an upper bound for risks. (See the EPA guidance memo entitled, *Guidance on Risk Characterization for Risk Managers*, 1992; docket number F-95-PRLP-

S0423, hereafter known as the Habicht memo, 1992.) Thus, all key parameters were set to their maximum or "high-end" values (typically the 90th percentile point on the distribution of values available for each parameter). If the risks resulting from the bounding analysis were below the level of any potential concern (i.e., carcinogenic risks below $1E-6$ and hazard quotients (HQs) less than one), the wastes and/or waste constituents were removed from further consideration.

For wastes and constituents that did not "bound out," EPA ran a double "high-end" deterministic sensitivity analysis, which produced point estimates of risk based on use of single values for input parameters. In this method, key input parameters were varied between the central tendency value (50th percentile) and the high-end (90th percentile) values. The point estimate in which all variables were set at central tendencies was assumed to be the central tendency risk estimate. The highest risk estimate for any combination of double high-end variables (with all other variables set at central tendency) was assumed to be the high-end estimate of risk. The high-end risk estimate was presumed by the Agency to be a plausible estimate of individual risk for those persons at the upper end of the risk distribution. The intent of these descriptors is to convey estimates of exposure in the upper end of the distribution (i.e., above the 90th percentile) and to avoid estimates that are beyond the true distribution.

After completing these various analyses, EPA compared individual exposure levels to HBLs for the toxic constituents to determine whether particular wastes are candidates for listing. In keeping with discussions of the Agency's listing policy (see *Dyes and Pigments Listing*, 59 FR at 66075-66078), EPA used a risk level of concern of $1E-5$, and/or HQs of one, to determine which wastes are considered initial candidates for listing. To make listing determinations, EPA then used a weight-of-evidence approach that considers the risk estimates along with other evidence related to the factors described in 40 CFR 261.11(a)(3).

Based on EPA's analysis for the proposed rule, the exposure pathway of concern for the landfill scenario was ingestion of groundwater contaminated by constituents leaching out of the unit. For the land treatment scenario, the potential release of wastes by air or runoff yielded exposure for nearby residents and home gardeners via soil ingestion and for other subpopulations (fishers, farmers) through indirect exposures, i.e., via ingestion of

contaminated fish and food. These analyses led to the proposed listing decisions as explained in the preamble to the proposed rule.

C. Notice of Data Availability

Many issues were raised by commenters on the proposed rule causing EPA to rethink its analyses and the risk assessments. These issues are discussed in the April 8, 1997 NODA (62 FR 16747) and the accompanying support documents. EPA conducted new risk assessments for both groundwater and non-groundwater pathways, in addition to analyses for the headworks exemption, recycled hydrocarbon-bearing materials, and leaching of oily wastes. This new information was presented for comment. At the time, EPA believed that the additional analyses tended to support the proposed rule and did not propose any new listing decisions. Important additional analyses provided in the NODA are briefly described below.

The NODA provided revised "high-end" analyses for the landfill and LTU scenarios. In the groundwater analysis, EPA completed more detailed sensitivity analyses and Monte Carlo analysis to better define high-end risks, and determine how close the high-end risks, were to the 90th percentile.

The Agency has been using Monte Carlo modeling methodology in various rulemakings for many years. Monte Carlo modeling is a statistical technique that can be used to simulate the effects of natural variability and informational uncertainty which often accompany many actual environmental conditions. It is a process by which an outcome is calculated repeatedly for many situations, using in each iteration randomly selected values from the distributions of each variable input parameter. When compared with alternative approaches for assessing parameter uncertainty or variability, the Monte Carlo technique has the advantages of general applicability and no inherent restrictions on input distributions or input-output relationships. Monte Carlo application results can also be used to calculate uncertainty, and can be used to quantitatively specify the degree of conservativeness used. However, potential limitations also exist when applying Monte Carlo techniques in modeling efforts. Variability (inherent variation in a measure over time and space) and uncertainty (lack of knowledge) may be difficult to distinguish within applications. Also, correlations among the various data parameters that have not been accounted for in the modeling may

distort conclusions. Finally, sufficient data must generally be gathered to ensure that acceptable statistical representations and sensitivity analyses within Monte Carlo applications can be properly prepared.

The Monte Carlo simulations used in this rulemaking assessed the full distributions of critical input data (e.g., distance to well, waste volumes, landfill area) to randomly generate receptor well concentrations of key constituents for certain landfill situations, and then combined the results from many runs (10,000) to produce a probability distribution of risks. EPA was then able to choose points along the probability distribution of risk for comparison to the high-end analysis. For example, a risk that corresponds to the 95th percentile for a specific waste constituent in a landfill means that the risk would be below this level in 95 percent of the runs. EPA also modified all groundwater risk analyses to add risks due to noningestion exposures (e.g., via inhalation and dermal absorption during showering) to the ingestion risks that may arise from residential use of groundwater.

Further groundwater analysis was also performed in response to comments on the proposed rule that noted EPA had used waste input data (TCLP) that exceeded the existing Toxicity Characteristic (TC) threshold and that disposal in nonhazardous landfills was unlikely for such wastes. This additional groundwater analysis limited the TCLP input used in modeling, such that none of the input levels exceeded the TC threshold, to examine the impact on risk results (the "TC-capped" analysis).

In the nongroundwater analysis presented in the NODA, EPA incorporated several modifications for LTUs, including: limiting wastes volumes modeled to nonhazardous waste; limiting unit characteristics used (e.g., unit area) to nonhazardous units; correcting an error in the air dispersion modeling; minor changes to the models used to estimate release and transport of contaminated soil to off-site receptors; and incorporating further biodegradation of key constituents after they travel off-site.

The appropriateness of the TCLP for petroleum wastes containing oil and the potential for oil and other materials to facilitate release and transport of wastes in landfills were major areas of comment. EPA provided additional information in the NODA to respond to this issue, including: analysis of the oil content of the waste samples, the prevalence of disposal of oily waste in landfills, analysis using alternative

leaching procedures, and calculated TCLP leaching efficiencies for organic constituents in the wastes.

EPA received comments on its choice of management practices modeled and the way volumes were allocated. Some commenters also suggested that volumes of wastes beyond those under consideration in this rule should have been considered in various codisposal scenarios for both landfills and LTUs. In response, EPA presented risk analyses in the NODA that assessed the potential impact of codisposal of the listing residuals with certain other refinery wastes.

In the NODA, EPA presented additional analyses to address comments on the headworks exemption for CSO storage tank sediment. While some commenters did not favor the exemption due to potential impacts on downstream wastes, other commenters argued the exemption should be expanded to exclude wastewater from spent hydrotreating and hydrorefining catalysts, the other two wastes EPA proposed for listing. The Agency evaluated the potential impact of including wastewater from these three wastes in the headworks exemption, and presented the results in the NODA that showed excluding them would not result in any significant risks in the downstream wastes.

Comments on the proposal suggested that the active life for a landfill used by EPA was too short. This parameter is important because it determines the total waste volume in the modeled landfill, which is one of the critical input parameters for the model. To respond to this comment, EPA presented data in the NODA for on-site landfills to show that the data in the 3007 Questionnaire supports the Agency's assumption of a 20-year active life.

The NODA also presented other information related to: the potential impact of the oil-bearing residuals exclusion on coke product, the potential for concurrent exposure to releases from landfills and LTUs, and the applicable UTS under the Land Disposal Restrictions program.

IV. Changes to the Proposed Rule

As a result of comments on the proposed rule and NODA analyses, certain modifications were made to the listing determinations and definition of solid waste exclusions. These changes and the subsequent scope of today's final action are described below. Detailed reasoning behind these changes is provided in Section V.

A. Definition of Solid Waste Exclusions

1. Exclusion of Oil-Bearing Hazardous Secondary Materials Inserted Into Petroleum Refining, Including Petroleum Coking

Today, the Agency is finalizing a portion of the proposed exclusion for oil-bearing hazardous secondary materials recycled within the petroleum industry. Specifically, oil-bearing hazardous secondary materials generated within the petroleum refining sector (i.e., SIC code 2911, petroleum refineries) are excluded under today's rule when they are to be inserted into the petroleum refining process, including into the petroleum coker, provided they are not placed on the land or speculatively accumulated before being so recycled. As discussed below, this exclusion applies to any oil-bearing material generated at a petroleum refinery, including oil-bearing wastes currently regulated as listed hazardous wastes (e.g., K048-K051), and including refinery wastes newly listed under today's rulemaking that are suitable for insertion into normal petroleum refining operations. EPA is not finalizing the proposed exclusion for oil-bearing hazardous secondary materials generated elsewhere within the petroleum industry, such as from petroleum exploration and production sites, bulk crude oil storage, and petroleum industry-related transportation facilities. However, the pre-existing recovered oil exclusion promulgated July 28, 1994, is still being retained under today's rule with respect to recovered oil generated from within the petroleum industry. EPA is also modifying an existing petroleum-industry listing (F037) to make it apply to discarded residues generated from processing or recycling petroleum-industry listed hazardous wastes that are otherwise excluded under today's provision.

The Agency notes that this exclusion will have little net effect on the materials or units involved. Under the current regulatory program (i.e., prior to today's amendments), oil-bearing secondary materials may legitimately be recycled into a petroleum coker. While such materials may be considered solid and hazardous wastes, the coking unit would be a recycling unit exempt from permitting requirements (40 CFR 261.6(c)(1)). The coke product is exempt under 40 CFR 261.6(a)(3)(v), provided the secondary materials are generated by the same "person," defined in 40 CFR 260.10 as "an individual, trust, firm, joint stock company, Federal agency, corporation (including a government corporation), partnership, association,

State, municipality, commission, political subdivision of a State, or any interstate body," and the petroleum coke does not exhibit a characteristic of hazardous waste. The oil recovered in the coking operation (including both conventional coking and the quenching process) which is used to produce fuels is excluded from the definition of solid waste as recovered oil under 40 CFR 261.4(a)(12).

2. Recovered Oil From Associated Petrochemical Facilities

In today's final rule, EPA is finalizing a somewhat narrower exclusion than originally proposed. Specifically, EPA proposed to exclude recovered oil from "associated organic chemical manufacturing facilities" where such facilities were defined as those within

the SIC code 2869 and either co-located or under common ownership with the petroleum refinery receiving the petrochemical recovered oil. In today's rule, EPA is dropping "under common ownership" from the definition of "associated organic chemical manufacturing facility" for reasons discussed later. In addition, EPA is limiting the applicability of the final exclusion to petrochemical recovered oils that are hazardous only because they exhibit the characteristic of ignitability (as defined in 40 CFR 261.21) and/or toxicity for benzene (40 CFR 261.24, waste code D018). Finally, in today's rule, EPA is also excluding petrochemical recovered oil generated at facilities where the primary SIC code is 2869, but where three other

classifications of chemical manufacturing units commonly occur at these vertically-integrated facilities (SIC codes 2821, 2822, 2865).

3. Use of Spent Caustic as Feedstock

Today EPA is finalizing the exclusion proposed for spent caustic solutions from petroleum refining when used as feedstocks to produce cresylic or naphthenic acid. This new exclusion is being added at 40 CFR 261.4(a)(19).

B. Listing Determinations

Table IV-1 presents a summary of changes to the proposed listing decisions. Detailed bases for today's final listing determinations are discussed in Section V.C for each specific waste.

TABLE IV-1.—COMPARISON OF PROPOSED AND FINAL LISTING DECISIONS

| Waste Stream | 1995 Proposal | Final decision | Basis for decision |
|-----------------------------------|---------------|----------------|--|
| Hydrotreating Catalyst | List | List | Groundwater risks due to benzene and arsenic from landfill disposal; pyrophoric and self-heating nature of waste. |
| Hydrotreating Catalyst | List | List | Groundwater risks due to benzene and arsenic from landfill disposal; pyrophoric and self-heating nature of waste. |
| CSO Storage Tank Sediment | List | List | Nongroundwater risks due to PAHs from land treatment disposal; some groundwater risks due to benzene from landfill disposal; high PAH and oil content. |
| Crude Oil Tank Sediment | No-list | List | Groundwater risks due to benzene from landfill disposal; PAH and oil content. |
| Unleaded Tank Sediment | No-list | No-list | Some groundwater risks due to benzene from landfill disposal, but no significant PAH or oil content; relatively low volume. |
| HF Alkylation Sludge | No-list | No-list | Relatively low groundwater risks due to benzene from landfill disposal; no significant PAH content; benzene found in only one TCLP sample. |
| Off-specification Product & Fines | No-list | No-list | Low groundwater risks due to PAHs from landfill disposal; PAHs only found in one TCLP sample near detection limit. |
| Other Wastes ¹ | No-list | No-list | No significant risks from any pathway. |

¹ Includes seven wastes: Catalyst from Sulfuric Acid Alkylation, Sludge from Sulfuric Acid Alkylation, Spent Caustic from Liquid Treating, Catalyst and Fines from Catalytic Cracking, Sludge from Sulfur Complex and Hydrogen Sulfide Removal Facilities, Catalyst from Sulfur Complex and Hydrogen Sulfide Removal Facilities, and Catalyst from Reforming.

In response to additional comments submitted on the NODA, the Agency further examined the record and reconsidered the entire risk assessment and decisions for all the wastes under consideration. Commenters on the NODA provided detailed comments on the groundwater modeling approach used by EPA. Some commenters submitted their own groundwater modeling, purporting to show higher risks than EPA's evaluation for a number of wastes. While the commenters used the same model as EPA (EPACMTP), they adjusted key input values to increase landfill area, increase active life of landfills and resulting volume disposed, move the receptor well location to the middle of the plume of contamination, increase TCLP concentrations using simplifying assumptions, and increase volumes due to codisposal. To respond fully to

critical issues raised in comments on the groundwater risk analysis, EPA decided to make modifications to some modeling assumptions and data inputs. EPA examined the impact of other suggestions by the commenters, but found these to be of no importance or did not agree that the changes were warranted. The changes to the modeling, and EPA's reasons for not accepting other suggestions, are discussed in detail in Section V.B. Specifically, in response to NODA comments, EPA decided that some revisions in the modeling assumptions were appropriate. Thus, the Agency performed additional risk analyses to reflect an increase in the active life for off-site landfills (which resulted in increased volume input to the modeling), and the use of off-site municipal landfill area distributions, rather than the areas for industrial

landfills used previously. With these changes, the final revised high-end and Monte Carlo risks increased somewhat from those presented in the NODA for off-site landfills and are summarized in Table IV-2. Also, in conducting the Monte Carlo analysis for the NODA, the Agency made a key assumption concerning well location which was inconsistent with the assumption made for the high-end analysis (see discussion of receptor well location in Section V.B.6). Therefore, EPA performed further Monte Carlo analyses using well location assumptions consistent with the high-end analysis, and the results show that this also increases risks, such that the 95th percentile Monte Carlo risks are more comparable to the high-end risks. Finally, while reexamining the groundwater risk analysis for off-specification products and fines, EPA corrected errors in waste volumes and a

health-based level used for prior analyses. (See Additional Groundwater Pathway Risk Analyses, 1998, in the public docket for this rule for details on the revised analyses.) The final risk results for off-site landfills, with the changes noted above, are summarized in Table IV-2 for wastes of concern. Other wastes either did not have significant risk in bounding analyses, or were not modeled for landfill disposal because the practice was not found.

TABLE IV-2.—SUMMARY OF REVISED GROUNDWATER RISKS FOR PETROLEUM WASTES IN OFF-SITE LANDFILLS

| Waste | Constituent | Revised risks ¹ | | TC-capped risks ² | |
|---|--------------------------|----------------------------|---------------------------------------|------------------------------|--------------------------|
| | | High-end risk ³ | Monte Carlo Risk ⁴ (95th%) | High-end risk | Monte Carlo risk (95th%) |
| Clarified Slurry Oil Tank Sediment | benzene | 4E-06 | 2E-06 | NC | NC |
| Hydrotreating Catalyst | benzene | 1E-04 | 3E-05 | 3E-05 | 9E-06 |
| | arsenic | 8E-05 | 2E-05 | NC | NC |
| Hydrotreating Catalyst | benzene | 7E-05 | 2E-05 | 3E-05 | 8E-06 |
| | arsenic | 6E-04 | 4E-04 | 6E-04 | 4E-04 |
| Crude Oil Storage Tank Sediment | benzene | 4E-05 | 1E-05 | 3E-05 | 9E-06 |
| Unleaded Gasoline Storage Tank Sediment | benzene | 3E-05 | 6E-06 | 2E-05 | 4E-06 |
| HF Alkylation Sludge | benzene | 1E-05 | 2E-06 | NC | NC |
| Off-Specification Product and Fines | benzo(a)anthracene | 2E-06 ⁵ | 1E-06 | NC | NC |
| | | 5E-07 ⁶ | 8E-07 | | |
| Codisposal Scenario | benzene | 8E-06 | 3E-06 | NC | NC |
| | arsenic | 4E-06 | 2E-06 | NC | NC |

¹ Revised risk includes new inputs for active landfill life (30 yr.) and municipal landfill areas.
² Input leaching rates were capped at TC regulatory levels for disposal in Subtitle D landfills (0.5 mg/L for benzene and 5.0 mg/L for arsenic); NC = no change because TCLP values were already below TC levels.
³ Risks using high-end values for two most sensitive parameters, and remaining parameters kept at median values.
⁴ Risks using Monte Carlo simulation runs at the 95th percentile level with well location restricted to plume.
⁵ Estimated TCLP input assumed to be mean value.
⁶ Estimated TCLP input assumed to be one high-end parameter.

The nongroundwater risk results for land treatment are unchanged from those reported in the NODA (see 62 FR at 16753). However, in response to comment EPA performed a Monte Carlo uncertainty analysis for land treatment risks that supports the results presented in the NODA. See Section V.B of today's notice for further discussion of this issue.

The revised groundwater risk assessment for landfills, in conjunction with the nongroundwater assessment for land treatment disposal presented in the NODA, continues to support the proposed listing of K170, K171, and K172. Therefore, EPA is promulgating these listings in today's final rule, with minor modifications to clarify the definition of the two spent catalysts (see Section V.C.3).

K171—Spent hydrotreating catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic units. (This listing does not include inert support media.)

K172—Spent hydrotreating catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic units. (This listing does not include inert support media.)

In addition, EPA has determined that the available information and the revised groundwater risk assessment provides sufficient basis to list as hazardous crude oil storage tank

sediment, and to have the waste designation of K169. The listing will read:

K169—Crude oil storage tank sediment from petroleum refining operations.

All final listing determinations depend upon EPA's consideration and review of public comments submitted in response to the proposed determinations, issues raised in the NODA, and any other relevant information available to the Agency. The final determinations are based on the Agency's evaluations as to whether the wastes meet the criteria in 40 CFR 261.11(a) for listing wastes as hazardous. EPA has assessed and considered the factors contained in these criteria primarily by incorporating them as elements in the revised risk assessment, which is based on the methodology described in the preamble to the proposed rule and subsequent modifications described in this preamble and in support documents in the rulemaking record. EPA bases its final listing determinations on the entire rulemaking record, including applicable sections of the preamble to the proposed rule, additional analyses provided in the NODA, the Agency's responses to the comments on significant issues raised in the preamble to the proposal and the NODA, and all other relevant information available to the Agency.

C. Other Exemptions

1. Headworks Exemption

EPA presented analysis in the NODA to support the headworks exemption for both wastewater associated with CSO tank cleaning and the expansion of the exemption to include water discharges from the clean-out and turn around of hydrotreating and hydrotreating catalytic units. After considering all comments on these analyses, EPA has decided to promulgate the expanded headworks exemption. As noted in the proposal, EPA intended to include crude oil storage tank sediment in the exemption, if this waste was listed. Thus, EPA is also promulgating the exemption for K169 as well. To fully respond to all comments, EPA completed an analysis of the impact of the discharge of crude oil storage tank sediment to the wastewater treatment system, which demonstrates that the discharge is unlikely to adversely impact downstream wastes. This decision is discussed in V.D, and supporting analyses are presented in the docket for this notice.

In amending the headworks exemptions under 40 CFR 261.3(a)(2)(iv)(C), the Agency intends the exemption to apply to wastewaters from cleaning operations when these wastewaters reach the headworks of the wastewater treatment system. As noted

in the proposal, however, the exemption is not intended to allow the discharge of the entire waste stream (i.e., tank sediments or spent catalysts), but rather dilute waters generated during tank or unit clean-outs and dewatering operations.

2. Exemption for Catalyst Support

The Agency is finalizing the proposed exemption (under 40 CFR 261.3(c)(2)(ii)) for these support media because the support media are generally inert materials and commonly managed separately. EPA is clarifying the exemption so that it is no longer limited to ceramic material, based on comments indicating that other inert materials, such as stainless steel, are also used.

3. Third Party Recycling of Spent Petroleum Catalysts

EPA does not believe at this time that it is appropriate to issue the proposed clarification to exempt, from permitting requirements under Part 266.100(b), third party units regenerating and reclaiming hydrotreating and hydrorefining spent catalysts. EPA is deferring to a later day any final decision on whether or not to clarify the BIF rule with respect to these wastes. In the meanwhile, EPA reiterates that nothing in today's rule (or indeed the proposal in this docket) changes the current RCRA status of facilities managing these hazardous wastes. (See Section V.E. for further discussion of this decision.)

V. Response to Comments and Rationale for Final Rule

The Agency is responding in this preamble to the most significant comments received in response to both the notice of proposed rulemaking and the NODA. Other comments received by the Agency are addressed in the Response to Comments Background Documents that are available in the docket associated with this rulemaking.

A. Proposed Modifications to the Definition of Solid Waste

1. Exclusion of Oil-Bearing Hazardous Secondary Materials Inserted Into Petroleum Refining, Including Petroleum Coking

Role of the Petroleum Coker in the Petroleum Refining Process

To determine RCRA jurisdiction, the Agency must differentiate between materials that are part of normal ongoing production activities and materials that are part of waste management, including recycling or treatment. Distinguishing waste management from normal production

can sometimes be difficult when it involves hazardous secondary materials generated by certain production processes and used as feedstocks in other production processes within the same industry that produce a relatively low-value product (especially hazardous secondary materials that have sometimes been discarded in the past). (see 50 FR at 618-620, Jan. 4, 1985). Regarding the petroleum refining production process, classification of the coking operation has been historically troublesome in delineating production from waste management because it is not typical of other refining processes.

Generally, and in the most basic of terms, petroleum refining processes serve to separate and remove hydrocarbon components out of a feedstream, in effect constituting a multi-stage process of separating valuable product materials from the contaminants (e.g., sulfur and metals) inherent in the original raw material (crude oil). In the coking process, however, the contaminants inherent in the crude oil feedstock are incorporated into the fuel product, along with the carbon that results from the thermal breaking of complex hydrocarbon chains into more valuable small- and middle-chain oil fractions (see detailed description of conventional coking versus the quenching process in Section III.A.1.).

EPA first evaluated whether the conventional coking operation is a true production process because the crude oil distillation bottoms, i.e., resids, used as feedstock contain many of the unwanted contaminants in the original crude oil which end up in the coke product (a low-value fuel product, relative to the other fuel products produced by petroleum refining) and because a majority of the coke product is exported rather than being used within the United States. As stated earlier, this is not typical of a petroleum refining process producing a fuel product. Thus, an argument could be made that the petroleum coker is simply a means of disposing of unusable heavy oils and other contaminants associated with crude oil feedstocks (including hazardous heavy metals), while producing a relatively low-value fuel.

However, the American Petroleum Institute (API) supplied the Agency with detailed information regarding the conventional coking operation, presenting a description of the physical processes involved in the coking process and the economic value of the overall coking operation to the refinery, as well as the feedstocks used and products produced. As discussed in the November 20, 1995, proposal preamble

(60 FR at 57754), the Agency has determined that the use of resids as feedstock to the petroleum coker is a legitimate production process whose main purpose is to thermally convert the heaviest crude oil fractions into light-end hydrocarbons (typically about 70 percent of the feedstock is recovered as lighter oil fractions) used as feedstocks for refinery processes that produce high-value fuel products. In many cases, the conventional coking operation is essential to the profitable production of petroleum products from heavier crude oil feedstocks, being a cost-effective process for maximizing the amount of hydrocarbon that can be recovered from the crude oil feedstocks. The coke product itself may best be characterized as a co-product of the coking operation, while the principal products are the light ends that are returned to the refining process. Thus, the Agency is affirming that the conventional coking operation is a production process resids are normal feedstocks to this process and petroleum coke is a legitimate fuel product (although EPA in fact notes that high-grade petroleum coke meeting relatively exacting specifications is used for producing anodes for use in electric furnaces, such as for steel and aluminum manufacturing).

However, the fact that the Agency considers the conventional coking operation to be a normal production process does not mean that any material introduced to the coking operation is, by definition, part of a normal production process. Indeed, when considering the regulatory status of hazardous secondary materials not typically used as feedstocks being introduced into such a process, the Agency must consider whether such use of the secondary materials is legitimate use in a production process, or rather is sham recycling where unwanted contaminants are being removed of under the aegis of an ostensible manufacturing operation. Typically, this is evaluated through a comparison to the normal feedstocks, with particular focus given to whether there are hazardous constituents contained in a hazardous secondary material that are not found in the normal feedstock materials for which it is substituting (see 50 FR at 638, Jan. 4, 1985). EPA received many comments relevant to the exclusion for the hazardous secondary materials inserted into the petroleum coker, especially the quenching process, both supporting and opposing to the exclusion. Much information, both anecdotal and analytical data, was received concerning various aspects of

the overall coking operation. This information included the constituent composition of the hazardous oil-bearing secondary materials at issue, the normal coker feedstocks, various aspects of the overall coking operation, the coke product, and the marketing of petroleum coke. The Agency made a very considered evaluation of all of the information provided in comment to the proposal, much of which was contradictory and difficult to confirm. The discussion below presents the Agency's reasoning in making its determination.

Use of Hazardous Secondary Materials in the Petroleum Coker

The Agency evaluated information received on the role of oil-bearing hazardous secondary materials in the coking operation. As discussed more below, the oil-bearing hazardous secondary materials typically put into the coker unit are unable to be processed via conventional coking because of their high water content (the water would volatilize and create unsafe pressures during the conventional coking process). Therefore, the Agency's evaluation centered around the role of these secondary materials in the quenching process, described in more detail in Section III.A.1. of today's preamble. In evaluating this information, the Agency's focus was to determine whether the use of oil-bearing hazardous secondary materials in the quenching process is consistent with the role of oil-bearing feedstocks in the conventional coking process, i.e., to provide hydrocarbon for further refining and to contribute carbon to the coke product. (EPA's reasoning is that it is the recovery of hydrocarbon and production of coke that is the intent of the overall coking operation, and thus the legitimate use of a hazardous secondary material in the quenching process should likewise contribute to this intent.) This evaluation compared not only the constituent make-up of the feedstocks to both conventional coking (resids) and to the quenching process (hazardous secondary materials), but also what physical/chemical processes occur in both aspects of the coking operation. The discussion that follows presents the Agency's evaluation.

In comparing the typical hazardous secondary materials used in the quenching process (i.e., listed hazardous wastes, primarily wastewater treatment sludges) to the residues normally used as feedstocks to conventional coking, the oil content in the hazardous secondary materials is much lower (ranging from around 8 percent to 40 percent in the hazardous secondary

materials to around 99 percent in the crude oil distillate bottoms), while the water content is much higher. The hazardous constituents (primarily heavy metals) in the secondary materials are measurably higher. However, as stated above, the hazardous secondary materials are not used in conventional coking, but rather are used in the quenching process. Therefore, a comparison of the hazardous secondary materials to the resids feedstock has limited value and is not dispositive for determining the legitimacy of the activity, because the hazardous secondary materials are not substituting for the feedstock, but are instead being processed in a different manner than the conventional coking feedstocks.

As described earlier, there are two aspects of the coking operation for the Agency to consider: (1) conventional coking—which entails the application of high temperatures to the heavy oil-bearing feedstock in the coke drum in order to break the complex hydrocarbon chains into lighter chains that are recovered for further refining, also resulting in the production of coke product, and (2) the quenching process—which, for the purposes of the Agency's evaluation in today's rulemaking, entails the insertion of oil-bearing hazardous secondary materials along with, or just prior to, water used to quench the coke product before removal from the coke drum.

Because the hazardous secondary materials are not processed along with the normal feedstocks to the coker, but rather are introduced into the coke product during the quenching process, the assessment of "legitimacy" becomes somewhat more difficult since there is no analogous raw material. (The Agency notes that this is typically the situation when determining the applicability of RCRA regulations to secondary materials used in connection with innovative technologies or practices.) The hazardous secondary materials are typically mixed with water to form a slurry that is injected into the coke at the beginning of the quench cycle (in some cases, the secondary materials are not slurried and are inserted ahead of the quench water). The hazardous secondary materials are unable to be used in conventional coking because of their high water content; however, the water content is not detrimental during the quenching process. Thus, in determining the legitimacy of this activity, the task at hand is not a straightforward comparison with analogous nonwaste feedstocks, but rather an evaluation of the processing that occurs when these hazardous secondary materials are used in the

quenching process, to determine whether this activity may be characterized as a "normal" production activity or whether it is better characterized as hazardous waste recycling, or even simply the disposal of hazardous wastes (i.e., sham recycling).

Indeed, some commenters opposed to the use of hazardous secondary materials in the petroleum coker raised the concern that the use of listed hazardous wastes in the quenching process is simply a means of disposing of RCRA hazardous wastes in a low-value product, much of which is exported overseas, and that if these materials truly had value to the coking process, they would be used as feedstock in the conventional coking process. Since it is obvious that these secondary materials would otherwise be hazardous wastes that would be treated and disposed of if not used in the quenching process, it would seem to be a simple matter, as some commenters have suggested, to ascribe a simple waste disposal motive to this activity and nothing more.⁴ However, the Agency is compelled to go further and determine whether the oil-bearing secondary materials actually contribute to the product and/or process, or otherwise determine whether there is a production-related value to this activity.

The petroleum industry, on the other hand, believes that such an evaluation is unnecessary. Industry representatives argue that oil-bearing secondary materials used in the quenching process for legitimate recovery of hydrocarbon as either a light oil fraction or by incorporation in petroleum coke can never be a solid waste, i.e., that these materials must be excluded from being RCRA solid wastes as a matter of law.⁵ Their argument is based on the initial case considering the scope of the statutory term "solid waste," namely the first AMC I decision. In that decision, the Court held that "materials that are recycled and reused in an ongoing manufacturing or industrial process"

⁴ Indeed, internal industry literature, as well as public statements made by industry representatives, relevant to the use of hazardous secondary materials in the quenching operation would lead one to believe that the principal purpose of this activity is to dispose of hazardous waste sludges (see the January 9, 1998 letter from Richard Fortuna to Mike Shapiro); however, the Agency does not, as a rule, take such statements as determinative and evaluates the activity independent of how the process may have been characterized in other contexts. The Agency would do the same in situations where all such industry statements would indicate that a particular process is legitimate production, i.e., evaluate the merits of the activity independent of statements from interested parties.

⁵ See January 23, 1998 letter from Paul Bailey to Michael Shapiro.

were not yet discarded and hence not "solid wastes." (see 824 F.2d at 1186).

EPA disagrees that an exclusion is compelled (even assuming legitimate recycling is occurring). First, there is direct case authority that secondary materials which originate from wastewater treatment systems can be considered to be "discarded" (see AMC II, 907 F.2d at 1186 ("Nothing in AMC I prevents the agency from treating as 'discarded' the wastes at issue in this case, which are managed in land disposal units that are part of wastewater treatment systems, which have therefore become 'part of the waste disposal problem,' and which are not part of ongoing industrial processes" (emphasis original)). Industry indicates that, primarily, the oil-bearing hazardous secondary materials utilized in the quenching process are wastewater treatment sludges (chiefly K048, F037, and F038), which are thus directly analogous to the sludges at issue in the AMC II decision, and thus could be considered to be discarded.

These sludges likewise could be considered to be solid wastes pursuant to RCRA section 3004(q)(2)(A) which indicates that certain provisions otherwise applicable to hazardous waste-derived fuels do not apply to petroleum coke produced from "petroleum refinery wastes containing oil which are converted into petroleum coke at the same facility at which such wastes were generated." The plain language of the provision can be read to cover the activity at issue here, and thus indicate that wastewater treatment sludges and other hazardous secondary materials going to quench coking could be classified as solid wastes.⁶

More basically, EPA does not regard the use of oil-bearing wastewater treatment sludges in the quenching process to be the type of operation which must necessarily be classified as part of an ongoing manufacturing process. The parts of the petroleum refining process outside the Agency's RCRA jurisdiction involve the sequential distillation of crude oil into various fractions such as gasoline, fuel oil, asphalt, and conventional coking. (see 824 F.2d at 1181). However, the quenching process need not be viewed as one more ongoing step in this

process. Not only is there the temporal interdiction of the generation of wastewater and subsequent management of the wastewater and sludges in the refinery's wastewater treatment system, but the quenching process differs in material ways from the standard refining operations. As discussed above, the materials utilized have less oil, higher percentages of unusable materials, and the process generates less recovered oil than any other unit operation in the conventional refining process. The Agency thus does not accept the argument that exclusion of hazardous secondary materials used in the quenching process is legally compelled.

This is not to say that the Agency lacks the discretion to make such a determination. The term "discarded" is ambiguous, and within the Agency's authority to interpret consistent with the general goals and policies of the statute. (See AMC II, 907 F. 2d at 1186; *American Petroleum Inst v. EPA*, 906 F. 2d 726, 741 (D.C. Cir. 1990)). Among these goals, of course, is encouraging environmentally sound recycling (see RCRA section 1003(a)(6)). Moreover, assessing what can permissibly be classified as continuous industrial processes, and which types of material recovery operations are "not part of the waste disposal problem" (AMC II, 907 F.2d at 1186), are the types of technical and policy questions particularly committed to EPA's expert discretion. It is that discretion which the Agency is exercising in determining in this rule that a conditional exclusion is appropriate for certain hazardous oil-bearing secondary materials used in the coke quenching process.

In describing the use of oil-bearing secondary materials in the quenching process, industry claims that, similar to the process of coking resids feedstock, the oil contained in the secondary materials is either volatilized and condensed for further refining into high-value fuels, or is incorporated into the coke product. This activity may be characterized as the efficient use of existing heat energy in the hot coke to recover the oil contained in the sludges, oil which would otherwise not be recovered (the temperature of the coke is approximately 800-900 degrees F before it is quenched). The oil that is not volatilized gets incorporated into the coke product, adding to the coke's energy value. The quenching process is operated such that the slurry is discontinued once the coke reaches the temperature of approximately 600 degrees F because, at this temperature, the oil is less likely to volatilize and is primarily incorporated into the coke.

(The coke product then continues to be quenched with water.) While the oil adds energy value, too much oil causes the coke product to actually lose economic value. Not only does too much oil make the coke difficult to handle, it also increases the Volatile Combustible Material (VCM) level, one of the product specifications for petroleum coke. If the VCM is too high, the marketability of the coke decreases.⁷

The Agency solicited further information from industry to demonstrate the recovery efficiency of the oil contained in the hazardous secondary materials used in the quenching process. EPA believes that a comparison of the recovery efficiency of the quenching process to the recovery efficiency of the conventional coking process (of the resids) would provide some indication of how "production-related" the use of the hazardous secondary materials in the quenching process is (i.e., the more similar the quenching process is to the conventional coking process in the recovery of hydrocarbon values, the more it may be considered analogous to, or a component of, the coking process). The data supplied indicate that the recovery efficiency of oil contained in the secondary materials during the quenching process is comparable to the recovery efficiency from the feedstock side of the coking operation.⁸ Thus, although the oil content in the hazardous secondary materials is markedly less, at the very least, there is demonstrated hydrocarbon recovery from the secondary materials used in the quenching process, which is consistent with the overall production intent of petroleum refining.

The Agency notes that one major point of contention between those commenters opposed to the exclusion and those supporting the exclusion is whether there is actual evidence that oil (or hydrocarbon value) is recovered during the quenching process. As stated previously, the oil content of the oil-bearing hazardous secondary materials typically used in the quenching process varies considerably (8 to 40 percent), although the typical secondary materials have an oil content around 10 percent.⁹ In determining the oil recovery efficiency of the quenching process (i.e., a quantification of how much of the oil contained in the secondary materials is

⁶ The AMC I court gave this provision a restrictive reading, stating (somewhat circularly) that it applied only to material that had already become a hazardous waste (824 F. 2d at 1188.) However, given the holding of AMC II that wastewater treatment residuals can be classified as solid wastes and that wastewater treatment operations break any chain of what must be regarded as a continuous industrial process, the wastewater treatment sludges destined for the quenching process could be classified as being hazardous wastes.

⁷ See the September 3, 1997, letter from Kyle Isakower to William Brandes and the January 23, 1998, letter from Paul Bailey to Michael Shapiro.

⁸ See January 23, 1998, letter from Paul Bailey to Michael Shapiro.

⁹ See the September 3, 1997, letter from Kyle Isakower to Max Diaz and the January 9, 1998, letter from Richard Fortuna to Michael Shapiro.

actually volatilized and recovered for further refining versus how much oil is simply incorporated into the coke product), EPA encountered difficulty in getting any actual data. The data the Agency primarily relied on were derived from surrogate tests (i.e., tests designed to simulate the conditions the secondary materials encounter during the quenching process) performed on the secondary materials typically used in the quenching process.¹⁰ This is because coking operations (particularly the capture and condensing of the light-end hydrocarbons) do not avail themselves to the type of quantifiable measurements that the Agency prefers. Regarding the quenching process, this is even more the case. However, surrogate tests may actually be more representative of the oil recovered from secondary materials used in the quenching process than actual measurements taken during the quenching process. This is because any measurement of the amount of oil recovered during the quenching process would also likely include the light ends that remain entrained within the coke product from the conventional coking operation (i.e., light-ends derived from the resids feedstock) which are typically recovered during the quenching process in a manner analogous to steam stripping.

One of the critical factors in estimating the oil recovery efficiency of the quenching process is the specific gravity of the oil contained in the hazardous secondary materials. The lighter the oil fractions, the more oil will volatilize during the quenching process. Here, too, there was disagreement among commenters over how the oil contained in the secondary materials should be characterized. One commenter stated that since crude oils have grown steadily heavier (i.e., contain a larger percentage of higher molecular weight, higher boiling point hydrocarbons) over time, a trend that is only expected to continue, the oil contained in the secondary materials, especially the wastewater treatment sludges, would be disproportionately heavy and thus would be less and less likely to volatilize during the quenching process. This was supported by data (gathered from listed hazardous wastes sent to RCRA-permitted facilities) demonstrating the heavy-to-light ratio for oil contained in the wastes.¹¹ In response, the petroleum industry stated that the oil contained in the secondary materials (particularly wastewater

treatment sludges) comes from oil that has been through some refining, and thus the trend towards heavier crude oils will not have a corresponding effect on the oil contained in the secondary materials. Also, industry claims that the actual data used to support the assertion that the oil contained in the secondary materials is predominantly heavy is not representative of the secondary materials used in the quenching process because, prior to sending such materials to a permitted facility for proper treatment and disposal, a refinery will typically use other processes (e.g., centrifuging) to aggressively extract as much oil (and water to reduce the volume of material sent for treatment and disposal) as possible from the materials, more so than would be the case if these materials are to be used in the quenching process. The oil recovered by these more aggressive recovery processes would tend to be the lighter oils, leaving a disproportionate amount of heavy oil in the materials analyzed.¹²

Based on a considered evaluation of these conflicting comments, and using engineering and technical judgement in lieu of data actually demonstrating the recovery of hydrocarbon values from the secondary materials used in the quenching process, the Agency believes that oil (i.e., hydrocarbon value) is recovered during the quenching process and that the efficiency of this recovery is comparable to the recovery of light-ends during the conventional coking process. (The Agency also notes that in the worst case scenario provided by one commenter opposed to the exclusion, which assumed 80 percent of the oil in the secondary material was too heavy to significantly volatilize at the temperatures encountered during the quenching process, there was recovery of hydrocarbon, even from the heavy oil fraction.)¹³

Effect of Using Hazardous Secondary Materials in the Quenching Process on the Coke Product

A further consideration, in spite of the hydrocarbon recovery and contribution of energy value to the coke product, is whether the use of the hazardous secondary materials in the quenching process actually provides some beneficial contribution to the coke, or whether it may degrade the coke product. Commenters opposed to allowing the use of hazardous secondary materials in the quenching process raised two main concerns regarding the

effect on the coke product. First, these commenters claim that the use of hazardous secondary materials in the quenching process contributes nothing beneficial to the coke product. These commenters dismiss the notion that the oil contained in the secondary materials used in the quenching process contributes energy value by stating that any energy value that may be gained is more than negated by the additional ash content that is also introduced to the coke product (thus, there is no net benefit to the product and instead a net degradation of the product).¹⁴ Furthermore, as at least one commenter noted, the ability for the coke produced using the hazardous secondary materials in the quenching process to continue to meet product specifications could simply be an indication that the specifications for this low-value fuel product provide a great deal of flexibility, rather than demonstrating that the product is not adversely affected. Thus, the product specifications themselves would allow for a certain amount of non-contributing hazardous secondary materials to be added to the coke product.¹⁵

The second concern raised regarding the effect of the secondary materials on the coke product is that the coke product demonstrates no significant change in concentration of hazardous constituents due to the simple dilution that occurs when a relatively small amount of hazardous secondary material is mixed with a much larger volume of coke product (approximately 100 barrels, or about 20 tons of hazardous secondary materials are used in the quenching of 700–800 tons of coke product). Simply stated, the lead and chromium in the secondary materials are being diluted by combination with the much larger volume of coke product containing low levels of lead and chromium. Since these metals are not volatilized during the quenching process, they must remain in the coke product. Commenters point to the insertion of lead and chromium (which serve no purpose in the coke product) as evidence that the use of hazardous secondary materials in the quenching process is simply disposal of hazardous constituents. Such disposition of unwanted and unneeded hazardous constituents, often termed "toxics along for the ride," is a prime indicia that sham recycling can be occurring (depending largely on the extent of contamination, as well as other case-

¹⁰ See January 23, 1998, letter from Paul Bailey to Michael Shapiro.

¹¹ See the January 9, 1998, letter from Richard Fortuna to Michael Shapiro.

¹² See the February 2, 1998, letter from John Medley to Max Diaz.

¹³ See the January 9, 1998, letter from Richard Fortuna to Mike Shapiro.

¹⁴ See the January 9, 1998, letter from Richard Fortuna to Mike Shapiro.

¹⁵ See the January 9, 1998, letter from Richard Fortuna to Mike Shapiro.

specific facts) (see *U.S. v. Marine Shale Processors*, 81 F.3d 1361, 1366 (5th Cir. 1996)).

In evaluating the first concern, i.e., whether the use of oil-bearing secondary materials in the quenching process provides a beneficial contribution to the coke product or process, the Agency notes that the main purpose of the petroleum coking unit is to recover hydrocarbons from the oil contained in the feedstocks for further refining. Similarly, the main purpose of using the secondary materials in the quenching process is the energy-efficient recovery of hydrocarbon from the residual oil in the oil-bearing secondary materials. Concerning the issue of net contribution to the coke product (i.e., added energy value versus added ash content), the petroleum industry maintains that the additional ash content is insignificant and points to the amount of coke product produced per cycle (ranging from about 400 to 800 tons) that would be endangered if the ash content (as well as the VCM level) contributed during the quenching process was sufficient to lower the value or marketability of the coke product.¹⁶ In answer to the concern that the product specifications for petroleum coke are too flexible to use as an indication that the coke is unaffected by the hazardous secondary materials, the Agency notes that coke product produced using hazardous secondary materials in the quenching process is basically similar to coke produced without using secondary materials in the quenching process. Further, EPA notes that the quenching process can and does produce anode-grade coke, the most high-valued coke with the most stringent product coke specifications.¹⁷

In considering the second concern, i.e., whether the fact that the coke product produced using secondary materials in the quenching process continues to meet the product specifications (and, in fact, demonstrates little change in the levels of contaminants compared with coke produced without hazardous secondary materials) is simply a result of dilution, the Agency acknowledges that such dilution does occur. However, there are several other considerations. As stated earlier, the primary product of the petroleum coking process is the hydrocarbon fraction recovered for use as feedstock in the production of high-value fuel products, with the coke

product being a co-product of the coking process. The Agency is convinced that such recovery occurs when oil-bearing secondary materials are used in the quenching process. Given that the recovered hydrocarbon is the primary product of using the secondary materials in the quenching process, the simple fact that the coke product (i.e., the co-product) continues to meet the applicable product specifications and shows no appreciable increase in risk carries more weight in the Agency's evaluation. In other words, demonstrating hydrocarbon recovery is the key test in determining whether the hazardous secondary materials actually serve a useful role in the overall coking operation, rather than demonstrating a net contribution to the coke (as opposed to no degradation of the coke). Acknowledging that there is a potential for some degradation of the coke product, depending on the constituent make-up of the particular secondary materials used in the quenching process, the Agency believes that the product specifications, and the economic consequences if those specifications are not met, will serve to limit the use of the quenching process to secondary materials that will not cause the coke to exceed its specifications, and effectively limits the allowable insertion of metals and excess high boiling point hydrocarbons. However, in cases where there is sufficient degradation of the product (or co-product) such that it no longer meets product specifications or otherwise becomes unmarketable, the Agency would question the legitimacy of using the secondary materials in the quenching process. Similarly, if there were sharply decreased efficiency of hydrocarbon recovery stemming from the use of the hazardous secondary materials in the quenching process (recovery rates of, for example, less than 50 percent of the oil contained in the secondary materials, rather than the minimum 70 percent efficiency EPA believes occurs), the Agency would question the legitimacy of the activity. (The Agency knows of no such cases at present.)

Taken all together, the fact that (1) the recovery efficiency of hydrocarbons from oil contained in the secondary materials used in the quenching process is comparable to the recovery efficiency of the conventional coking process, (2) the use of oil-bearing hazardous secondary materials (including RCRA listed hazardous wastes) in the quenching process is consistent with the overall goal of the petroleum refining industry, namely to maximize the

recovery of hydrocarbon values from the original crude oil feedstocks (and thus is akin to ongoing processing), (3) the oil cannot be recovered from these secondary materials by any other process customarily utilized in petroleum refining, and (4) the coke product continues to meet product specifications and indicates no increase in risk, the Agency concludes that the use of oil-bearing hazardous secondary materials generated by the refinery industry can legitimately be used in the coke quenching process, dependent upon whether there is both hydrocarbon recovery and no adverse effect on the coke product.

Regulatory Status of the Quenching Process

Having determined that certain oil-bearing hazardous secondary materials can be legitimately used in the quenching process, the question then becomes whether this activity constitutes ongoing production and hence is excludable, or, rather that it is legitimate hazardous waste recycling—potentially subject to regulation as a form of hazardous waste treatment. There are several factors that could lead to either outcome. As stated earlier, there is recovery of hydrocarbon values from the oil-bearing secondary materials, short- and middle-chain fractions that are condensed and sent to refining processes to produce high-value fuel products (consistent with the overall coking operation). In addition, there is some beneficial contribution to the coke product in the form of carbon and higher energy values (even though this may not be reflected by an actual increase in market value), and the Agency also notes that the coke product continues to meet the market-driven specifications for the product, even for high-value anode grade coke. In addition, as with other sidestreams generated by one process and used as feedstocks to other production processes, this activity constitutes a link in the multi-step chain of processing steps designed to recover as much of the hydrocarbon value from the original crude oil feedstock as possible. Thus, there are aspects of this activity that lead one to conclude that the oil-bearing hazardous secondary materials used in the quenching process can be considered, for regulatory purposes, as part of an ongoing production process and hence classified as an activity not subject to RCRA jurisdiction.

There are, however, several factors that were raised in comments to argue that using the hazardous secondary materials in the quenching process is a form of waste management, e.g.,

¹⁶ See the September 3, 1997, letter from Kyle Isakower to William Brandes and the January 23, 1998, letter from Paul Bailey to Michael Shapiro.

¹⁷ See the September 3, 1997, letter from Kyle Isakower to William Brandes.

legitimate hazardous waste recycling. The oil-bearing secondary materials are not typical of normal feedstocks to any other refining process. Typical feedstock streams are very high in oil content (i.e., primarily oil), while these secondary materials contain a range of oil concentrations that is consistently much lower than typical feedstocks (thus resulting in a much smaller amount of oil being recovered, albeit at an efficiency comparable to conventional coking, as discussed above).

There are numerous statements, both written and verbal, found within the industry's internal descriptions of the use of hazardous secondary materials in the quenching process, that depict this activity as an efficient means of disposing of RCRA hazardous wastes.¹⁸ There is also anecdotal evidence of a refinery with a coker charging another refinery without a coker to take such oil-bearing hazardous secondary materials which are then used in the quenching process, analogous to tipping fees or charges that a hazardous waste recycling facility would receive from a generator in return for a waste management activity. These issues are some of the reasons EPA felt it was not compelled by statute to exclude these wastes as ongoing manufacturing, and that this is a decision for EPA's discretion.

In considering both viewpoints, the Agency has decided that use of hazardous secondary materials in the quenching process warrants an exclusion from the definition of solid waste (always assuming that the particular practice is legitimate recycling). In the Agency's view, the primary purpose of this activity is the recovery of the remaining hydrocarbon values in the oil-bearing secondary materials (with the addition of carbon and energy value to the co-product coke), utilizing the existing heat energy contained in the coke product after the conventional coking process. The assertion, by commenters opposed to this activity that it is questionable that the component in the secondary material that fulfills its primary purpose (i.e., oil) could also be a limitation on the use of the secondary material (i.e., that too much oil would degrade the coke product itself) is not compelling. It is not uncommon for industrial processes to have specifications on a feedstock material that require a minimum of a certain component while at the same time requiring that a maximum level for the same component not be exceeded because it would degrade the quality of the product. EPA

also believes that the lead and chromium in the secondary materials should decline with time. This is due to overall reductions in the use of these metals throughout the refinery (e.g., leaded gasoline is no longer produced on a wide scale and chromium-based water treatment chemicals are no longer used in industrial cooling towers, as a result of Clean Air Act requirements; see 40 CFR Part 63, Subpart Q). Thus, with the exception of lead and chromium (which are expected to decrease due to process changes), the hazardous metals found in the hazardous secondary materials can be traced back to the metals found in the original crude oil feedstock and so do not represent contaminants introduced through means other than the continued processing of the initial raw material feedstocks. EPA's traditional concern regarding unnecessary hazardous constituents being processed and ending up in a product is mitigated in this case because the Agency views this activity more as the continual processing of a raw material that contains hazardous constituents, with concentrations of these constituents found in the feedstock streams to various refining processes varying dependent on the point in the overall production process. In the context of a multi-step production process, there is much less of an element of discard of the hazardous constituents inherent in the original raw material than there would be had these secondary materials been generated by another industry or had the hazardous constituents not been inherent to the original raw material.

EPA also has no evidence that the quenching process could be viewed as part of the waste management problem, part of the jurisdictional tests articulated in AMC I and II. As discussed earlier, there is no significant evidence of degradation of coke product quality, and indeed, coke produced with and without using secondary materials in the quenching process are largely indistinguishable from the standpoint of concentrations of hazardous constituents.¹⁹ Finally, again, EPA believes that the recovery of hydrocarbon from the oil-bearing secondary materials in the quenching process is consistent with the overall petroleum refining process the coking operation in particular, i.e., the recovery of hydrocarbons for the production of high-value fuel products. This goal, in turn, is consistent with the RCRA objective to encourage safe types of recycling (see RCRA section 1003(a)(6)).

Therefore, the Agency is providing a conditional exclusion for oil-bearing hazardous secondary materials that are inserted into the coker, based on the assumption that, whether inserted along with normal feedstock (i.e., resids) or used in the quenching process, hydrocarbons are recovered for further refining and there is no degradation of the coke product.

Conditions for the Exclusion

As stated at proposal (60 FR at 57754-57755), the exclusion applicable to oil-bearing hazardous secondary materials destined for insertion into the petroleum refinery, including the coker (and the quenching process), is conditioned on there being no land placement and no speculative accumulation, ensuring that these oil-bearing hazardous secondary materials do not become part of the waste disposal problem. EPA reiterates its belief, presented in the proposal, that the management of these secondary materials prior to insertion into the refinery will not pose a risk to human health and the environment, and that the American National Standard Institute (ANSI) standards for the design, construction, operation, maintenance, and inspection of petroleum terminal and tank facilities are sufficient to ensure that such materials will be managed in an environmentally protective manner. The Agency also notes that the exclusion being promulgated today is only for those oil-bearing hazardous secondary materials that are actually used in a refining process, including the quenching process of a petroleum coker. Hazardous secondary materials that are released and not immediately recovered and used in a refining process would not be excluded, and thus would be subject to Subtitle C regulation as hazardous wastes that have been disposed.²⁰

The Agency is also requiring that the materials excluded under this provision of today's rule be returned directly to a refinery for insertion. While this is not an issue if materials are recycled onsite, EPA has concerns (as did some commenters) about situations where these materials are generated at one refinery for insertion into another, but are not directly sent and instead are sent to an intermediate non-refinery facility for processing. EPA does not think it

²⁰The Agency notes that today's rulemaking is not intended to affect the applicability of existing regulatory exclusions in § 261.2(c)(2) and (3) regarding the reclamation of off-specification or spilled commercial chemical products listed in § 261.33, or that otherwise exhibit a hazardous characteristic (50 FR 14219; April 11, 1985).

¹⁸ See the January 9, 1998, letter from Richard Fortuna to Mike Shapiro.

¹⁹ See the January 23, 1998, letter from Paul Bailey to Michael Shapiro.

unreasonable to assume that these materials should either be located at the generating refinery, at the receiving refinery, or are otherwise in transit between the two; this is consistent with the underlying argument that this is ongoing production within the petroleum refining sector.

The Agency is maintaining the condition that only those oil-bearing secondary materials that result in a coke product that does not exhibit a characteristic of hazardous waste be subject to the exclusion. This condition mirrors the statutory provision stating that petroleum coke produced from petroleum industry hazardous wastes is not subject to Subtitle C regulation provided the coke does not exhibit a characteristic of hazardous waste (see RCRA section 3004(q)(2)(A)). This condition (coupled with the industry's own product specifications) will serve to ensure that the coke product does not degrade such that the secondary materials used in producing the coke will become a part of the waste disposal problem. As a result of this condition and the fact that this exclusion is limited to refinery wastes, today's exclusion in § 261.4(a)(12) supersedes the existing exemption in § 261.6(a)(3)(v); therefore, the regulations are being amended to remove § 261.6(a)(3)(v).

The Agency considered, as suggested in several comments, setting a minimum oil content to define the scope of "oil-bearing secondary materials" that are excluded when used in the quenching process, or to require a demonstration of hydrocarbons actually being recovered from the excluded secondary materials that is comparable to oil recovery in the conventional coking process. The Agency rejected limiting the exclusion based on a set minimum oil content or a recovery efficiency requirement for several reasons. As discussed above, the quenching process represents the final, and last possible process in which to recover hydrocarbon from the original crude oil feedstock. The refinery processes and operating procedures are designed to separate and process into products as much hydrocarbon as possible from the crude oil feedstock; in other words, to prevent as much oil from making its way into these secondary materials as possible. The oil that does make its way into these secondary materials is generally considered unavoidable and inevitable, or, in some cases, too much oil in these secondary materials is evidence of a problem with some aspect of the overall refining process (which helps to explain the wide range of oil contents in these materials). Thus, it would be counter to

the overall efficiency of the petroleum refining process to require a minimum oil content in the secondary materials. Conversely, the Agency believes it is fundamental to this exclusion that there actually be oil recovered for further refining when these oil-bearing hazardous secondary materials are used in the quenching process. To the extent there is no recovery, or drastically inefficient recovery, the operation could be a type of sham recycling, as discussed earlier.

Also, the Agency believes that, in this case, a minimum oil content condition would do little to ensure that only those secondary materials from which oil can actually be recovered would be excluded; in other words, the Agency does not believe that setting a minimum oil content would ensure that secondary materials are legitimately being used in the quenching process. Since most of the secondary materials in question result from wastewater treatment, a minimum oil content requirement would only serve to encourage a refinery to operate the refinery wastewater treatment process less efficiently to ensure that these secondary materials contain the minimum oil content and thus avail themselves of an exclusion.

As for requiring a demonstration of oil recovery efficiency comparable to the conventional coking process, the Agency concluded that the normal operating practices and conditions (e.g., temperature) inherent to the quenching process will result in a comparable oil recovery efficiency. While there may be fluctuations in the actual volume of oil recovered (due to the fluctuations in the oil content of the secondary materials as well as the ratio of heavy-to-light oil in the secondary materials), the quenching process, when properly operated, is such that there will be oil recovered from oil-bearing hazardous secondary materials due to the high temperatures inherent in the process. Therefore, requiring an actual demonstration of recovery efficiency would be unnecessarily burdensome unless there is a question regarding a site-specific coke quenching process or the hazardous secondary materials being used. Therefore, the exclusion for refinery-generated, oil-bearing hazardous secondary materials being legitimately recycled into the petroleum refining process, including in the coke-quenching process, is conditioned only on these materials being managed such that there is no land placement and no speculative accumulation, and that the coke product produced not exhibit a characteristic of hazardous waste.

Materials Subject to the Exclusion

At proposal, the Agency proposed to exclude oil-bearing hazardous secondary materials that are generated within the broad petroleum industry (covering SIC codes 1311, 1321, 1381, 1382, 1389, 2911, 4612, 4613, 4922, 4923, 4789, 5171, and 5172—which comprise petroleum refining, marketing, transportation, exploration, and production) and inserted in the petroleum refining process, including in the coker. As discussed earlier in today's preamble, the exclusion being promulgated today is limited to only those oil-bearing hazardous secondary materials that are generated within the petroleum refining sector (SIC code 2911). To conform with this limitation, EPA is retaining (with some clarification) the existing exclusion for recovered oil from the broader petroleum industry. (EPA is also excluding petrochemical recovered oil from certain petrochemical facilities, which is a related but different exclusion discussed elsewhere in today's rule.) In the context of oil-bearing hazardous secondary materials being used in the quenching process, limiting the exclusion to the petroleum refining sector is entirely consistent with the information evaluated in making this determination (i.e., data representing the materials currently used in the quenching process, namely F037, F038, and K048–K052). As discussed above, the exclusion for oil-bearing hazardous secondary materials used in the quenching process was not made on a strict jurisdictional basis. The types of secondary materials, their constituent components, and the fact that the coke product remains basically unchanged when such secondary materials are used were all factors in EPA's determination. The fact that the Agency only evaluated oil-bearing secondary materials that were generated by the refining sector in its determination is sufficient reason to limit the exclusion to refinery-generated secondary materials.

However, a further reason relates to the concept that oil-bearing secondary materials that are generated by the refining process and continue to be processed in the coker (by use in the quenching process) is more akin to an ongoing production process than would be the case for secondary materials generated outside the refining sector of the petroleum industry. The Agency maintains that the quenching process is an ancillary activity that is somewhat removed from the overall production process; however, the fact that the secondary materials are generated and

used in another production process (i.e., the overall coking operation) within the same industry, imparts a closer association with the concept of an ongoing production process (see AMC I) than would be the case for secondary materials generated by a different industrial sector. The Agency has no information on which to base a finding that the use of oil-bearing hazardous secondary materials originating in a non-refinery sector of the petroleum industry in the coke quenching process would be anything other than the management of wastes (e.g., hazardous waste recycling) from that non-refinery sector.

In one sense, the exclusion for recovered oil (as opposed to "oil-bearing secondary materials"), which spans the scope of the broad petroleum industry, reflects the Agency's assessment that only those hazardous secondary materials that are comparable to normal feedstocks (i.e., oil) used in typical production processes should be excluded from RCRA without attention to how they are processed. Oil-bearing secondary materials (as opposed to "recovered oil") originating from a non-refinery sector have the potential to be more waste-like (i.e., they are not clearly "oil" and also may contain types or quantities of toxic constituents that have not been evaluated, especially if their ultimate use is in the quenching process) and thus do not warrant an exclusion. Therefore, the Agency is today promulgating an exclusion for (1) secondary materials that are similar to normal refining feedstocks, even if generated by a non-refinery petroleum industry sector (i.e., recovered oil) and (2) secondary materials that are both generated by and used in any refinery production process, including the coking operation (i.e., refinery-generated oil-bearing hazardous secondary materials).

The Agency notes, however, that non-refinery generated oil-bearing secondary materials that are used in the quenching process (i.e., hazardous wastes) may nevertheless be legitimately recycled by use in the quenching process, depending on there being oil recovered during the quenching process and no adverse impact on the coke product. The oil recovered during the coking operation (including both conventional coking and the quenching process) is excluded from the definition of solid waste under 40 CFR 261.4(a)(12). The coke product produced from such hazardous wastes, however, would be subject to hazardous waste fuel regulations. This does not represent a change from current requirements, because the current regulatory

exemption for coke produced using hazardous waste (superseded by today's exclusion for refinery waste being recycled) does not apply to coke produced using anything but refinery-generated waste.

Status of Residuals from Processing or Recycling Excluded Oil-Bearing Secondary Materials

EPA received comments stating that the proposed rule did not clarify the status of residuals generated from the processing and recycling of excluded oil-bearing hazardous secondary materials.²¹ Specifically, certain oil-bearing hazardous secondary materials generated at petroleum refineries are listed hazardous wastes if they are discarded instead of recycled as described in today's rule. However, the Agency is aware that these materials may be processed in various ways prior to insertion into the petroleum refinery, depending upon the nature of the oil-bearing material and the intended point of insertion into the refinery. Some of these processing steps may result in residuals that are not suitable for insertion, again based upon the choices available to the refinery. If these residuals are to be discarded, they are clearly solid wastes and would not retain their original hazardous waste listing because of the exclusion. The hazardous waste characteristics may or may not capture these materials, and therefore they could be disposed of outside the Subtitle C system. The Agency then became concerned about situations where, for example, a listed waste was generated and only minimally processed to recover oil for insertion into the refining process, leaving behind a largely unchanged residual that was to be discarded but was no longer defined as listed waste. The Agency agreed that this was a potential problem with the exclusion, and a subsequent request for comment letter was sent to interested parties on October 1, 1997. EPA requested comment on whether the interested parties viewed this situation as a potential loophole, and what, if anything, might be done to remedy it. Responses to EPA's request were somewhat mixed. Some commenters did not believe the loophole was a realistic construction of the effect of the exclusion, while others agreed that it was indeed problematic and needed to be addressed. After reviewing the information submitted by commenters, the Agency has decided that it would be an undesirable outcome if listed wastes

were only marginally processed, generating residuals that were not recycled and escaped regulation. Therefore, the Agency has slightly modified the existing hazardous waste listing description in 40 CFR 261.31 for the F037 waste, to include in the listing description any residuals generated from recycling or processing oil-bearing secondary materials that (1) would have otherwise met a listing description when originally generated, and (2) are disposed of or intended for disposal.

2. Recovered Oil From Associated Petrochemical Facilities

It is logical that the Agency evaluate the integrated nature of petroleum refining and petrochemical manufacturing to further identify oil-bearing materials that can be permissibly classified as part of "ongoing manufacturing" within the petroleum industry, and that are not part of the waste disposal problem. In proposing the exclusion for oil-bearing materials from petrochemical operations which are returned to refining, the Agency had two important considerations. The first consideration was to encourage the recovery of a valuable resource and reduce regulatory uncertainties in cases where oil from petrochemical facilities is returned to petroleum refineries, specifically in situations where the refineries generally provide the raw materials (refinery products) to the organic chemical manufacturing facilities. The second was to consider whether or not these hydrocarbon streams have accumulated toxic constituents through the various chemical manufacturing processes, constituents that have no value to the petroleum refinery, are different from the constituents typically encountered in a petroleum refinery, and may be inadequately managed through this activity. Given the large and complex nature of the organic chemical manufacturing industry, this was not a straightforward undertaking. Accordingly, the Agency proceeded cautiously, engaging in discussions with representatives from both the chemical manufacturing and petroleum refining industries.²² As discussed at proposal, the Agency agreed with industry arguments indicating that because significant volumes of materials composed almost exclusively of oil from petrochemical facilities are being directed to various petroleum refining processes, careful controls were in place

²¹ Comment PRLP-0054, ARCO Products Company.

²² April 7, 1995, and July 31, 1995, letters to Steven Silverman (EPA Office of General Counsel) and September 13, 1995 letter to Becky Dais, from Michael W. Steinberg (Morgan, Lewis & Bockius).

as a result of concerns about operational upsets and product quality. (See 60 FR at 57756). For example, representatives from the petroleum industry have stated that they have significant concerns about the presence of organic chlorides in their process units due to damage from corrosivity. In addition, comments submitted by the chemical manufacturing industry describe "feedstock quality management programs," whereby the quality of petrochemical recovered oil is routinely evaluated and its contribution to refinery product performance determines its acceptability and value. One commenter, an organic chemical manufacturer, stated that due to the critical nature of refinery finished product specifications, all sources of hydrocarbons to a petroleum refinery are assessed to ensure their suitability. This "suitability" of petrochemical recovered oil is assessed either through process knowledge or periodic analyses of certain characteristics, including water and solids content, gum-forming compounds, and metals. As the Agency has noted elsewhere in today's rule, the petroleum refining process can be described as a process of separating valuable product materials from the contaminants inherent in the original feedstock, crude oil. Based on comments submitted by the organic chemical manufacturing facilities that supply these hydrocarbon streams to refineries, refinery operators cannot simply assume that certain contaminants will be separated from hydrocarbon feedstocks (crude oil or petrochemical recovered oil) during the refining process without potentially causing equipment fouling, corrosion, or problems with product quality. Further, due to the integration between some refineries and organic chemical manufacturers, there is a shared stake in avoiding costly shutdowns, operational upsets, or other situations that might compromise the overall safety and profitability of the combined facilities. It is from this perspective that EPA began reviewing information indicating that recovered oil from organic chemical manufacturing facilities was acceptable to the refinery as a substitute for crude oil.

The Agency acknowledged in the proposed rule that this potential exclusion was based on a "very limited set of data" (see 60 FR at 57756). At proposal, EPA was interested largely in how petrochemical recovered oil compared to refinery recovered oil, in terms of the parameters that would indicate suitability of the material for refining (e.g., specific gravity;

distillation temperature range; flash point; hydrocarbon type; and sulfur, ash, and total chlorine/halogen content). EPA also was interested in comparisons to the used oil specification, in part because EPA has used the used oil specification in a previous rulemaking as a surrogate for product fuel oil. Although EPA recognizes (and two commenters independently agreed) that there are shortcomings in using the used oil specification in the context of analyzing petrochemical recovered oil (largely because of the purposes for which the used oil specification was derived) the specifications for metals and halogens are a partial surrogate for crude oil content. The Agency also considered comparing the composition of the petrochemical recovered oil to "comparable fuel specifications" currently being developed as part of a separate Agency effort to define specifications which would indicate when a secondary material would pose no greater risk when burned than a fossil fuel, and therefore might be defined as products, not wastes (see proposed rule at 61 FR at 17460, April 19, 1996). However, comparing the petrochemical recovered oil halogen data to the comparable fuel specification did not seem appropriate because the petrochemical recovered oil is not being burned as a fuel, but is instead being inserted into a complex series of fuel manufacturing processes (i.e., petroleum refining), where contaminants are removed and hydrocarbons are converted into various fuel products.

In response to EPA's request in the proposed rule, data was received during the comment period on samples of various hydrocarbon streams from organic chemical manufacturing facilities (SIC code 2869) and non-organic chemical manufacturing units (representing SIC codes 2821, 2822, 2865) located at these same facilities. EPA also received some data representing other non co-located, intercompany chemical manufacturing facilities. The organic chemical manufacturing data (representing SIC code 2869) indicate that in comparison to refinery recovered oil, the petrochemical stream was similar, and in some aspects, "better" than the refinery sample (i.e., the petrochemical recovered oil was a "narrower cut" requiring less refining, thus preferable to a refiner). When comparing the submitted data representing SIC code 2869, as well as a sample of refinery recovered oil, to the used oil specification, both samples were well within the specification (with the exception of flashpoint, which is not a

concern here). Regarding total halogens, the highest concentration reported in a sample of petrochemical recovered oil was 3,400 ppm (parts per million) total chlorine. Irrespective of where this number fell with regard to the used oil specification for total halogens (at 1000 ppm EPA presumes mixing of used oil with hazardous waste has occurred; 4000 ppm is an upper limit for burning used oil without being subject to certain requirements; see 40 CFR 279.11), the Agency was concerned about the possible source(s) of the halogens in the petrochemical recovered oil. Information submitted along with this data indicates that chlorine could be introduced in small amounts to petrochemical recovered oil due to the use of chloride-based catalysts. Subsequent comments clarified that the use of seawater as a "seal" in the petrochemical facility's oil/water separation system was the source of the chloride in that particular sample. The commenter indicated that although the use of seawater as a seal or barrier in the separation tank results in some salt entering the recovered oil phase, because this particular hydrocarbon stream is sent to a co-located petroleum refinery to be managed along with crude oil, the chlorides are removed in the same process that removes chlorides typically found in crude oil (i.e., the desalter unit).²³

In summary, in the analytical data submitted in response to the proposed rule, certain patterns in the composition of petrochemical recovered oil were evident, including a similarity in composition to refinery recovered oil being used as feedstock by the refinery.

Limitation on Petrochemical Recovered Oil

As mentioned earlier, part of the evaluation of whether or not these recovered oils from petrochemical facilities are part of an ongoing manufacturing process within the petroleum industry, and whether the operation can be viewed as part of the waste disposal problem, includes whether or not these materials contain toxic constituents not normally present in typical refinery feedstocks and intermediates. One concern that the Agency has is the possibility that certain hazardous wastes, particularly wastes containing halogens, may end up in the petrochemical recovered oils either through inadvertent or intentional mixing (i.e., "adulteration").

²³ December 29, 1997, and January 22, 1998, letters to David Bussard (EPA Office of Solid Waste) from Ronald Shipley (Chemical Manufacturers Association).

Specifically, there are many secondary materials that the EPA has explicitly listed as hazardous (e.g., K-wastes at 40 CFR Part 261, Subpart D, under "Organic Chemical Industry"). Many of these wastes are highly-halogenated residuals, and EPA studied each of these waste streams at the time they were listed and determined that their management is easily capable of posing significant risks unless done properly (viz. with exceeding care, such as is specified in the Subtitle C regulatory standards). EPA believes that these listed wastes are clearly distinct from the petrochemical recovered oils discussed here, and based on the information EPA has received on the recovered oils sent to refineries, these listed wastes are not recycled in this manner. To ensure that this "adulteration" of the petrochemical recovered oils (by mixing listed hazardous wastes) would be prohibited under today's final rule, EPA is limiting the petrochemical recovered oil exclusion to those recovered oils that are hazardous only because they exhibit the characteristic of ignitability (as defined in 40 CFR 261.21) and/or toxicity for benzene (40 CFR 261.24, waste code D018). EPA believes that petroleum refineries are able to handle hydrocarbons that are ignitable and contain benzene, given the types of materials that are routinely managed at these facilities; also, based on the information EPA has received on these materials, these are likely the only characteristics that would classify these petrochemical recovered oils as hazardous.

Co-Located and Common Ownership

EPA proposed that the exclusion for petrochemical recovered oil apply only where the organic chemical manufacturing facility is "associated" with the petroleum refinery, either by being physically co-located or under common ownership. As mentioned previously, this was partly due to the limited data the Agency had, but also because EPA believed that the degree of integration between a petrochemical facility and a petroleum refinery that occurs in co-located and/or co-owned situations helped ensure more familiarity with each other's manufacturing processes, composition of products and intermediates, and administrative procedures. These attributes go beyond the strict commercial relationship that is more typical of transactions between buyers and sellers of various secondary materials, by-products, and intermediates. However, the Agency has not been able to develop a definition of

"common ownership" that would be clear and workable for such purposes. As part of EPA's continuing efforts to redefine solid waste, defining common ownership (as a possible means of describing certain intracompany transfers) also has been explored and has proven very difficult. This is largely because of the many complex ways in which "ownership" can be defined from both a financial and a legal perspective. EPA believes that to attempt to do so here would not prove effective. However, EPA does believe that the concept of "co-located" is more or less understandable and reflects physical boundaries as well as a degree of integration that would help ensure more control by each facility over the transfer of materials throughout the combined facility. "Co-located" in today's rule means that the petroleum refinery and the organic chemical manufacturing facility are physically adjacent to one another, or otherwise share a common boundary. In situations where the facilities consider themselves co-located but they are not physically adjacent nor do they share a common boundary, the Agency is further clarifying co-located to include facilities that have a high degree of integration with one another, as evidenced by things such as shared wastewater treatment systems; shared manufacturing units; transfer of materials via dedicated piping; environmental permits that cover both facilities; facilities that share common emergency response equipment, procedures, and planning; etc. These examples can be typical of physically co-located facilities, and therefore can be used to clarify cases where for one reason or another an integrated petrochemical and petroleum refinery do not actually share a common boundary. Also, to better define the relationship and degree of integration between a petroleum refinery and the co-located petrochemical facility, the Agency is including in the definition of "associated organic chemical manufacturing facility" in § 261.4(a)(18) the condition that the petroleum refinery that is receiving recovered oil from a co-located petrochemical facility also provides the hydrocarbon feedstocks to the same co-located petrochemical facility.

Other SIC Codes

In the proposed rule, EPA stated that it would consider broadening the proposed exclusion to include hydrocarbon streams from certain other chemical manufacturing facilities, including plastic materials and resins (SIC code 2821), synthetic rubber (SIC code 2822), and cyclic crude and

intermediate producers (SIC code 2865), if sufficient analytical data were received to support such a broadening. Much of the data that the Agency received on recovered oil from these other SIC codes actually represented recovered oil from process units that are located at petrochemical facilities whose primary classification is under SIC code 2869. In other words, many of the organic chemical manufacturing facilities can be described as vertically integrated, where process units classified under several SIC codes operate in an integrated fashion. For example, an organic chemical manufacturing unit under SIC code 2869 may produce intermediates that are then fed to a unit classified under SIC code 2821. Both units may produce hydrocarbon side streams that represent unreacted feedstock or other hydrocarbon by-products (consisting almost entirely of oil), which are typically commingled and sent to a co-located petroleum refinery for refining along with crude oil. (Of the three co-located petrochemical facilities for which the Agency received data on recovered oil, only one of them was engaged in operations classified solely under SIC code 2869; the other two facilities had units or activities from the other SIC codes as well). The Agency reviewed analytical data on recovered oils from specific process units representing SIC codes 2821, 2822, and 2865, and found these to be comparable to refinery recovered oil.

Because the recovered oil from process units classified under the SIC codes 2821, 2822, and 2865 is similar to refinery recovered oil (where these units are part of vertically-integrated organic chemical manufacturing facilities whose primary SIC code is 2869), the Agency is including these materials in the scope of today's exclusion. These materials are typically managed together and returned to the co-located petroleum refinery together. Commenters also pointed out that limiting the exclusion of recovered oil to the primary SIC code, at a complex where several SIC codes are represented (and where the hydrocarbons are similar and recycled back to the petroleum refinery together) may have a significant impact on facilities with multiple SIC codes. Commenters also argued that segregating recovered oil systems based on differing SIC codes could be prohibitively expensive and may result in a reduction in hydrocarbons returned to the refinery. The regulatory language in today's exclusion at § 261.4(a)(18) for petrochemical recovered oil will limit the exclusion to recovered oil from

associated petrochemical facilities whose "primary" SIC code is 2869 (organic chemical manufacturing), but may also include SIC codes 2821, 2822, and 2865.

B. Modeling Approaches and Risk Assessment

Commenters provided extensive comments on various aspects of the modeling approaches and risk assessment used in the listing determinations. Many comments on the determinations were raised repeatedly for various wastes. Therefore, EPA discusses the most important risk and modeling issues below, and more specific comments important for individual wastes are addressed in Section V.C on Residual-Specific Comments. For complete responses to comments on these and other issues, see the Response to Comment documents for comments on the proposed rule and the NODA in the docket to today's rule.

1. Sampling and Analysis of Refinery Wastes

Use of the TCLP for Oily Wastes

EPA characterized the wastes through an extensive effort of waste analysis, including analysis for constituents that leach out of the waste using the TCLP. In the TCLP, the waste is filtered to separate any liquid phase present, and the solids are then mixed with an aqueous solution in order to estimate the levels of the waste constituents that dissolve and separate into the liquid phase. The Agency's use of the TCLP as input to groundwater modeling for landfill disposal was challenged by several commenters as either underestimating or overestimating the leaching of constituents from the petroleum wastes studied, due to the oil and/or the multiple phases present in the wastes. EPA has decided that the TCLP is appropriately used in this rule to characterize the amount of hazardous constituents potentially released from landfills through aqueous leaching. As discussed below, EPA found no need to change its risk assessment because of any failure of the TCLP due to potential problems that might arise from the presence of oil in some wastes.

One commenter argued that the TCLP is very conservative because it assumes that the waste is disposed of in a municipal solid waste landfill, and disposal of potentially hazardous industrial wastes in a municipal landfill is not a likely mismanagement scenario today. The commenter also argued that the TCLP is a water phase model, not a multi-phase model (multi-phase meaning wastes with high oil content

leading to release of nonaqueous as well as aqueous phases). The commenter claims that use of the TCLP to estimate risks from oil-bearing residuals (e.g., CSO and crude oil storage tank sediment) would produce overestimates of potential risks.

EPA does not agree that the TCLP overestimates leaching levels for these wastes. EPA did not assume in its quantitative risk assessment that oily liquids elute from the landfill to groundwater, because EPA's initial and subsequent analyses showed that oil in the wastes in question was unlikely to migrate from a landfill containing these wastes. Thus, EPA did not use the TCLP to predict movement of oily liquids. While the commenter is correct in stating that the TCLP procedure was designed, in part, to represent leaching from a municipal landfill, the industry reported significant volumes of residuals being disposed in precisely the type of landfill modeled by the TCLP. Specifically, EPA examined the data collected from the 3007 Questionnaire and found that, in fact, petroleum refineries reported 146 wastes that were sent to municipal landfills (see Additional Listing Support Analysis, 1998, in the docket for this rule).

Other commenters felt that the TCLP may underestimate the leachability of constituents from the refinery wastes due to high oil content. These commenters pointed to an EPA report presented in past rulemakings (e.g., the listing of F037/F038 refinery wastes, November 2, 1990, 55 FR 46376), which indicated that the TCLP may underestimate leachate concentrations because of difficulties in the TCLP procedure associated with filtering oily wastes, such that any constituents in the oily fraction in the waste are not properly evaluated. The commenters believed that EPA should use alternative procedures for oily waste, specifically the Oily Waste Extraction Procedure (OWEP) rather than the TCLP.

EPA disagrees with these comments. First, the report cited by the commenters discusses difficulties in filtering multi-phasic oily wastes (Evaluation and Modification of Method 1311 for Determining the Release Potential of Difficult-to-Filter Wastes, April 1990). Multi-phasic wastes are wastes with readily separable oil, solid, and possibly aqueous portions. EPA's lab results show that the wastes under study in this rule did not exhibit the filtration difficulties EPA has found with other, more problematic, oily wastes. The wastes studied were not multiple phases, heterogeneous, or difficult to filter. While EPA measured

levels of "total oil and grease" (TOG) that appeared high for some wastes (e.g., up to 25 percent for crude oil storage tank sediment), the Agency stresses that the TOG method measures all extractable organic material, some of which are not likely to migrate out of the waste, such as waxes, greases, and other large molecular weight substances. The TOG method does not measure, in any sense, "free" oil (i.e., oil that might migrate from the waste as a separate phase). Furthermore, the EPA report cited by the commenter concluded that the TCLP method was adequate, even for some "oily" wastes, provided the wastes could be filtered. EPA did not encounter the types of problems described in previous listings during the present rulemaking.

Second, the Agency does not believe that the use of the OWEP method is necessarily more appropriate for the wastes under consideration. The OWEP method was designed to measure the aqueous mobility of the metals (not organics) present in wastes, and uses a strong solvent to remove the organic phase prior to leaching with the aqueous leachate used in the TCLP. This may significantly alter the original sample matrix and affect the leaching results, and the Agency recognizes that this aggressive method may not be fully representative of possible leaching from a landfill. Despite these concerns, EPA performed additional analysis of archived samples using the OWEP to fully respond to the comment by examining any differences in metals mobility between the TCLP and the OWEP. The results of this analysis were presented in the NODA. Based on the results of this analysis, EPA found that metal leachate results were similar between the two tests. Therefore, EPA concluded that oil content (as measured by TOG) does not appear to impact the mobility of metals in the wastes under study.

Commenters on the NODA OWEP analysis argued that the results showed some increase in the mobility of several metals in the wastes, and argued leachable levels of arsenic, chromium, and lead are higher in some of the OWEP samples. However, the same commenters also questioned the validity of the OWEP reanalysis because three years had elapsed between the TCLP and OWEP analyses and pointed out that the reanalysis was not useful since the detection levels were higher for the TCLP analysis.

EPA disagrees that any measurable differences, of which there were few, in the OWEP/TCLP results are dramatic or meaningful. Overall, the OWEP results are consistent with the original TCLP

data; only 14 out of 189 OWEF values were greater than the original TCLP concentrations. Moreover, 8 of the 14 higher OWEF values were associated with residuals that contained less than one percent oil and grease, thus indicating oil and grease content is not a significant factor. In fact, the variability within each waste category is greater than the variability between OWEF and TCLP results. Thus, any differences are more likely due to sample composition variability rather than the leaching technique. Furthermore, if oil content were truly interfering with the TCLP analysis, one would expect the wastes with higher oil content to show correspondingly greater leaching with the OWEF, but there is no such trend in the data (see NODA Response to Comment Document, 1998, Section I.C.1, for more detailed discussion of the OWEF data). While there are limitations in the OWEF data, the lack of any significant differences in the data sets that can be compared indicates that the use of the TCLP did not underestimate the leaching of the metals of concern.

In response to the commenters' concerns over the use of the TCLP for measuring the mobility of organics in these refinery wastes, EPA examined the analytical data for the wastes under study to see if oil content (as measured by TOG) significantly affected the leachability of a key organic constituent (benzene) and presented the results in the NODA. For the 27 samples for which the leaching efficiency of benzene could be calculated, the average efficiency was 53 percent, i.e., 53 percent of the total mass of benzene contained in the residual was extracted into the aqueous phase. This efficiency is governed by the solubility of benzene in water, as well as benzene's affinity for the specific sample matrix. In any case, while the leaching efficiency varied somewhat from sample to sample, the leaching rate was fairly consistent regardless of whether the waste contained higher or lower total oil; the average leaching efficiency for the six of the 27 samples which had TOG above 1 percent (samples of crude oil tank and CSO tank sediment) was also 53 percent.

Comments on the NODA suggested using the average leaching efficiency (53 percent) for modeling the key constituent benzene for all waste samples analyzed by EPA, regardless of the actual TCLP results for each waste. EPA disagrees with the suggestion to use the simple average TCLP leaching efficiency for all wastes studied, because this would ignore important waste-specific information. This

approach would overestimate benzene levels for some waste and underestimate levels for others. Leaching results are dependent on the specific matrix, and EPA believes that the actual TCLP result is a better indicator of the potential mobility rather than an average for all wastes studied. The most important point to draw from EPA's evaluation of leaching efficiency for benzene is that these results indicate the TCLP mobility of benzene is not greatly affected by the oil content in these particular wastes.

Comments on the data presented in the NODA also argued that EPA should evaluate TCLP leaching efficiency for constituents other than benzene, in particular for polycyclic aromatic hydrocarbons (PAHs). The commenters were concerned the oil content and free oil present in some wastes (CSO and crude oil storage tank sediment) would facilitate leaching of PAHs.

EPA disagrees that these constituents, including benzene, will be more mobile due to free oil in the wastes under study, because the existing data show "free" oil is not present. EPA evaluated the leaching potential of benzene because this compound was found in various wastes and was a key constituent in the risk analyses due to its high toxicity and relative mobility. However, to respond to the comment, the Agency further evaluated the leaching potential of four additional constituents (xylenes, naphthalene, methyl phenol, and phenanthrene). These results indicate that there is no significant discernable trend with respect to lower leaching values associated with higher oil and grease content (see data presented in Tables 5 through 8 in the NODA Response to Comment Document, 1998, in the docket for today's notice). The constituents generally leached in similar proportions for all residual types. It is not possible to calculate extraction efficiencies for most PAHs because these constituents were generally not detected in the TCLP extract due to their very low solubility in water. In any case, EPA notes that the two wastes with the higher measured TOG and PAH levels (CSO and crude oil storage tank sediments) are being listed as hazardous waste, thus largely addressing this concern.

Co-Solvency Effects

Some commenters felt that the TCLP is inappropriate because it measures only the movement of contaminants that are dissolved in the liquid TCLP phase into the groundwater, and thus fails to consider the "co-solvency" effects of oil and other compounds in the landfill. Such effects, they argue, would facilitate

release and transport of constituents beyond that predicted by the TCLP, because of organic phases separating from wastes. The commenters offered no way to account for this in the modeling, but indicated this would increase risks.

While the commenters' concerns are theoretically possible, EPA has no evidence that the co-solvency effect is significant in this case. To respond to the potential for co-solvency effects due to disposal of oily waste in landfills, EPA examined the only available data that provides any detailed characterization of potentially co-disposed wastes—data from the 3007 Questionnaire for the refinery wastes under study. Thus, EPA examined the TOG data available from the 3007 Questionnaire for the refinery wastes that were reported to go to landfills. As presented in the NODA, this analysis showed that few wastes with higher TOG levels (i.e., >10 percent) were sent to landfills; of the 168 wastes with TOG data, only 14 had reported TOG levels at 10 percent or above.

Comments on the NODA analysis argued that the data set was limited because most samples landfilled did not have TOG data, especially those that would have higher oil content (e.g., crude oil tank sediment). Further, commenters noted that some of the larger volumes sent to landfills had significant TOG levels.

EPA disagrees. While the data set is limited, the data available clearly indicate that refinery wastes with relatively high oil content are not typically sent to landfills. In response to the comment that larger volumes sent to landfills had significant TOG levels, EPA estimated volume-weighted average TOG levels for the wastes with TOG data that were sent to on-site and off-site nonhazardous landfills, and found that these values were relatively low, i.e., less than 1 percent for on-site landfills and about 3 percent for off-site landfills. These weighted averages represent the TOG if all of these wastes were sent to the same hypothetical on-site or off-site landfill. EPA notes that this analysis of wastes sent to landfills did not consider the impact due to listing the wastes with the highest oil content (i.e., CSO and crude oil storage tank sediments) as hazardous under RCRA. After listing, neither waste can go to such a landfill and would no longer contribute to any purported co-solvency effects. Finally, as discussed above in response to comments on the TCLP method, even those wastes with higher TOG levels did not contain observable amounts of free oil, which might cause co-solvency. Therefore, EPA believes that co-solvency effects

due to oil content of the wastes under study are not likely to be significant.

One commenter also argued that other compounds in wastes other than those under study may lead to co-solvency effects in landfills and provided specific refinery examples of codisposal of individual waste streams in 1992 and Toxic Release Inventory (TRI) data to show potential co-solvency effects.

EPA disagrees with the commenter's approach to using the TRI database to calculate co-solvency effects at refineries. First, EPA notes that the TRI reporting form specifies that "quantities reported on the form should . . . not reflect the total quantity of waste or constituents of the waste that are not subject to reporting requirements." In other words, the reported quantities are the mass loadings of the chemical components in land-disposed wastes and do not reflect the total quantity of the waste itself. Since these chemicals were managed in on-site Subtitle D landfills, they must have been components of wastes that did not exceed the TC criteria, i.e., in the part per billion (ppb) range. The ppb concentration range was confirmed by dividing the TRI loadings by the total waste quantity disposed in the on-site units identified by the commenter in 1992 as reported in the 3007 Questionnaire. Therefore, since these "solvent-type" chemicals would be only a very small component of the waste, their co-solvency properties would be insignificant.

Laboratory and Field Methods

Two commenters claimed that EPA's lab and field methods were deficient. Specifically, they believed that EPA violated basic sampling protocols by allowing samples to air dry prior to collection. The commenter specifically pointed out examples of CSO sediment with lower volatile organic levels than in other samples and examples of unleaded tank sediment with lower benzene concentrations than in other samples. Based on these flaws, both the total and leachable levels of volatile organics (e.g., benzene) were underestimated by EPA, according to the commenter. One commenter also argued that, by compositing samples, EPA may have lost substantial amounts of volatile compounds and that the background document does not reveal whether careful procedures were followed.

The commenter misunderstood EPA's sampling descriptions which described the refineries' practices of air drying of storage tanks generating the cited wastes. This is a standard operating procedure designed to comply with

basic occupational safety practices, so that refinery personnel can enter tanks for cleaning and inspection. In no case did EPA allow for additional air drying. EPA believes that the samples are representative of residuals generated throughout the industry. In response to the commenter's comparison of detected benzene levels among three gasoline tank samples, the Agency's entire sampling data set demonstrates a wide concentration range for several wastes. EPA maintains that this variability is normal, and the Agency is neither surprised nor concerned with the range of benzene levels detected in the waste samples mentioned by the commenter. Finally, concerning the low levels of benzene in the CSO samples, EPA disagrees with the commenter that benzene levels vary significantly across these samples. Data in the proposed rule background documents show that benzene was only detected in one of four samples at a level near the quantification limit. The levels in the other three samples were below the quantification limit. This means that the benzene levels were very low (at or below the quantification level), and thus the data do not in any sense show that there is significant variability.

Field compositing procedures, when necessary, were performed for the non-volatile analytes only. EPA did not composite samples for volatile analyses, because the act of mixing the samples may lead to loss of volatiles by evaporation. The sampling and analysis protocols used were consistent with EPA's analytical guidance and were documented in Sampling and Analysis Plans. Careful procedures were followed in sampling conducted for volatile analyses and loss of volatiles was minimized.

The commenters also felt that EPA did not correctly sample CSO sediment or HF alkylation sludge. The commenters stated that the practice of mixing CSO sediment with cement kiln dust (CKD) prior to sampling misrepresented the liquid content of the CSO sediment and EPA should not have dewatered HF alkylation sludges.

In response, EPA notes that it collected samples of such wastes that were available after tank cleanout, and in this specific case, it had been mixed with CKD. This was done by the facility prior to landfilling of the waste. While this treatment may have altered some properties of this sample, the oil content (16 percent TOG) was relatively low, compared to the other three samples of CSO sediment collected by EPA (see Table 3.1.18 in the Listing Background Document, 1995). Even if the Agency discounted entirely the analytical

results for the one sample mixed with CKD, it would not impact the risk assessment significantly, because this would only raise average levels of some critical PAHs slightly (approximately 10–20 percent). In any case, EPA is listing this waste, so inclusion of this sample had no material impact on EPA's final decision.

HF alkylation sludge dewatering is conducted routinely by refineries, and EPA collected most samples following this step. In this case EPA believes this waste form reflects the way the waste is disposed in landfills. EPA did take one sample of HF alkylation sludge directly from the neutralization tank and dewatered it in the laboratory to better simulate the characteristics of the waste as it would actually be generated.

2. Waste Management Assumptions

EPA described how the Agency selected waste management scenarios for risk analysis in the proposed rule, and requested comments on its choice of plausible management scenarios. Some commenters wrote to support the common sense approach the Agency used in basing listing determinations on plausible management practices. These commenters stated EPA's decisions were based on current management practices and believed EPA obtained accurate and relevant data on the residuals and management practices through site visits and the 3007 Questionnaire. However, two other commenters suggested the Agency should evaluate risks from other waste management practices. These practices included waste management in surface impoundments, use as on-site cover for landfill or LTUs, use as road bed material, and storage in a pile.

EPA does not agree that these other management practices merit further modeling. As EPA stated in the proposed rule, while some of these practices were reported for several different wastes, they typically involved small volumes or very few generators, and are not expected to present significant risk. The information collected by EPA shows that the vast majority of the waste volume that was disposed on the land went to landfills and LTUs, and the Agency focused its modeling efforts on these scenarios.

The commenter specifically cited management of several wastes in surface impoundments (spent caustic, HF alkylation sludge, off-specification product and fines). However, EPA does not believe these are significant as described in the sections on individual wastes (Section V.C). In general, surface impoundments at refineries are an integral part of the wastewater treatment

system, and EPA did not typically evaluate this system in detail for the reasons noted in the proposed rule. Briefly, risks from such treatment are unlikely to be of concern because: (1) treatment is already regulated under the National Pollutant Discharge Elimination System (NPDES) and air programs; (2) primary sludges generated from wastewater treatment are already regulated as hazardous waste (K048, K051, F037, F038); (3) volumes of the discharged residuals under evaluation are relatively small in comparison to the volumes typically treated; (4) the wastewater treatment systems are designed to treat refinery wastes effectively. Furthermore, in some cases units receiving the waste were not, in fact, surface impoundments, but tanks (e.g., HF alkylation sludges), or other concrete-lined units used as part of refinery processes (e.g., coke drilling pads for off-specification product and fines). See Section V.C for the specific wastes in question for further discussion, and Section V.D on the headworks exemption for other analyses related to wastewater treatment systems.

Two commenters argued that the use of crude oil tank sediment and CSO tank sediment as landfill cover or on-site road material should be evaluated. One commenter stated that EPA's own preliminary assessments for uncovered landfills show that use of these wastes as a landfill cover or for on-site road material poses high cancer risks for subsistence farmers and home gardeners and high risks from mercury exposure for subsistence fishers. Finally, according to the commenter, it is incorrect to assume that EPA's modeling of LTUs would account for risks posed by road spreading or other uses constituting disposal.

The Agency disagrees that these scenarios were not adequately considered, and the Agency does not believe that they would present significant risk. These practices were exceedingly rare, e.g., the one refinery which managed its crude oil tank sediment as "cover for on-site landfill" in 1992 no longer uses that landfill. In addition, the risks for crude oil tank sediment cited by the commenter were based on bounding levels, and resulted from a preliminary screening analysis designed to overestimate possible risks for landfills. Such bounding estimates use worst-case assumptions for all sensitive parameters to screen out exposures of little concern, and to identify what pathways require further analysis. Furthermore, the apparent risks in the bounding analysis were based on incorrect biotransfer factors (used in beef, dairy, and plant indirect

paths), which EPA has since determined to overestimate worst-case risks by at least two orders of magnitude. Likewise, the apparent problem from mercury was also traced to an error in units for the bioaccumulation factor used and when corrected mercury does not present any significant risk in these wastes. Thus, EPA believes that the bounding analysis was flawed and grossly overestimated risks. Similarly for CSO sediment, EPA also notes that only two refineries reported using CSO sediment in road bed material in 1992. EPA believes that the modeled land treatment conditions are conservative surrogates for road spreading because: (1) The volumes and areas assessed for land treatment greatly exceed the reported road spread volumes and areas, (2) road spreading usually involves mixing with gravel, asphalt, dirt, etc., thereby diluting toxicants below that represented by the wastes modeled for land treatment and reducing risk; and (3) road spreading creates a stable road base, which is compacted and then covered by additional fill, aggregate, or pavement, making material less apt to wash away, erode, leach, or enter non-groundwater pathways than material managed by land treatment. Finally, the issue is moot because the two wastes specifically cited by the commenters (crude oil and CSO tank sediments) are being listed, thereby preventing these rare practices in any case.

One commenter stated that the Agency did not properly evaluate the storage of wastes such as off-specification products and fines (i.e., coke-derived fines) in piles. The Agency's response to this issue is given in Section V.C for the specific waste in question. EPA evaluated each waste being studied to determine whether waste was being generated frequently enough to pose a potentially significant risk, and if so, whether it was appropriate to model interim storage (e.g., tanks, containers, piles). In most cases, the exposure risks of most concern are associated with long-term final disposal, and short-term storage was not judged to pose significant potential risk. Many residuals are generated infrequently, e.g., sediments from tanks are cleaned out about every 10 years. EPA did model interim storage of certain wastes that were generated more frequently when appropriate (i.e., spent caustic, sulfur complex sludge).

Two commenters stated that by modeling management practices and volumes based only on what occurred at the time of EPA's survey in 1992, EPA substantially understated risk and does not reflect the potential for waste management volumes and practices that

may occur in the future. They argued the modeled volumes and practices are "forever fixed" and merely reflect a snapshot in time.

EPA does not agree that the volumes and practices used in modeling understate risks. Based on the economic factors affecting the refining industry and practices observed during the Agency's field investigation, 1992 was a typical year for refinery operations. As described in the annual report issued by the Department of Energy (DOE/EIA Petroleum Supply Annual 1992, Volume 1; May 1993), in 1992, the national economy was not in extremis, capacity rates were high, and plant closings and openings were within normal ranges. Furthermore, the DOE report for 1995 shows economic and production trends for crude oil and petroleum products. While prices for petroleum products and crude oil varied from 1985 to 1995, no unusual spikes or dips occurred during this time, and product production remained fairly constant over this time period.

In addition, EPA reviewed API's Generation and Management of Residual Materials, 1992-1993 Appendix C, which provides trends of waste generation from 1987-1993. In general, 1992 was representative when comparing waste generation and management for the API waste categories and the residuals under review. Only hydroprocessing catalysts showed a slight increase in production that year possibly due to the new low-sulfur diesel regulations. In developing reasonable management scenarios for subsequent risk assessment modeling, EPA considered some potential shifts in management practices. These considerations are discussed in the context of each specific waste (see Section V.C). For the remaining residuals, EPA considered the industry to be stable, and thus assumed that 1992 provided a reasonable picture of the petroleum refining industry's practices. EPA's approach was not "forever fixed", but used 1992 as a reasonable starting place for assessing the industry's waste generation and management practices.

Finally, EPA notes that its survey of refineries was a complete census of the industry, and gathered information from all active petroleum refineries in the United States. It is reasonable for the Agency to conclude that the large amount of information gathered in its 1992 survey of petroleum refineries related to waste generation, management, and disposal practices is representative of such practices in any year. While individual refineries may change practices in any given year, the overall pattern of these practices,

including waste volumes and the potential environmental risks posed, are unlikely to change significantly for the industry as a whole. Therefore, EPA has no reason to believe that 1992 was not a representative year.

The commenter also stated that waste volumes modeled in the NODA risk assessment were inappropriate because the individual waste volumes modeled for land treatment were typically much smaller than modeled for landfilling, even though there is no legal or technical bar for the wastes to be managed in either fashion during any given year. The fact that refineries relied upon land treatment less in 1992 is not necessarily indicative of future practices.

In response to the commenter's concern regarding the transferability of wastes between land treatment and landfilling, EPA notes that a refinery may choose different disposal practices based on a variety of considerations, two of which are particularly important. First, the refinery must consider the waste's characteristics. Wastes with higher liquid content are more likely to be land treated due to the moisture requirements of the land treatment process, while dewatered wastes are more likely to be landfilled due to cost and waste volume constraints (e.g., more waste costs more), and liquid content. This is supported by the data collected in the 3007 Questionnaire, which show that wastes sent to land treatment contain on average higher TOG and water than wastes sent to landfills. The average oil and water content reported for landfilled wastes were 5.9 percent and 7.5 percent respectively, compared to average oil and water levels of 14 percent and 17 percent for land treated wastes. The second important consideration regarding the transferability of wastes between landfills and LTUs is availability of the two disposal methods for each refinery. Certainly, on-site Subtitle D LTUs are rather limited and may not be available to many refineries. As described in information EPA provided in the NODA, EPA's database showed only one facility with both on-site nonhazardous landfill and nonhazardous LTUs (see Supplemental Background Document-Listing Support Analysis, April 1997 in the docket, p. 15) and only six nonhazardous LTUs for all refineries (*ibid.*, p. 30). Thus, to project that large volumes of waste would shift between landfills and LTUs appears implausible. Finally, assuming for the sake of argument that such shifts did occur, it is possible that any change in waste management practice for one refinery would be offset by the opposite

change by another refinery, in effect balancing out any changes from year to year.

3. Codisposal of Wastes

Two commenters noted that the waste volumes do not reflect either the actual or potential for codisposal of wastes (i.e., disposal of two or more wastes in the same unit). Such codisposal of the wastes is found in several instances in EPA's database for on-site and off-site units receiving these wastes. The commenters argued that codisposal would increase risks for the individual wastes evaluated by EPA, because the greater volumes would release more toxic constituents. The commenters noted that EPA found waste volume to be an important parameter, especially in the groundwater model.

In response to these comments EPA first notes that its modeling for the proposed rule and NODA did, in fact, combine volumes in cases where the same landfill accepted multiple portions of the same waste stream for disposal. Thus, volumes of the same residual sent to the same landfill were aggregated and placed into the waste volume distribution for use in modeling. In response to this comment, however, EPA expanded its analysis in the NODA to include codisposal of all 14 residuals examined for this listing determination that were landfilled, as well as another set of 15 refinery wastes that were under study. This analysis excluded only (1) wastes that were proposed for listing, because they could no longer be placed in a nonhazardous landfill (spent hydrotreating and hydrorefining catalysts), and (2) any wastes that were not landfilled at all (e.g., spent caustic). EPA combined the waste constituent and TCLP data for individual wastes by weighing the concentrations determined for each waste according to the volume of the wastes used. Thus, volume weighted waste and TCLP concentrations were used to construct a hypothetical scenario of all these wastes being in one generic on-site or off-site landfill. The codisposal analysis showed risks below $1E-5$, which EPA does not view as significant. Revising this assessment to reflect the changes in the off-site landfill scenario as described elsewhere in this Section, the high-end risks were $8E-6$, and remain below $1E-5$ (see Table IV-2).

However, comments on the NODA argued this analysis was flawed, because EPA used only median volumes for each waste, and did not undertake a full sensitivity analysis for the high-end risk analysis. In response, EPA notes that the NODA also presented a Monte Carlo analysis of the codisposal

scenario, which used the full volume distribution for these wastes, not just the median volumes, and even at the 99th percentile, the Monte Carlo risk was below $1E-5$. After revising the input parameters and Monte Carlo assumptions for off-site landfills as described earlier in this Section, the Monte Carlo risks remain low ($3E-6$ at the 95th percentile; see Table IV-2).

Commenters also argued that EPA's codisposal approach did not consider codisposal with other refinery wastes in landfills that are not under examination by EPA in the listing determination or the study. One commenter submitted analysis that attempted to account for the on-site codisposal of the wastes under study by increasing the combined waste volume to include on-site landfill volumes reported in the 3007 Questionnaire. The commenter also assumed that each waste was sent to the same landfill for 40 years. These assumptions resulted in an increase of about 5-fold in the total volumes modeled. However, the commenter noted merely increasing this volume alone did not significantly increase risks for the codisposal scenario. The commenter went on to assume that the codisposed wastes (i.e., the wastes that were not part of EPA's current listing determination or study) would contain sufficient benzene to leach at one-half the TC (i.e., 0.25 mg/L). The commenter's analysis also made other changes to EPA's modeling assumptions, including assuming all wastes leach benzene with an efficiency of 53 percent, and that the receptor well is located on the centerline of the plume of contamination (see discussion later in this Section on groundwater issues). With these further set of assumptions, the commenter estimated high-end risks up to $4E-5$.

EPA does not find the commenter's codisposal analysis compelling for several reasons. First, the assumption that the codisposed wastes will all leach at one-half the TC level is speculative and without foundation. In fact, the existing data available to EPA for the refinery wastes under study show that very few of these wastes contain such high levels of benzene. EPA has no valid reason to project that benzene levels in other codisposed wastes would be drastically different, as assumed by the commenter. Also, EPA does not agree with other modeling assumptions used by the commenter, and the Agency has arrived at a different conclusion in its modified risk analysis. As noted later in this Section, EPA believes the commenter's assumption about well location and landfill active life are incorrect. (EPA used a 30-year life and

treated well location as one of the variable parameters). EPA's revised high-end and Monte Carlo analyses did not change significantly (see Table IV-2), even when using the larger volume inputs. This is consistent with the commenter's initial results, as noted above. Furthermore, EPA notes that the final listing decisions would tend to lower any codisposal risk, because of EPA's final listing of two other wastes as hazardous, crude oil, and CSO tank sediment. Both contributed leachable benzene to the codisposal analysis performed by EPA (and the commenter), thus with these wastes removed from any possible codisposal with the remaining wastes, any risks from codisposal should be lower than estimated with them included.

Finally, EPA questions how relevant such a codisposal analysis would be, even if it could be done to the commenter's satisfaction. EPA is not attempting to list landfills that may contain a variety of wastes, but rather the Agency is trying to determine whether an individual waste merits listing, based on the incremental risk posed by a specific waste. To properly factor in all wastes that are in each landfill would require extensive site-specific information that would be essentially impossible to gather, and would require speculation about what wastes would be sent to a disposal unit and how long disposal of such wastes would occur. This could create an analysis difficult to interpret for use in listing determinations. In any case, this is not necessary to protect human health and the environment, because EPA's analysis shows the risks from codisposal are below levels of concern.

EPA also evaluated the impact of codisposal on the risks from land treatment of the wastes under study, and provided this analysis in the NODA. Constructing a hypothetical LTU that contains all of the wastes so managed is unnecessary, given the very limited number of nonhazardous units that are available for land treatment. Of the 172 refineries in the 3007 Questionnaire, only 13 nonhazardous units were reported to receive any of the residuals of concern (6 on-site and up to 7 off-site LTUs). The risks from land treatment of individual wastes were dependent on the PAH content in the waste, thus the waste with high PAH content, CSO sediment, yielded significant risks when evaluated by itself. As shown in the land treatment risk analysis in the NODA, none of the other wastes when evaluated individually had risks approaching $1E-6$. EPA found only one on-site LTU and three off-site LTUs that received more

than one waste under study in 1992 containing any PAHs of concern. Because of the limited codisposal found in LTUs, EPA examined the potential risks from the actual disposal reported, assuming that wastes proposed for listing (most notably CSO tank sediment) were removed. Because few other wastes had appreciable PAH content, the codisposal analysis yielded negligible risk. Crude oil storage tank sediment was included in the codisposal analysis, however, EPA has since decided to list this waste. Therefore, removing this waste, which contains moderate levels of PAHs, from any codisposal analysis would further reduce the likelihood that codisposal of the unlisted wastes in LTUs will yield significant risk.

4. Impact of Hazardous Characteristic Regulations

Wastes Exceeding the TC

Some commenters stated that the risk assessment in the proposed rule overstates the risks from benzene and arsenic (the key constituents of concern for the wastes proposed for listing) because EPA included benzene and arsenic TCLP concentrations in excess of the TC limit for these compounds. The commenters suggested that EPA should calculate groundwater risks from Subtitle D landfill disposal of crude oil tank sediments and spent hydrotreating/hydrorefining catalysts by using only the data that does not exceed the TC limit. Commenters noted that EPA's risk assessment assumed that no RCRA Subtitle C controls were in place for any of the management scenarios; therefore, including any waste samples that exhibited the TC (i.e., for benzene) in the risk assessment would lead to unrealistically high risk.

To respond to the commenter's concerns, the Agency presented further analysis in the NODA resulting from groundwater modeling runs in which the input TCLP data for wastes that exceeded the TC threshold were "capped" at the TC level. Thus, EPA used the assumption that wastes could contain toxic constituents at or near the TC threshold, and that such data should be included in the risk assessment. EPA notes that the groundwater risk analysis in the proposed rule, as well as in subsequent analyses, did not include waste volumes reported in the 3007 Questionnaire to be hazardous and sent to hazardous waste Subtitle C landfills in the volume distributions used in modeling risks from nonhazardous Subtitle D landfills. EPA believes this is reasonable because these volumes were handled as hazardous and would not

affect risks from Subtitle D units. This point is discussed further in the following section in the context of comments on volumes used in modeling LTUs.

The final revised groundwater analyses (see Table IV-2) showed some reduction in risks, using the TC-capping assumptions. However in all cases the high-end risks for these TC-capped runs exceeded the $1E-5$ risk level for both benzene and arsenic. The 95th percentile Monte Carlo risks also exceeded $1E-5$ for one key constituent (arsenic) for the spent hydrotreating and hydrorefining catalysts analysis. The TC-capping has essentially no effect on groundwater risks from arsenic in these catalysts, and the modeling results for these specific wastes are discussed in more detail below and in Section V.C.3.

Two commenters responded to the Agency's analysis on the capping of waste concentrations at the TC levels by arguing that EPA's "cap" was too high, and provided alternative methods that would result in lower input values for benzene and arsenic for the spent hydrotreating and hydrorefining catalyst wastes. EPA had capped the average TCLP input data for the high-end analysis at the TC level, while the commenters suggested capping each individual sample before averaging. The commenters noted that EPA's Monte Carlo analysis used the original TCLP data and substituted the TC threshold for individual values that exceeded the TC. Using the approach applied by EPA in the Monte Carlo analysis, the commenters calculated that the average TCLP concentrations decreased to 60 percent of the TC level used in the high-end analysis.

The Agency believes that its approach is more appropriate for the conservative high-end risk analysis, but notes that the Monte Carlo analysis, effectively, does what the commenter suggests. The Agency performed the TC-capped analysis to assess the level of risk that might occur, assuming wastes that exceed the TC threshold are managed as hazardous wastes. Therefore, EPA believes that capping the actual input to the high-end model is appropriately conservative. As discussed in detail in the discussions for specific residuals (see Section V.C), the Agency believes that even the Monte Carlo TC-capping analyses support listing these wastes.

For the catalysts, EPA notes that using this alternative approach in the high-end analysis is unlikely to affect the listing decision because: (1) the pyrophoricity of the wastes supports listing these wastes, (2) the arsenic risks would remain very high under either TC-capping approach, and (3) the high-

end risks for benzene remain of concern. To explain the second point, EPA notes that the TC-capping has no effect on hydrotreating catalyst because none of the samples exceed the TC level for arsenic. For hydrorefining catalysts, which did have some values above the TC level, even if the lower average arsenic input levels assumed by the commenters were used, the arsenic risks would remain above $1E-4$. (Note that the risk results are not very sensitive to the TCLP input level for arsenic under the conditions modeled, because this chemical moves very slowly in groundwater, causing the maximum receptor well concentration to be relatively insensitive to the starting leaching concentration.)

Another commenter objected to capping waste samples at the TC level, particularly for benzene, arguing that this implies the toxicity characteristic may be an appropriate alternative to listing the wastes. The commenter stated the TC-capped modeling and the underlying implications are wrong because (1) the TCLP is unreliable for oily wastes, (2) a generator may apply "knowledge" in lieu of testing, (3) generators may render inaccurate determinations, and (4) the characteristic does not consider the high PAH content of some wastes.

EPA generally agrees that for the wastes at issue, crude oil tank sediment and spent hydrotreating/hydrorefining catalysts, the TC does not provide sufficient regulatory control for the various reasons stated in the residual specific discussions in Sections V.C. As shown by the TC-capped modeling analysis, the risk levels remain at levels of concern, whether or not EPA assumes wastes exceeding the TC levels would be managed as hazardous. Furthermore, as discussed later in this section on the use of the TC as an alternative to listing, EPA believes that listing these wastes is supported by other factors.

EPA does not agree with the commenter's claim that the TCLP is unreliable for the wastes evaluated in today's rule (see discussion at the beginning of Section V.B.1). While EPA agrees that inaccurate determinations by generators may occur due to the difficulties associated with sampling some wastes (see discussion in Section V.C.1), the Agency believes that the use of a generator's knowledge in lieu of testing is appropriate in many cases. Finally, the Agency agrees that, to the extent potential risks from PAHs are not controlled by the TC, wastes should be listed. This may occur because PAHs are not TC constituents, as noted in the following section on use of the TC as an alternative to listing. Therefore, if a

particular waste exceeds TC levels only some of the time, any PAH risks would not be adequately covered for those instances where the waste does not exceed the TC levels.

Eliminating Hazardous Waste Volumes

In allocating volume inputs for the groundwater and nongroundwater modeling, EPA omitted waste volumes that were reported to be hazardous (i.e., exhibited a characteristic defined in 40 CFR 261.24). EPA had not done this in the proposal for wastes sent to land treatment, and for inadvertently modeled hazardous waste volumes that were, in fact, disposed of in permitted hazardous waste LTUs. EPA corrected this in the risk analysis for land treatment presented in the NODA. One commenter disagreed with EPA's approach of not counting waste volumes managed as hazardous in 1992, and noted this dramatically reduced the high-end volumes of crude oil storage tank sediment used as input to the NODA risk assessment for land treatment disposal. The commenter stated that the "recalculations" for land treatment volumes are based on the unverified assumption that because certain wastes were managed in 1992 as hazardous, they will always be managed as hazardous. The commenter argued that by excluding these wastes, EPA is implicitly relying on the existing TC in lieu of listing the waste, and therefore making the same policy errors as the landfill TC-capping modeling (discussed above).

EPA does not agree with this comment. The wastes that were excluded for the revised land treatment modeling were, in fact, reported to be hazardous in the 3007 Questionnaire. While some wastes may exhibit a characteristic sometimes, and not at others, EPA has no reason to believe that 1992 was not a typical year. Thus, EPA could reasonably assume that similar amounts would be hazardous from year to year, and such variation should not lead to significant changes in the risk analysis. While excluding these volumes does rely on the TC as the commenter noted, this reliance seems justified because these wastes did, in fact, exhibit the TC and were reported to be managed as hazardous. Furthermore, EPA notes that the waste of primary concern to the commenter, crude oil tank sediment, is being listed as hazardous in any case due to groundwater risks from landfill disposal. For the other wastes modeled in LTUs, removal of volumes regulated as hazardous did not alter the risk results significantly, i.e., the median and 90th percentile volumes were only

slightly different (see Table 2.1 in the NODA nongroundwater risk assessment background document, Supplemental Background Document; Nongroundwater Pathway Risk Assessment, March, 1997).

Use of the TC as an Alternative to Listing

Some commenters indicated that the use of the TC adequately regulates potential risks, and therefore, makes listing of the refining process residuals unnecessary. Others commented that the TC does not adequately capture wastes that should be regulated, and supported the proposed listings.

In response, the Agency notes that its listing decisions are based on a weight-of-evidence approach, which evaluates various factors, including the results of the risk analysis. In general, EPA may consider listing wastes that frequently exhibit a characteristic if risks are not adequately controlled by the characteristic. The TC, for example, was based on an evaluation of potential threats constituents may present if released to groundwater (see 55 FR 46369; November 2, 1990). Thus, for a waste that is TC hazardous, EPA may consider listing if other pathways besides groundwater present a risk, if other constituents in the waste are not included in the list of TC constituents, or if a waste with levels of TC constituents below characteristic thresholds still shows significant risk for some situations.

In today's rule, EPA is finalizing listings for the two spent catalysts and crude oil tank sediment, even though these wastes are often characteristically hazardous, because risks from landfilling these wastes are not adequately controlled by the TC (see specific waste discussions). Furthermore, EPA is listing another waste, CSO tank sediment, that often exhibits the TC characteristic for benzene, because the TC does not effectively control risks presented by PAHs in LTUs via nongroundwater pathways. The TC was developed to provide protection against potential risks from the contamination of groundwater by leachate from land disposal units, and was not designed for nongroundwater pathways. In addition, PAHs are not on the list of TC constituents.

5. Other General Risk Issues

Consistency With Past Listings

One commenter stated that EPA's methodology for the current listing determination is inconsistent with previous Agency practice and policy,

specifically with the finalized carbamates listing and the previous petroleum listing. The commenter noted that, for the carbamates listing rule (February 9, 1995; 60 FR 7825), EPA computed landfill waste volumes according to the quantity of wastes that could be landfilled, not just the quantity that happened to be landfilled in the reporting year. The commenter provided examples in the current listing proposal where waste volumes for land treatment exceeded the volumes for landfilling, and argued that the volumes used in the landfilling assessment were therefore too small. The commenter also noted that EPA considered the codisposal of solvents and other oily wastes in petroleum refining waste management units as part of its 1990 listing determination for refinery wastewater treatment sludges, F037/F038 (November 2, 1990; 55 FR 46354).

As a general response, EPA notes that the commenter did not take into consideration the evolving nature of the Agency's risk assessment process and policies. EPA's risk methodologies have progressed over the years, and the modeling tools have been refined. The earlier rule cited by the commenter, the listing decision for treatment sludges (F037/38), did not, in fact, rely on modeling, but rather used a more simplistic approach based on a comparison of waste constituent concentrations to health-based levels. Given the modeling tools currently available, EPA no longer believes such an approach is appropriate, because it does not take into account the potential for waste constituents to be released from the waste units, their fate and transport in environmental media, and the levels to which receptors may ultimately be exposed. In today's rule, EPA has used various models to estimate the release and transport of the toxic chemicals of concern, and the Agency believes such an approach is more useful in projecting the potential risk to exposed individuals.

While EPA did perform modeling as part of its risk assessment in the carbamates listing cited by the commenter, this was essentially the first time the Agency attempted to use such modeling to support listing decisions. Thus, EPA made various simplifying assumptions. For example, EPA created a hypothetical off-site landfill for modeling by assuming that all of the carbamate wastes under examination would be placed in the same off-site unit. Such a simplifying assumption would be unrealistic in the current rulemaking, given that the petroleum refining industry consisted of 185 facilities in 1992, and that these

facilities were widely distributed throughout the country (for comparison, the carbamates industry comprised 23 facilities). To use the same approach as was used in the carbamates rule, i.e., to assume disposal of all wastes in one landfill, does not appear reasonable in the current rulemaking.

Therefore, EPA believes that the approach used in today's rule is a reasonable progression of EPA policy. For responses to the specific comments related to the use of volumes reported for land treatment and landfills, see the discussion on Waste Management Assumptions, which appears earlier in this section. Elsewhere in this rule EPA also responds to comments related to codisposal (Section V.B.3) and co-solvency (Section V.B.1).

The commenters also argued that previous listing determinations were based on lower levels of contaminant concentrations than those found in wastes being considered in this notice, and that the wastes under consideration in this rulemaking should be listed. For example, the commenter pointed out that the average total concentration of benzene and PAHs, such as benzo(a)pyrene found in crude oil tank sediment exceeds the level of benzene in F037 and F038 that caused those wastes to be listed in 1990.

EPA recognizes that crude oil tank sediment and other residuals characterized in this listing determination may contain concentrations of some constituents comparable to previously listed wastes, including the F037 and F038 refinery residuals. However, direct comparison of these concentrations to previous listing benchmarks is not an adequate basis for listing. Listing determinations consider many factors beyond the concentrations of constituents in a waste, including the waste volume, constituent mobility, management practices, damage cases, other regulatory controls, etc. (see 40 CFR 261.11(a)(3)). As noted above, the listing of F037/F038 sludges did not use modeling for support, but instead relied on constituent concentrations, as well as various other factors. The other factors that EPA relied on in this listing included the very large volumes of F037/F038 generated (over 400,000 metric tons per year), the widespread use of surface impoundments to manage the wastes, and damage cases. Therefore, merely comparing constituent levels may not provide a useful measure of what wastes should be listed. Furthermore, as noted above, EPA's risk assessment process has evolved, and the Agency has developed a more sophisticated set of risk

assessment tools than were available for listing determinations in 1990. As a result, EPA believes that it is better able to measure and predict risk now than previously, and that the better procedures and methodologies should be used.

Individual Versus Population Risk

Several commenters stated that the population risks estimated by EPA do not justify a decision to regulate the wastes proposed for listing (hydrotreating and hydrorefining and clarified slurry oil sediment), and that consideration of the risks posed by these landfills to the entire population potentially exposed would lead to the conclusion that these residuals do not pose substantial hazards to human health, and thus, should not be listed as hazardous wastes. Commenters argued that EPA's failure to give serious consideration to the low levels of population risk is at odds with the statute, the listing criteria, and regulatory precedent within the federal government. The commenters claimed that, due to the low populations risks, EPA cannot conclude that any of these residuals "is capable of posing a substantial present or potential hazard to human health or the environment," as required in 40 CFR 261.11, and should not list any of these residuals.

In response, EPA notes that "population risk" is not explicitly used in either the RCRA statute or the hazardous waste listing regulations in 40 CFR 261.11. EPA does not believe it is appropriate to allow contamination from waste management units to cause substantial risk to nearby residents simply because there are few wells in the immediate area. In addition, the regulation cited by the commenter clearly states that wastes are to be listed if they are "capable of posing a substantial present or potential hazard" (emphasis added). Thus, the Agency must protect against potential, as well as present risks that may arise. The Agency's decision to list these wastes is based primarily on the concern over risks to those individuals who are significantly exposed, even if there are relatively few of them.

Population risk is only one of many factors to be considered in Agency decisions, and there are numerous precedents where the Agency has taken action, for example at Superfund sites and in previous listing determinations, when there are relatively few people potentially affected. See, for example, the report entitled Land and Soil Health Risks from CERCLA (Federal Superfund), and WQARF (State Superfund) Sites, Arizona Department

of Environmental Quality, 1995, in the docket for today's rule, which concluded that population risks were low because the number of people exposed to groundwater contamination is small. The Agency has stated that the key objective of the CERCLA National Contingency Plan (NCP) is to protect individuals at contaminated sites (see 55 FR at 8710), and rejected using population risk as the point of departure for setting clean-up levels (see 55 FR at 8718). In addition, the CERCLA regulations (see 40 CFR 300.430(e)(2)(i)(A)(2), and 55 FR at 8848) direct EPA to establish preliminary remediation goals for carcinogens based on "cancer risks to an individual."

Population risks arising from contaminated groundwater due to waste management are expected to be low, because often only a limited number of domestic wells will be near these facilities, and groundwater moves very slowly. EPA's Guidance for Risk Characterization (USEPA Science Policy Council, February, 1995) states that, when small populations are exposed, population risk estimates may be very small, however, "in such situations, individual risk estimates will usually be a more meaningful parameter for decision-makers." Finally, it is important to note that the Agency is also concerned about the loss of the groundwater resource for the future, which could be of particular concern if land use patterns were to change and there were a future demand for the resource. In this case, beneficial uses would be precluded or, if the potential users were unaware of the contamination, risks could occur.

Additive Risks From Multiple Units

One commenter stated that risks posed through different groundwater and nongroundwater pathways should be summed when the potential for simultaneous exposure exists, but that EPA instead assumed that groundwater exposures were occurring after the nongroundwater exposures. The commenter noted that the time of travel for benzene and perhaps other mobile constituents in EPA's groundwater risk assessment is 17 years or less, clearly within the period of time nongroundwater exposures may occur.

EPA does not agree with the commenter's suggestion that groundwater and nongroundwater risks should be combined. This is because, as discussed previously, EPA's analysis showed that groundwater risks are only potentially associated with landfills, and nongroundwater risks are only potentially associated with LTUs.

Therefore, the only potential for the combination of groundwater and nongroundwater risks to be significant, would be for a situation in which a landfill was located in close proximity to a LTU. EPA examined the information provided in the 3007 Questionnaire for any sites where landfills and LTUs are co-located, and presented the results in the April 1997 NODA. This analysis showed only one facility at which a nonhazardous LTU and landfill were both located at the same site, and even in this one case the units are approximately 5,000 feet apart, making significant simultaneous exposure unlikely.

6. Specific Groundwater Modeling Issues

Active Life of Landfills

Two commenters disputed EPA's assumption of 20 years for the active life of landfills to estimate the total volume of a specific waste placed in a landfill, and argued that the report and data for off-site landfills used by EPA to make this assumption (National Survey of Solid Waste (Municipal) Landfill Facilities, EPA/530-SW88-034, September 1988) actually demonstrate an active life of at least 40 years. The commenters believed that this is an important difference, because this would increase the total waste volume used as input to the groundwater models and result in increased risks.

In response, EPA reexamined the report cited and concluded that the assumed active life of 20 years may be an underestimate. Using the data in the report, however, the Agency calculated that an average active life of 30 years is more appropriate for us in the risk assessment, rather than the 40-year life suggested by the commenter. EPA believes that the commenter simply summed the reported average age of the landfills (19 years) and the average remaining life (21 years) to obtain 40 years. However, this calculation is not appropriate, because it would overestimate the active life for existing units. This is because the average age in the report included closed units, not only existing units, and thus does not reflect the average life for those units still in operation. Likewise, the average remaining life given in the report included planned units, as well as existing units, and this also would tend to inappropriately increase the apparent active life for existing units. Correcting for this by eliminating closed and planned units, EPA calculated a 30-year active life, based on corrected values of 16.5 years for the average age of active units, and 13.3 years for the average

remaining life of active units (see Additional Listing Support Analysis, 1998, in the docket to today's rule for full calculations). EPA has used the revised active life (and correspondingly larger volumes) to calculate the new risk numbers given in Table IV-1.

The same commenters also argued that EPA's use of a 20-year life for on-site landfills was wrong. In the NODA, EPA provided an analysis of the data for on-site landfills for refineries from the 3007 Questionnaire, showing a calculated median of about 21 years for on-site landfills. The commenter continued in comments on the NODA to dispute the 20-year calculation, and cited an alternative method presented by EPA in the NODA to calculate a 39-year average (i.e., mean) active life, which the commenter argued EPA should use.

In the NODA analysis, the Agency used the projected date for closure of on-site landfills reported by refineries in the 3007 Questionnaire to estimate active lives. EPA also examined an alternative method to calculate on-site landfill life for use when facilities did not report the projected date of closure. Under this alternative method, EPA used the remaining capacity reported for the units, assumed disposal rates for all wastes in the landfills would remain constant, and thereby estimated when the landfill may reach full capacity. EPA believes the direct method chosen is most appropriate because it uses the actual landfill lives reported in the 3007 Questionnaire, rather than relying on estimating remaining active life by projecting past waste disposal rates into the future. The alternative approach is especially uncertain when the landfill is relatively new, thereby requiring the extrapolation of a small percentage of used landfill capacity into the far future, which means that small variations or errors in the used capacity of a landfill may lead to widely varying landfill life projections. Thus, EPA did not revise its modeling for on-site landfills to reflect a longer landfill life. EPA also used the median active life, rather than the mean suggested by the commenter, because the median value lessens the impact of widely variable data and outliers. For example, a few very large values in a data set would have a major impact on the mean, but the median would not be overweighted by the few very large values. EPA notes that the only data available for off-site municipal landfills were average values, not medians, so the Agency had no choice but to use the average estimate active life for the off-site landfills.

Furthermore, EPA notes that many of the wastes of concern, such as the

sediments from storage tanks, are generated only intermittently, since facilities clean out crude oil storage tanks about every 5–10 years. While refineries may have many such tanks of different ages, EPA estimates that a typical refinery may generate such a clean out waste about every 1.5 3 years. In effect, a typical facility may not dispose of the tank sediments in on-site units every year, but approximately every 2 years. Therefore, even assuming arguendo that the on-site active life might be about 40 years, as the commenter suggested, if tank sediment is only generated every two years or so, the total volume of a specific waste in the unit may more closely resemble 20 years worth. EPA notes that, unlike on-site units, off-site landfills may accept waste from other refineries, thus disposal may well occur every year. Therefore, the 30-year active life used for off-site units is a more appropriate measure of the number of years a specific waste may be disposed.

Finally, EPA notes that because the revised risks from off-site landfills were somewhat greater than risks from on-site landfills for the wastes of most concern to the commenter that the Agency is not listing (i.e., unleaded gasoline tank sediment, and HF alkylation sludge), the off-site risks are likely to be determinative in any case.

Waste Unit Area

Two commenters believed EPA should have used larger waste unit area sizes in its groundwater risk assessment, and that this would result in the listing of more refinery wastes. These commenters questioned EPA's decision to vary on-site landfill sizes for different petroleum wastes when projecting mismanagement scenarios. The commenters argued that since any petroleum waste can be disposed in any on-site landfill, EPA should assume that any waste will be disposed in units representing the largest landfills. The commenters believe that a larger waste unit area would result in a higher concentration at the receptor well, and that EPA underestimated the risk associated with several of the wastes the Agency decided not to list.

In response, EPA notes it used waste quantity and on-site landfill sizes in the modeling analysis for individual waste streams from the RCRA 3007 Questionnaire responses, which are based on actual petroleum waste management practices. EPA disagrees that a refinery would necessarily use a landfill to dispose of any number of wastes, and the Agency believes that there are indeed reasons why a facility would not dispose all its generated

waste in an on-site landfill, including permit limitations and liability considerations. EPA verified such limited or segregated management practices during site visits. For example, EPA reviewed site visit reports for four facilities that operated on-site nonhazardous landfills. Two facilities manage Fluidized Catalytic Cracking (FCC) catalyst and fines, but no other listing or study wastes in their landfills. The other two operate the on-site landfills for disposal of only some of their generated wastes. Other wastes are disposed off-site or recycled. EPA believes its approach of calculating different unit areas for different wastes was reasonable because they are reflective of actual operating practices, and another approach may result in unrealistic or unreasonable assumptions regarding waste management practices. As noted in the above section on waste management assumptions, a refinery may choose different disposal practices based on a variety of considerations, including the waste's characteristics and access to landfill capacity. Furthermore, it is not necessarily true that the larger the landfill, the higher the resulting receptor well concentration. The modeled receptor well concentration is a function of a number of parameters, such as waste volume, leachate concentration, the concentration of constituent in the waste, and various chemical transport properties. Thus, for a given waste volume, a larger landfill area will not necessarily produce higher well concentrations.

The commenters also stated that the standard off-site landfill areas used by EPA were arbitrarily small (2,020 square meters (m²) median; 162,000 m² high-end). The commenters noted that EPA apparently derived these area sizes from an industrial landfill survey taken of on-site industrial waste landfills, and therefore the areas are inappropriate to use for off-site units. The commenters went on to state that the Agency should use data available for municipal solid waste landfills for the off-site modeling, (i.e., the same database EPA relied on for length of active life.) They noted that the areas reported for active municipal waste landfills in EPA's 1988 survey appear many times greater than the volumes used by EPA.

EPA agrees first that the median area used by EPA in this analysis was in error, and believes that the data for off-site municipal landfill area cited by the commenter are more appropriate for modeling off-site landfills than the industrial database used by the Agency. This is primarily because, as the commenter noted, the database originally used by EPA reflected landfill

areas collected from what are likely industrial on-site landfills, rather than off-site landfills. EPA does not have, at this time, any area data for off-site industrial nonhazardous landfills, so the Agency has decided to use the data available for off-site municipal landfills. The use of municipal landfill data is entirely appropriate because the refineries reported in the 3007 Questionnaire that close to one-half of the wastes disposed off-site went to municipal landfills. Therefore, EPA revised the groundwater modeling for off-site landfills to reflect the larger areas associated with municipal landfills, and the risk results in Table IV-2 incorporate the revised landfill areas.

Noningestion Exposures for Groundwater

One commenter stated that EPA's groundwater risk assessment only considered the impact of ingestion of the water, but ignored potential risks from inhalation and dermal absorption of contaminants that might arise from the use of water in the home (e.g., showers or bathing). Such an additive affect would increase the overall risks from groundwater exposures.

EPA agrees with the commenter that the noningestion exposure route for groundwater may be important for some constituents. The Agency presented its analysis of such noningestion risks in the NODA. For the wastes under study, this was only significant for benzene (no other toxic constituent of concern was volatile enough to affect the risk evaluation). EPA's analysis resulted in effectively increasing risks from benzene projected to reach a receptor well by about 60 percent over the ingestion risk (See Chapter 5, Supplemental Background Document for Groundwater, 1997.)

Biodegradation of Benzene

Five commenters argued that the biodegradation of benzene should be considered in estimating the potential risks from Subtitle D landfilling of spent hydrotreating catalyst, spent hydrorefining catalyst, and crude oil storage tank bottom sediment. Two commenters used the groundwater model used by EPA (EPACMTP) to show that concentrations of benzene in groundwater decrease when a conservative biodegradation rate is assumed. Several commenters calculated benzene biodegradation rates to show that both anaerobic and aerobic biodegradation processes limit the subsurface transport of benzene in particular, and related aromatic hydrocarbons in general (benzene,

toluene, ethylbenzene, and xylenes, also known as BTEX). Commenters believed that the studies are relevant because the levels of BTEX compounds in the wastes' leachate are comparable to levels measured in the studies. Commenters argued, although the studies do not follow the Toxic Substances Control Act (TSCA) protocol developed by EPA to document biodegradation, the results should be viewed as comparable by EPA because they are presented in peer-reviewed journals.

EPA conducted an evaluation of all submitted data and the documented anaerobic biodegradation studies of benzene suggest that in-situ anaerobic biodegradation of benzene rates are strongly dependent on site-specific conditions (e.g., availability of chemicals to act as electron acceptors, availability of nutrients, temperature). The necessary conditions for anaerobic benzene biodegradation are poorly understood, and the absence of biodegradation can be caused by the presence of competing substrates, such as toluene, xylenes and ethylbenzene, as well as inadequate geochemical conditions and lack of proper electron acceptors (e.g., nitrate, sulfate, iron). Therefore, because of the lack of information to correlate site-specific controlling factors to biodegradation, the limited number of field data, and the field and laboratory evidence that benzene tends to be recalcitrant to anaerobic biodegradation, biodegradation of benzene was not considered directly in the groundwater analysis. However, EPA did complete preliminary modeling for the proposed rule that incorporated assumed rates into the analysis to see what impact this might have on receptor well concentrations (see the Petroleum Refining Listing Determination Background Document for Ground Water Pathway Analysis, 1995, in the docket for details). When assuming degradation rates of 0.00001 and 0.0001 per day, the well concentrations for all wastes examined decreased by approximately 2 percent and 44 percent, respectively. In addition, there may be a degradation "lag time," which is the time period between the introduction of a constituent into the subsurface and the start of actual biodegradation. This time reflects the period subsurface microbial populations may need to acclimatize to the organic substrate before degradation may occur. Thus, if the lag time were 10 years, the decrease in the well concentration due to biodegradation assuming the higher decay rate of 0.0001 day, would be lowered to only

22 percent. These results suggest that using a conservative degradation rate would not significantly alter the risk results for benzene. For example, even assuming biodegradation of benzene lowered the high-end risks for this constituent by about 50 percent, the risks would remain above $1E-5$ for the hydrotreating/hydrorefining catalysts and crude oil storage tank sediment.

EPA plans to study further the modeling of anaerobic biodegradation in the saturated zone of hazardous constituents from hazardous wastes and the physical conditions under which anaerobic degradation occurs where the Agency has developed sufficient data to permit such an analysis.

Location of Receptor Well

The distance from the landfill to the receptor well is an important parameter in the groundwater model, because the projected concentrations of constituents at the well, and the corresponding risks, increase as the well location is moved closer. EPA received comments from six commenters on the value used by the Agency for the distance to the nearest well from a landfill. One of the commenters felt that EPA should have used a smaller distance, while the remaining commenters felt EPA's value was too small.

One commenter believed EPA should have used the distance to the nearest well for off-site landfills that the Agency used in past listings, (i.e., 48 meters used in the dye and pigment proposed listing determination.) This value was less than half the value used for the petroleum listing determination. The commenter suggested that EPA perform the two parameter high-end analyses using the 48-meter distance to the receptor well.

In response, EPA notes that in its Monte Carlo analysis the Agency used the full distribution of available receptor well distances, including wells at smaller distances. The risk results for wastes of concern were presented in the NODA, and were subsequently revised as described elsewhere to yield the final results in Table IV-2 (see Section IV.B, and the groundwater background document in the docket, Additional Groundwater Pathway Risk Analyses, 1998). Concerning the well distance used in the dyes and pigments rule, EPA notes that the Agency used essentially the same underlying well distance data in this rule as was used in the dyes and pigments proposed rule. The apparent high-end value used in this earlier rule (46 meters, not 48 meters cited by the commenter) represents the 95th percentile distance, and 104 meters is the 90th percentile. However, EPA

states in the dyes and pigments rule risk documentation (see page 21, Health Risk Assessment Background Document for the Dyes and Pigments Manufacturing Industry, November, 1994, in the docket for that rule) that the high-end well distance of 46 meters was chosen because this was the 90th percentile value. But as Table IV-2.7 in the dyes and pigments risk document shows, the 90th percentile value actually was 104 meters, nearly the same as the 102 meters high-end value used in the current petroleum rulemaking. Therefore, the use of 46 meters in the dyes and pigments rule as the 90th percentile distance was an oversight. Regardless, EPA believes that the 90th percentile value is more appropriate to use in the type of high-end sensitivity analysis performed for this rulemaking, and that the 95th percent value would be unreasonably conservative. EPA believes that setting two critical parameters to the 90th percentile level is a reasonable approach to generate high-end risks that are above the 90th percentile, but still realistically on the distribution. Such an approach is consistent with EPA's guidance (see Habicht, 1992). EPA's Monte Carlo analysis for the groundwater pathway supports this approach, i.e., the revised groundwater risks presented in Table IV-2 show that the high-end risks are above the 95th percentile risks estimated from the Monte Carlo analysis. Therefore, EPA believes its approach is appropriately conservative.

The commenter also argued that the distance to the nearest well used in the groundwater assessment was inconsistent with the distance to the nearest receptor EPA used in the nongroundwater risk assessment. The commenter noted that the high-end value of 102 meters used for groundwater well distance is inconsistent with the high-end value of 75 meters EPA used for the nearest residence in the nongroundwater risk assessment, and that this discrepancy between the distance values is never addressed or justified.

EPA disagrees that the distances must be equivalent, because different pathways are represented in each assessment. Exposure from groundwater pathways occurs through potentially contaminated drinking water wells. Exposure from nongroundwater pathways occurs through multiple exposure routes, such as run-off and air releases from LTUs, and the point of exposure is considered the location of the residences nearest the LTU. Therefore, EPA used different data sets to estimate receptor distances for these pathways to account for well locations

for groundwater and residences for the nongroundwater pathways. For distances to residences in the nongroundwater pathways, EPA used information compiled for Treatment Storage and Disposal Facilities (National Survey of Hazardous Waste Generators and Treatment, Storage, Disposal, and Recycling Facilities in 1986: Hazardous Waste Management in RCRA TSDR Units, July 1991). These values were used instead of the ones used for groundwater because they reflect the distances to receptors being modeled, (i.e., residences at which people may be exposed to air releases or contaminated soils.) The distances to residences will not necessarily correspond to drinking water well distances.

Four commenters felt that EPA should have used data from the 3007 Questionnaire to calculate the distance to the nearest receptor well, which would result in a larger distance. Three of these commenters felt that EPA's decision to use values from the OSW Subtitle D Waste Management Facility Database was inconsistent with its earlier determination to base other information for its rulemaking on the 3007 Questionnaire. They believed that the RCRA 3007 Questionnaire obtained sufficient data from respondents, and that data from this Questionnaire is more appropriate, since unlike the OSW data, the data are specific to refineries and residuals considered for this listing. Two commenters suggested that if EPA felt there was insufficient response to the 3007 Questionnaire, EPA should have contacted non-respondents for further information.

Because of the lack of completeness of the reported well distances in the 3007 Questionnaire, the Agency decided to use well distances from the Subtitle D Survey Database. The 3007 Questionnaire response was incomplete and inadequate. Of the 172 3007 Questionnaires returned, 27 facilities reported the presence of nonhazardous on-site landfills used for the disposal of any waste in the survey in any year. Of these 27, EPA found that only 15 reported the distance to the nearest drinking water well with any reliable documentation (e.g., well location maps, groundwater flow gradients, company survey of nearby wells). This limited data set is not surprising given the difficulty associated with seeking off-site information from the refineries that is not related to on-site operations. Furthermore, wells may be placed closer to the on-site landfills in the future. Therefore, EPA relied on distances obtained from the Office of Solid Waste (OSW) database as more representative of potential well locations. EPA notes

that the 3007 Questionnaire only provides well location information for evaluating on-site landfills, and even if used, would not have impacted the modeling results for off-site landfills. Because the risks from off-site landfills were higher or comparable to risks calculated for on-site landfills, any change in the results for on-site landfills is unlikely to alter any decisions to list wastes.

Two commenters disapproved of EPA's methods for locating the receptor well in the contaminant plume for EPA's high-end and Monte Carlo analyses. The commenters argued that EPA should have assumed that the well is always located on the centerline of the contamination plume, in accordance with previous Agency listing determinations, and not have varied well locations across the width of the plume. The commenters submitted modeling results purporting to show that locating the receptor well on the centerline would increase risk such that a listing is required for most petroleum refinery wastes covered by the NODA.

EPA defined the well location for modeling purposes by using the distance perpendicular to the plume centerline (Y coordinate) and the distance from the landfill to the well (X coordinate). The X distance to the well was discussed in the preceding comments. In the high-end analysis completed in the proposed rule, EPA fixed the Y coordinate of the receptor well location half-way between the plume centerline and the edge of the plume. However, the Agency has revised the two high-end parameter evaluations using a full sensitivity analysis for each waste, in which the Y-location of the well was either placed on the plume centerline (the high-end value) or at plume half-width (the median value). EPA also has performed Monte Carlo analyses in which the receptor well location was varied in such a way that the location reflected the nationwide distribution given in the USEPA database of Subtitle D landfills. The final revised Monte Carlo analyses used the available distance to well data (X coordinate) as noted earlier, and then randomly placed the well anywhere within the projected plume. Both of these approaches are more appropriate than what the commenter suggested, because placing the well on the plume centerline will tend to overestimate risks in affected wells by not considering other well locations. Therefore, EPA does not agree with the commenter, and believes that the approaches used by the Agency in the revised risk analysis fully considered well placement. In any case, EPA notes

that the modeling submitted by the commenter shows that simply holding the well location on the centerline has little impact on the results. For example, the commenter's analyses that assumed the receptor well was always on the centerline yielded very minimal increases of zero to eleven percent for the four wastes they modeled in off-site landfills (see Appendix A in "Analyses Using EPACMTP to Estimate Groundwater Pathway Risks from Disposal of Petroleum Refinery Wastes" King Groundwater Science, in comment F-97-PRA-0005.A).

Finally, in conducting the Monte Carlo analysis for the NODA, the Agency made a key assumption concerning well location, which was inconsistent with the assumption made for the deterministic analysis. In the high-end analysis, the downgradient wells of concern were assumed to be those within the plume of contamination from the landfill, as noted above. For the Monte Carlo analysis, all potential wells within a 180-degree arc downgradient from the landfill were included, thus including wells that would never be affected by contamination from the landfill. Each approach can provide valid assessments of risk distributions, but the two approaches describe risks for different populations of receptor wells. Upon further consideration of this issue, the Agency determined it is most interested in risks at well locations that *could* be affected by the landfill. Including wells that, because of their location, could not be affected no matter how toxic or mobile the waste constituents, provides EPA with little information about the waste on which EPA is making a decision. Thus, EPA has relied on the revised Monte Carlo analysis that includes only those well locations that were within the plume. The results of this change, along with the other revisions to waste volume and landfill area estimates that were described earlier, show that risks are higher than previously reported for different percentiles on the Monte Carlo distribution. For example, the Monte Carlo risk for landfills for crude oil tank sediment with the receptor well restricted to the plume was $1E-5$, an increase over the Monte Carlo result of $7E-6$ when placing the well anywhere downgradient, and more comparable to the high-end results from the sensitivity analysis, $4E-5$. With this adjustment in the Monte Carlo assumptions, the high-end and Monte Carlo results appear more consistent, and EPA believes that such an adjustment is logical.

The differences between the two different approaches in locating receptor

wells in the Monte Carlo analysis is most obvious when comparing the constituent concentrations at the well calculated to be the 50th percentile values, otherwise known as the "central tendency." By restricting the well location to the plume, the 50th percentile concentrations are over several orders of magnitude greater than those predicted when the well location is allowed to be outside the plume. (See Additional Groundwater Pathway Analysis, 1998, section 5.3.1, in the docket for this rule for more details.)

EPA would like to use this occasion to make some observations about central tendency estimates. There is a common misperception that the central tendency estimate might be an "unbiased" or "best" estimate of risk. That could be extremely misleading, especially where it is difficult to distinguish variation and uncertainty. The 50th percentile estimates in the EPA groundwater Monte Carlo risk assessment used to support listing determinations under RCRA strive to be estimates of results for which half of the potentially exposed receptors face more risk and half face less risk in some group. However, that does not mean that such an estimate is a "best estimate" of a relevant result. As an example, consider if EPA did Monte Carlo estimates of groundwater risk at all wells in a 360 degree direction from a unit. In many cases (notably those with a fairly constant direction of groundwater flow relevant to any upgradient wells), well over half of the wells within any distance of the unit will be unaffected by releases from the unit and will have no risk. This would occur no matter what the toxicity or mobility of the hazardous constituent, and even though deterministic modeling might show with high certainty that wells in the direction of groundwater flow from the unit would have high risk. Clearly a central tendency estimate of "no risk" is not a "best" estimate of whether or not there will be groundwater risks, nor even a predictor of "mean" risk or of the "expected value" risk. Instead, it gives an indication that there is considerable variation and that many or most wells will not be affected. That indication would not give EPA any confidence that a hazardous constituent would not have significant effect on the downgradient wells, nor any particularly useful information on the toxicity or mobility of the waste.

Monte Carlo Versus Deterministic Analysis

Two commenters felt that the deterministic high-end risk assessment used by EPA does not allow EPA to

determine what percentile of the risk distribution is represented by the high-end analysis. In response, EPA performed a Monte Carlo groundwater analysis to generate probability distributions for risk presented by each waste. These results were presented in the NODA, and revised Monte Carlo analyses, using the revised inputs for landfill area and lifetime, are given in Table IV-2.

Several commenters recommended that the Monte Carlo analysis serve as the basis for a listing decision, due to the superior quality of the Monte Carlo-based risk estimates in comparison to the deterministic risk estimates (i.e., point estimates). They noted that in the NODA, EPA states that the Monte Carlo analysis "confirms" the risk findings (62 FR 16750-51); the commenters disagree with this approach and state the Monte Carlo results should be used as the primary determinant of individual risk. The commenters cite EPA guidance that has recognized the superior quality of Monte Carlo-based risk estimates compared to high-end approaches.

In response, EPA notes that the Agency's "Policy for Use of Probabilistic Analysis in Risk Assessment" states that "* * * such probabilistic analysis techniques as Monte Carlo analysis, given adequate supporting data and credible assumptions, can be viable statistical tools for analyzing variability and uncertainty in risk assessments." The policy also states that "[i]t is not the intent of this policy to recommend that probabilistic analysis be conducted for all risk assessments supporting risk management decisions." In addition, as one of the conditions for using Monte Carlo analysis, the policy states that "[c]alculations of exposures and risks using deterministic methods are to be reported if possible." Thus, the commenter's contention that information from Monte Carlo analysis is necessary to make a defensible listing determination is over broad and is inconsistent with Agency policy. The Agency's policy indicates that Monte Carlo analysis can be a useful tool for providing additional information on variability and uncertainty in certain situations (which is the way it was applied for this listing determination).

Furthermore, it is important to note that the Agency's policies do not indicate that there is any particular point on a Monte Carlo distribution that should be the point at which the Agency regulates or does not regulate. The 1992 guidance (memorandum from the then Deputy Administrator F. Henry Habicht "Guidance on Risk Characterization for Risk Managers and Risk Assessors") states that "[t]he 'high end' of the risk

distribution [generally the area of concern for risk managers] is conceptually above the 90th percentile of the actual (either measured or estimated) distribution. This conceptual range is not meant to precisely define the limits of this descriptor, but should be used by the assessor as a target range for characterizing 'high-end risk'." Therefore, a high-end estimate that falls within the range (above the 90th percentile but still realistically on the distribution) is a reasonable basis for a decision.

Exposure Duration

One commenter questioned why the groundwater risk analysis used a constant exposure duration of 9 years for receptors, while the nongroundwater risk analysis for LTUs included this parameter in the sensitivity analysis and used a high-end value of 30 years. The commenter submitted modeling analysis that purported to show that including exposure duration as a high-end parameter in the sensitivity analysis would result in increased groundwater risks, and specifically cited increased risks for crude oil tank sediment and unleaded gasoline tank sediment.

EPA does not agree that exposure duration is a particularly sensitive parameter in the analyses at issue. In the sensitivity analysis using exposure duration presented in the commenter's groundwater analysis, 30-year exposure risks appear to be erroneously calculated by simply multiplying the calculated 9-year exposure groundwater risk by a factor of 3.33, corresponding to the ratio of 30 years/9 years. However, EPA's risks based on a 9-year exposure duration were calculated from the peak well concentrations averaged over a 9-year period, using health-based numbers derived for a 9-year exposure period. The more accurate approach to model 30-year exposure would be to calculate maximum 30-year average groundwater concentrations from the modeling results, and then calculate the risk based on health-based numbers derived for a 30-year exposure period. Maximum 30-year average well concentrations may be smaller than 9-year average well concentrations depending on the peak concentration period. The commenter's apparent approach of simply scaling up risks based on a 9-year exposure by a factor of 3.33 will likely overestimate the extrapolated risk for a 30-year exposure. EPA examined the effect of including exposure duration as an independent parameter in a sensitivity analysis for several wastes (HF alkylation sludge, unleaded gasoline tank sediment, and hydrorefining catalyst). The results of the analysis

showed that exposure duration was never a sensitive parameter, and including it in the sensitivity analysis had no impact on the selection of the two high-end parameters or the risk results for any of the wastes examined (see Section 3 of Additional Groundwater Pathway Risk Analyses, 1998). Therefore, EPA does not believe this factor greatly affects the risk calculations conducted for this rulemaking.

Potential for Release of Oil Phase From Wastes

One commenter believed EPA inappropriately discounted the potential for migration of nonaqueous-phase liquids (NAPLs) arising from free oil in the wastes to the groundwater zone beneath the waste units. (Note that NAPLs that sink in water because they are more dense are called DNAPLs, while NAPLs that float because they are lighter than water are called LNAPLs). The commenter argued that EPA underestimated risk by evaluating management conditions unfavorable for NAPL release from landfills. The commenter also stated that EPA ignored the impact of this oil phase, or NAPL, on transport of waste constituents in the groundwater zone to the receptor well. EPA's evaluation in the proposed rule had concluded that the NAPL flow, if any, from these residuals will not reach the underlying aquifer and thus further modeling was not necessary. The commenter argues that EPA underestimated the fraction of oily liquid in the waste (suggesting a value of 80 percent), falsely assumed that the waste will be uniformly mixed with benign material that would not contribute to free oil, overestimated the capacity of the soil beneath the landfill (the unsaturated zone) to retain oil released from the landfill, and failed to consider the potential movement of the oil sideways in the subsurface.

EPA does not agree with the commenter's assertions. First, EPA notes that its analysis assumed a 27 percent free oil content in the waste for its initial calculations, based on data from the 3007 Questionnaire. This is more realistic than the value of 80 percent cited by the commenter, because the 80 percent value resulted from an error in reporting. The 80 percent value represents the waste prior to deoiling, and does not reflect the oil content of wastes in landfills (see Supplemental Background Document-Listing Support Analysis, April 1997 in the docket, App. A). The Agency used EPA's Composite Model for Oily Waste (EPACMOW), which accounts for both aqueous phase and non-aqueous phase

flow and transport, to estimate constituent transport. High-end parameters were chosen for sensitive parameters (landfill area, waste quantity, waste fraction, constituent concentration, and infiltration rate). Thus, even assuming the oil fraction is free to migrate, the model predicted no release of NAPL from the landfill, because there is not sufficient oil to saturate the material in the landfill beyond the 10 percent soil or waste saturation limit. Below this limit the oil will not migrate as a NAPL. If the oil does not escape the landfill, the NAPL cannot saturate the soil beneath the landfill, nor can NAPL-facilitated transport in the subsurface occur.

EPA believes the commenter's concerns about NAPL or free-oil release from landfills are unwarranted for a more fundamental reason. As discussed elsewhere (see Sampling and Analysis of Refinery Wastes), the residuals of concern are not oily in the manner anticipated by the commenter. While the sampled residuals may contain oil, this observation is not equivalent with concluding, as the commenter does, that free oil is present in these residuals. The method used to estimate oil content in the samples, the Total Oil and Grease (TOG) method, will overestimate "free" oil because it uses a strong organic solvent to extract various organic material, including waxes, greases, and higher molecular weight oils that are not mobile. During EPA's observation and handling of crude oil storage tank sediment during sampling and laboratory analysis, a discrete free oil phase, was not observed. None of the samples analyzed via the TCLP in this investigation were found to have oily phases. In addition, as noted elsewhere, reported oil and grease content of landfilled wastes support EPA's conclusion that wastes with high oil content (whether free oil or not) are not typically land disposed. This result is consistent with EPA's belief that oil concentrations in a landfill will not reach the levels the commenter suggested, since refineries generally have economic incentives to recover free oil and minimize the amount of oil that is disposed in wastes.

The commenter also submitted a report to document the plausibility of NAPL flow of contaminants from waste management areas ("Release of Dense Nonaqueous-Phase Liquids to Groundwater in Waste Disposal Areas: Part 1," March 1997). The commenter stated that the report showed four waste management facilities "associated" with the petroleum sector may have released nonaqueous phase liquids, or oil, into the groundwater. The commenter

concluded that refinery wastes like those at issue in this rulemaking were codisposed with other wastes in the units, and may have caused the NAPL or oil release.

EPA disagrees that the report cited by the commenter provides any information relevant to either the wastes under examination in this rule, or the type of landfill disposal at issue. EPA evaluated the report cited by the commenter and does not believe the information is particularly relevant to the listing decisions under consideration for several reasons. First, of the 26 sites identified in the report as having "definite" DNAPL contamination, 24 were Superfund sites listed on the National Priority List (NPL) for remediation. This limited number of NPL sites represented various industrial sites, many having a long history of many forms of waste mismanagement beyond landfilling (e.g., land spreading, land disposal of liquids, surface impoundments). As such, these sites can hardly be deemed to represent typical off-site landfills. Furthermore, the four facilities "associated" with the petroleum sector all operated from the late 1950s and most ceased operation by the early 1970s (one operated until 1981). Not surprisingly, the types of waste disposal that occurred at these four facilities do not resemble the typical disposal that occurs presently at landfills. The report shows (see Table A-3) that all of these facilities disposed of liquid wastes and sludges in surface impoundments; other liquid disposal practices included dumping into trenches and buried barrel mounds. In fact, from the information in the report it is not clear that any of the four sites had any unit resembling a solid waste landfill.

In addition, the four sites accepted a variety of wastes, including chlorinated solvents and other organic wastes (see Table A-2 in the report). While two sites were reported to receive wastes from tanks ("wastes from tank cleaning" and "tank bottom sludge"), there is no evidence presented in the report to support the commenter's assertion that any wastes were similar to the wastes at issue in this rulemaking. In fact, given the apparent predominance of disposal of liquids at these two sites, and the lack of any mention of a landfill, it does not appear likely that the wastes cited resemble the wastes under evaluation in today's rule. As noted previously, the listing residuals of concern here did not exhibit free oil, and the available data indicate that residuals sent to landfills had low total oil content. Certainly the samples of tank sediments obtained by EPA were not liquids. Therefore, EPA

believes that this report does not demonstrate anything significant, beyond the general fact that some landfills in the past have contained wastes that may release NAPLs. However, it provides no useful information about the wastes under study and their potential for NAPL formation, in either on-site or off-site disposal. EPA does not believe the information is particularly relevant to the listing decisions under consideration.

Existing Groundwater Contamination

One commenter stated that the subsurface under many refineries is grossly contaminated, and may affect the rulemaking in two important ways: (1) existing subsurface contamination can contribute significantly to groundwater risks at the modeled receptor well near refinery sites, thus EPA should include the cumulative risks in its assessments; and (2) the existing refinery groundwater contamination is often in the form of LNAPL (such phases float on top of the groundwater and typically contain lower molecular weight constituents, such as those found in gasoline) or other conditions that can facilitate the transport of organic contaminants at refinery sites, including but not limited to the PAHs in refinery wastes. The commenter noted that the rate and extent of LNAPL migration can depend upon site-specific circumstances, and often results in lower dilution and attenuation, and could result in higher concentrations at a receptor well. The commenter stated that while there is no nationwide survey of LNAPL occurrence at refinery sites, there is ample evidence that LNAPL contamination is frequent and severe, and EPA must take into account the hydrogeologic conditions known to the Agency that can affect the transport of hazardous constituents. However, the commenter did not offer any suggestions as to how to consider such "facilitated transport" in the groundwater assessment.

EPA agrees that there are no doubt petroleum refineries at which significant LNAPL contamination from product spills exist; however the Agency does not believe this should have a significant impact on its listing decisions for several reasons. First, EPA's risk assessment is conservative in that it assesses incremental risk associated with targeted residuals using a relatively low 10-5 to 10-6 risk listing threshold, in part because of possible exposure to unknown pollutants. Furthermore, EPA cannot conclude that LNAPLs would be present

at the precise sites where these wastes are likely to be disposed and potentially release constituents. As the commenter also noted, the rate and extent of NAPL migration can depend upon site-specific circumstances. The proper consideration of existing contamination would call for the full analysis of many other site-specific factors as well, some of which may tend to reduce constituent release from landfills, subsurface transport, and human exposure. Such factors would include the possible lack of potable groundwater near the site, and potential biodegradation at some sites, perhaps accelerated due to the prevalence of subsurface organisms that may exist in areas with contamination. Further, if LNAPL or other contamination exists, there may well be ongoing remediation, perhaps involving groundwater interception or pumping that would significantly alter or limit groundwater flow. The Agency believes that a site-specific assessment would be more appropriately carried out by State or Federal programs related to remediation of sites, and that such an approach would be quite difficult to follow in pursuit of an industry-wide listing determination.

EPA also notes that it is not likely that aquifers so widely contaminated so as to have floating hydrocarbons would be a continuing source of drinking water. Such contamination should be easily detected and avoided, and would be unlikely to lead to the multiple-year transport and exposure scenario that is the basis for EPA's risk assessments. Furthermore, the level of benzene in likely sources of LNAPLs, gasoline (1.6 percent average, or 16,000 ppm), would dwarf any potential risk that might arise from the leachable levels of benzene in wastes under consideration in this rule, making any concept of cumulative risk difficult to apply in any meaningful way in a listing determination. (For comparison, the highest level of benzene in any TCLP sample of listing residual was 39 ppm for hydrotreating catalysts). As noted above, the commenter's approach also presumes a number of additional worst-case assumptions (regarding the presence of critically placed NAPLs) that cannot be considered in a vacuum, and would require the consideration of many other site-specific factors to fully evaluate.

The Agency notes that the practical impact of considering LNAPLs and facilitated transport, even if this could be done, is not likely to be significant for most wastes of concern. EPA has decided to list the wastes with higher oil content (CSO tank sediment and crude oil tank sediment), as well as the spent catalysts. Thus, the wastes for

which this comment is most relevant are being listed, leaving unleaded gasoline tank sediment and HF alkylation sludge as the only other wastes that showed any groundwater risk of concern to the commenter. EPA notes that the effective dilution and attenuation factors for benzene resulting from the modeling (DAF; calculated by dividing the TCLP input at the point of release from the landfill by the projected concentration at the receptor well) for both of these wastes were on the order of 2 to 4 (see Additional Groundwater Pathway Analysis, 1998). These low DAFs approach the theoretical limit of one, which mean that benzene released from the landfill is estimated to reach the receptor well at concentrations that approach the levels in leachate released. Therefore, it is highly unlikely that EPA's assessment significantly understates groundwater risks for these wastes, and any further considerations in the modeling (such as "facilitated transport" due to existing contamination) are unlikely to significantly alter the modeling results.

Unlike the modeling for benzene, which is relatively mobile in groundwater, the limited modeling for PAHs detected in TCLP samples indicates that contaminated subsurfaces may have the potential to affect the migration of PAHs in groundwater. PAHs are relatively insoluble in water and are not expected to migrate easily via aqueous leaching and transport, and the high-end analysis for the PAH benz(a)anthracene showed DAFs of 15-64 (see Additional Groundwater Pathway Analysis, 1998). As the commenter noted, the presence of existing contamination such as NAPLs in the subsurface may facilitate migration. Some oily wastes contained potentially significant levels of PAHs (CSO sediment, crude oil storage tank sediment), and while TCLP results showed no detectable leaching, the detection limits in these samples were above health-based levels. It is difficult to assess potential groundwater risks from PAHs with complete certainty because undetected but potentially significant levels might possibly be in the TCLP leachate. PAHs could theoretically present some risk if they leached at their aqueous solubility levels, which in many cases are below detection limits. For example, the water solubility of benz(a)anthracene (0.013 mg/L) is 32 times the health-based level (4E-4 mg/L at the 1E-6 risk level), and this level is very close to the method detection limit (about 0.010 mg/L). While EPA cannot quantify any risks from TCLP samples in which PAHs

were not detected, the presence of these carcinogenic PAHs in the waste present some potential for additional risk, especially if transport is facilitated by existing contamination. Therefore, while EPA is not using the presence of carcinogenic PAHs as the sole or overriding factor in listing any waste (except for CSO sediment which clearly exhibited high risks from nongroundwater pathways due to PAHs), the presence or absence of carcinogenic PAHs was a contributing factor EPA considered in decisions to list or not list certain wastes (i.e., crude oil storage tank sediment, unleaded gasoline tank sediment, and HF alkylation sludge. However, EPA would not list solely on the undetermined potential for groundwater risks from PAHs given their relative insolubility, and because facilitated transport by LNAPLs is a complex hypothesis that EPA did not find likely for these particular wastes.

7. Specific Nongroundwater Modeling Issues

Uncertainty Analyses in Indirect Exposure Assessment

For both the proposed rule and the NODA, estimates of non-groundwater pathway risks were derived using a deterministic risk assessment method, which produces point estimates of risk using single values for input parameters. In this method, input parameters are varied between the central tendency value (50th percentile) and the high-end (90th percentile) values. The point estimate in which all variables are set at central tendency is assumed to be the central tendency risk estimate, and the highest risk estimate for any combination of double high-end variables (with all other variables set at central tendency) is assumed to be the high-end estimate of risk. The high-end risk estimate is presumed by the Agency to be a plausible estimate of individual risk for those persons at the upper end of the risk distribution. The intent of these descriptors is to convey estimates of exposure in the upper end of the distribution (i.e., above the 90th percentile), while avoiding estimates that are beyond the true distribution. The high-end risk as estimated in the proposed rule and NODA is the highest risk estimate for any combination of double high-end variables defined as those two variables modeled that, when set at 90th percentile values, pose the highest risk of all possible combinations of any two variables. Using this methodology, the point estimate in which all variables are set at central tendency (50th percentile) is assumed to

be the central tendency risk estimate, and the highest risk estimate for any combination of double high-end variables is assumed to be the high-end estimate of risk (above the 90th percentile; see Agency guidance in the Habicht memo, 1992).

The Agency requested comments on how best to factor uncertainty into Agency listing determinations based on the non-groundwater risk assessment. These risk assessments are so-called "indirect" exposure assessments, and are discussed in the proposed rule preamble at 60 FR 57762. Indirect exposure assessments are those in which the receptors (in this case nearby residents, home gardeners, subsistence farmers and subsistence fishers) are exposed to contaminants in the waste after these contaminants have been transported from the waste management area and have entered another environmental media (in this case soil and various food products) at the receptor site. This issue is important for this rule because the potential exposure pathways of concern arose from releases of soils through erosion (run-off) or wind-blown air emissions from LTUs onto adjacent areas.

Of particular concern to the Agency in the proposal was the issue of whether it is accurate to assume that greater uncertainty generally results in a more conservative risk assessment. One commenter noted that because the uncertainty in indirect exposure assessment can lead to a substantial overestimation of risks, failure to consider uncertainty can result in listing decisions for refining process residuals that do not actually pose a significant risk. The commenter suggested that EPA could account for uncertainty in indirect exposure assessment through a quantitative probabilistic uncertainty analysis, or to list those wastes associated with substantial uncertainty only if the estimated risks are at the high-end of the risk range.

Other commenters questioned the use of individual assumptions or input parameters in the nongroundwater risk assessment for LTUs. Commenters specifically noted that EPA should include a quantitative analysis of the following sources of uncertainty in the risk estimates for residuals proposed for listing: biotransfer factors, food consumption rates, biodegradation, land application rates, and physical transport processes.

The Agency agrees that an uncertainty analysis is desirable and conducted an uncertainty and variability analysis in support of the final nongroundwater risk assessment. The Agency addressed specific comments regarding use of

individual parameters (e.g., biodegradation rates) by including those parameters in the uncertainty analysis. A detailed description of the uncertainty analysis is presented in the document titled *Uncertainty Analysis: Nongroundwater Pathway Risk Assessment; Petroleum Refining Waste Listing Determination* available in the docket for today's rule. This document identifies the source of uncertainty or variability noted by commenters in each step of the analysis and describes the method of quantifying or mitigating that uncertainty/variability. When data distributions were available, variable parameters were included in a Monte Carlo simulation to provide a quantitative measure. If little or no data were available, a qualitative discussion of the source and effect of the uncertainty is provided. Key variables included in the uncertainty analysis include: constituent concentrations, biodegradation rates, distance to receptor, soil erosion parameters, bioaccumulation factors and bioaccumulation rates, and ingestion and consumption rates. The uncertainty associated with the generalized site assumptions of LTU area, waste quantity, and geographic location used in the deterministic analysis was addressed through the use of site-specific data where available.

The nongroundwater assessment uncertainty analysis covers three waste streams: CSO sediment, crude oil storage tank sediment, and off-specification products and fines. These were the only wastes with moderate to high levels of carcinogenic PAHs, and because PAHs were the constituents of concern for LTU risks, the risks for other wastes in this scenario were negligible (see 62 FR at 16753). EPA proposed CSO sediment for listing on the basis of the nongroundwater deterministic (high-end) analysis, which showed significant risk from PAHs. Crude oil storage tank sediment, which contains similar constituents in lower concentrations, showed risk levels from land treatment below EPA's range of concern. Off-specification products and fines also have similar constituents present in lower concentrations, but were not originally modeled as managed in LTUs for the proposal because the volumes managed this way were relatively small. However, off-specification product and fines were modeled as part of the LTU analysis conducted for the NODA to respond to comments on potential risks arising from codisposal. (See Section V.C.6 for a full discussion of the decision on off-specification products and fines).

The probabilistic uncertainty analysis was performed on a constituent specific basis, thus comparisons between the Monte Carlo and the high-end results must be made for a specific constituent to be meaningful. For example, for clarified slurry oil sediment managed on-site, the high-end risk analysis estimated a risk of $5E-5$ to the subsistence farmer from dibenz(a,h)anthracene via oral ingestion pathways. The uncertainty analysis for on-site management of clarified slurry oil sediment indicated a 90th percentile risk to the farmer from dibenz(a,h)anthracene via oral ingestion of $5E-5$ for the site modeled (Anacortes, WA). For CSO managed off-site, the high-end ingestion pathway risk to the farmer from dibenz(a,h)anthracene was estimated to be $2E-6$. Based on the probabilistic analysis, the corresponding 90th percentile risk for this waste stream was $3E-6$ and $1E-5$, respectively, for the two off-site LTUs modeled (Robstown, TX and White Castle, LA). For both crude oil storage tank sediment and off-specification products and fines, the uncertainty analysis indicates that risks are below $1E-5$ at the 90th and 95th percentiles for all exposure scenarios associated with on-and off-site management of these waste streams in LTUs, consistent with the high-end deterministic results.

The uncertainty analysis confirms that the high-end risk results presented in the NODA are plausible estimates of risk for individuals at the upper end of the risk distribution. In the high-end analysis presented in the NODA, the total carcinogenic risk (i.e., the combined risk from all of the hazardous constituents) for this waste was $2E-4$, a level well above EPA's benchmark level of concern ($1E-5$). For the on-site CSO scenario, the uncertainty analysis indicates risks of $1E-5$ from individual constituents at the 90th percentile of the risk distribution. Thus, the uncertainty analysis indicates that on-site high-end risks for CSO from individual hazardous constituents clearly do not represent risks that are outside of the true distribution. Rather, the probabilistic analysis indicates that high-end risks for individual hazardous constituents in some cases represent exposure below the 90th percentile of the risk distribution.

The total carcinogenic high-end risk for CSO for off-site units was $2E-5$. For this waste management scenario, the uncertainty analysis indicates risks of $1E-5$ from a single constituent at well below the 90th percentile. The off-site probabilistic analysis also suggests that the high-end risks may be somewhat

below the 90th percentile for this scenario.

Based on the results of the uncertainty analysis, therefore, the deterministic analysis certainly does not appear to overestimate risks from CSO. In any case, the decision to list CSO sediment is clearly supported by the uncertainty analysis. The Monte Carlo risk results below $1E-5$ under all conditions for crude oil storage tank sediment and off-specification product and fines also confirms the decision not to list these wastes based on nongroundwater risks (note that EPA has decided to list crude oil storage tank sediment based on groundwater risks from landfill disposal).

Run-on/Run-off Controls

EPA received numerous comments regarding the use of run-on/run-off controls for LTUs, which indicated that there was some confusion about EPA's assumptions regarding these controls in the risk assessment. The proposed listing determinations (as well as today's final decision) assumed no controls for the high-end analysis, and 50 percent effective controls for the central tendency analyses. Commenters challenged these assumptions as outlined below.

Two commenters argue that there is no legal or factual foundation for the Agency's assumption that any plausible mismanagement involving land treatment now or in the future will occur at a facility with run-off controls, much less with controls achieving 50 percent efficiency. Conversely, seven commenters state that even where there are no Subtitle C or mandatory state Subtitle D regulatory requirements for these controls, numerous other factors are motivating their use, as evidenced by the fact that most facilities use them.

EPA conservatively assumed that no run-off controls were present in its high-end analysis of risk to individuals residing near land treatment facilities because the presence and effectiveness of such controls could not be verified. The central tendency scenario, however, assumed that controls were in place that were 50 percent effective. After consideration of all comments and the available data, EPA did not change these assumptions in subsequent risk assessments for the NODA. The bases for these assumptions were responses to the 3007 Questionnaire and a survey of State programs. In the 3007 Questionnaire, refineries were asked to characterize whether run-on or run-off controls were in place at LTUs used in 1992. Based on this information, all of the 18 facilities with LTUs reported some level of controls. As part of the

revised risks analysis for LTUs presented in the NODA, EPA determined all but 6 LTUs are permitted Subtitle C units, and thus required to have run-on/run-off controls (see 40 CFR 264.273). For the nonhazardous units, it was not possible to quantify the effectiveness of the controls due to the very general nature of the questions and responses.

EPA's survey of State programs showed that, while some states have established minimum standards for Subtitle D units, many states do not have regulations on run-on/run-off controls (see Communications with State Authorities on Requirements for Land treatment Units, EPA, 1995; Docket # F-95-PRLP-S0019). The effectiveness of run-off control is dependant on many factors (e.g., level of engineering design, operation and maintenance practices, regulatory oversight and minimum standards, weather conditions), and the effectiveness may vary because of the lack of Federal nonhazardous LTU standards. As a result, EPA assumed only partial effectiveness, 50 percent controls, for the central tendency analysis, and no controls for the high-end analysis. EPA does not have data available that would allow for more precise quantification of effectiveness. The Listing Program's mandate to consider potential mismanagement scenarios clearly does not rely on assumption of the best controls, but rather must more closely evaluate the weakest plausible management scenarios. In the case of LTUs, this includes the potential for no or minimal run-on or run-off controls in many states, reflecting the lack of national minimum standards. (EPA notes that, in the revised NODA analysis, the Agency did not use LTU areas for *hazardous* waste units in its risk assessment, because these units are assumed to have effective controls in place. This information would not be applicable to estimating risks for nonhazardous LTUs).

Furthermore, EPA notes that the risks arising from soil run-off have limited impact on the Agency's final listing decisions based on the outcome of the risk for the nongroundwater pathways. This is because EPA has discovered that, due to an error in the air dispersion modeling conducted for the proposal, the risk attributable to the air pathway has increased and is now the same order of magnitude as the risk due to soil erosion. (The error was in converting units from $\mu\text{g}/\text{m}^2$ to g/m^2). The unit conversion correction makes the risk due to air deposition from windblown soil from the LTU comparable to the risk

attributed to soil erosion. For example, for on-site LTU risk for CSO sediment, the total carcinogenic risk due to soil transport is $1E-4$. The risk due to air deposition is approximately $7E-5$, and the risk from soil run-off is about $3E-5$ (see the NODA response to comment document for a more detailed discussion). Thus, soil erosion and run-off control assumptions are not as critical for the listing determination, because even in the absence of exposure through run-off, the risks for this waste are well above $1E-5$ and merit listing. The relative contributions to the media concentrations of contaminants from air and erosion were investigated in the uncertainty analysis conducted in support of this listing determination.

Soil Transport

EPA received numerous comments to both the proposed rule and the NODA questioning the methodology used to estimate soil run-off and transport from an LTU to surrounding fields and water bodies. Commenters to the proposal stated that transport of soil from the land treatment area to the receptors was not physically possible as modeled by EPA's use of the Universal Soil Loss Equation (USLE).

The USLE is an empirical erosion model originally designed to estimate average soil erosion losses to waterbodies from an agricultural field having uniform slope, soil type, vegetative cover, and erosion control practices. In the proposed risk assessment, the USLE was used to estimate the mass of soil lost per year per unit area from a LTU and deposited onto an adjacent receptor site. EPA estimated the percentage of the eroded soil that reached the receptor site using a fixed sediment delivery ratio. The Agency estimated the amount of soil eroded from the LTU and deposited on each receptor site (agricultural field, residential lot, home garden) independently of soil eroded and deposited into the nearby waterbody.

In response to comments on the proposed rule, EPA substantially revised its approach to estimating soil concentrations. This approach is presented in the NODA. Revisions were made to more accurately model an integrated soil erosion setting that includes the field, a buffer zone and the water body. The revised method for estimating soil erosion incorporates mass balance assumptions within the field to stream setting, and places the receptor field between the landfill and the waterbody. The model estimates rate of soil delivery to the nearest waterbody and assumes that the soil eroded from the source that does not reach the

stream is deposited evenly over the subbasin, including the garden.

Commenters on the NODA regarding EPA's use of USLE to estimate soil erosion centered on the assertion that run-off after leaving the land treatment area does not flow uniformly across the landscape, but will instead flow in a "channel" moving downstream toward the outlet of the basin or watershed. A number of commenters also argued that EPA's assumption of receptor locations relative to LTUs is unreasonable. They noted that EPA assumed that residences are directly downgradient of LTUs and that there are no obstructions to flow, when in fact the existence of a ditch, fence, wooded area, road, building, or swale between the landfarm and a garden eliminates this pathway of exposure. Commenters contended that the run-off cannot reach the gardens, farms and adult residents without unrealistic assumptions regarding location of receptors. These commenters argued that EPA failed to adequately respond in the NODA to proposed rule comments that the run-off from an LTU cannot physically reach the home gardens as assumed and that therefore the revisions presented in the NODA are inadequate.

EPA's revised method for estimating soil erosion assumes that the sediment delivery ratio is constant across the area between the LTU and the waterbody (i.e., it does not assume channeling), and that receptor sites are assumed to be downgradient from the source and within the same defined subbasin as the LTU. EPA believes that these assumptions are reasonable in order to estimate risk that might be expected to occur at petroleum refining locations. In the absence of specific data, EPA believes that its assumptions are reasonable and appropriately conservative, because residential locations may change over time. In addition, EPA notes that to properly consider channeling in soil erosion would require extremely detailed site descriptions of the topography and local conditions, and sufficiently detailed site descriptions are not available. In the absence of such detailed data, EPA used simplifying assumptions to estimate soil erosion that may occur over a wide range of possible scenarios. Furthermore, while the commenters disputed the modeling approach used by the Agency, they did not provide any alternative model that could be used with the information available.

For listing determinations, EPA wants to ensure that its risk estimates are conservative, and do not underestimate risks from releases from LTUs containing these wastes. As noted

extensively elsewhere in this Section, other commenters have raised reasons why EPA's modeling of LTUs may underestimate risks (e.g., existing contamination around refineries, codisposal with other wastes). EPA believes that its overall modeling approach for LTUs is an appropriate middle ground and reflects risks that may arise from such units. The models used by EPA to develop this rule are exceedingly complex. It would not be practicable, and likely impossible, to develop models that would account for all possible sources of site-specific variability. Accordingly, EPA has used reasonable, simplifying assumptions to estimate risks.

As described above in the discussion on run-on/run-off controls, EPA inadvertently made an error in the modeling for the proposed rule in unit conversion, which created an underestimation of risk due to air deposition. This change was described in the nongroundwater risk background document for the NODA. Because the unit conversion correction makes the risk due to air deposition from windblown soil the same order of magnitude as the risk attributed to soil erosion, USLE modeling assumptions do not provide the sole basis for the listing determination.

Specific comments regarding the individual parameters and assumptions used in EPA's USLE calculations (e.g., steepness of slope, soil delivery rate, meteorologic and soil data) are addressed in detail in the response to comment documents for the proposal and the NODA. In addition, the modeling conducted as part of the uncertainty and variability analysis for LTUs included site-specific meteorologic data, soil data, USLE parameter values, and the distance between the LTU and the home gardener receptor. This analysis has shown that the listing decision is not altered by the use of site-specific data for some of the parameters questioned, or by variation in the receptor location.

Bioavailability and Bioaccumulation

EPA received a number of comments on the manner in which biological processes such as bio-uptake, biotransformation, and bioaccumulation were considered in the non-groundwater risk assessment. One commenter states that EPA should have, but did not, consider the potential health effects to subsistence farmers and fishers due to bioaccumulation of PAHs. The commenter contends that EPA simply ignored this exposure route for these receptors due to the "high uncertainty" associated with fish and

plant-to-animal bioconcentration factors for the PAHs of concern in this rulemaking. The commenter believes that EPA should consider the information qualitatively, and/or present a range of results based upon possible bioconcentration factors. EPA responds that the Agency appropriately considered bioaccumulation of PAHs in these receptors as discussed below. A more detailed response to this issue is found in the uncertainty and variability analysis conducted in support of the risk assessment for this rule.

The subsistence farmer scenarios were evaluated initially for the proposed rule using beef and milk biotransfer factors for PAHs that were estimated based on the octanol/water partition coefficient (K_{OW}). K_{OW} is a measure of the affinity a chemical has for a nonaqueous, organic environment (octanol), versus its tendency to stay in water, and is commonly used to assess the absorption rate of a given compound from the environment into organisms. Beef and dairy biotransfer factors are used to estimate the transfer of constituents from the diet of cattle into meat and milk products consumed by humans. K_{OW} was initially used as a surrogate for biotransfer because measured data on the biotransfer of PAHs from plants to cattle or other ruminants are currently unavailable. However, in the NODA, EPA decided not to use these estimates in the risk assessment because the Agency believes that use of K_{OW} greatly overestimates biotransfer for constituents with large K_{OW} s. This includes the PAHs of concern in petroleum waste streams.

Estimates of biotransfer based upon K_{OW} only consider transfer of the constituent from the concentration in the diet into the concentration in the lipid storage in the animal. These estimates do not consider metabolic pathways for any constituents. In fact, PAH compounds with large K_{OW} s are readily metabolized by the mixed function oxidase metabolic pathway in mammals to water-soluble substances, which are then excreted. In other words, these PAHs tend not to bioaccumulate in animal or human tissue, but rather to be metabolized and excreted.

To summarize, because it is not possible to estimate PAH biotransfer factors without at least one measured value for any PAH compound, the Agency did not quantitatively model risks from bioaccumulation of PAHs for the farmer and child of farmer scenarios. Rather, based on knowledge of how PAHs with large K_{OW} s are metabolized in mammals, the Agency has concluded that risk attributable to the beef and dairy pathway are likely to be less than

the risk attributable to other ingestion pathways for these scenarios. A more detailed discussion of the metabolic pathways for these constituents is provided in Section 4.5 of the uncertainty and variability analysis.

Subsistence fisher scenarios were evaluated using measured bioaccumulation and bioconcentration factors (BAFs and BCFs) where available. BAFs generally reflect the transfer of contaminant from the environment to the fish from food sources. BCFs represent the transfer from the dissolved phase to the fish tissue BCF. Because measured BAFs are usually not available, BCFs are most often used. For those constituents for which neither measured BAFs nor BCFs were available, EPA assumed that BAFs did not exceed 1000 liters per kilogram of fish body weight (L/kg). This assumption is based on the data presented in Derivation of Proposed Human Health and Wildlife Bioaccumulation Factors for the Great Lakes Initiative (U.S. EPA, 1993).

While there are insufficient data to define the distributions and correlations needed for a reliable Monte Carlo analysis of bioaccumulation of PAHs in fish, EPA did conduct a quantitative uncertainty analysis after the NODA for BAFs using interval analysis. This is an appropriate statistical method for estimating missing values in a distribution even when data are limited as is the case for BAFs for PAH.

This analysis indicates that although there is not enough information to define the distribution and correlations needed for a reliable Monte Carlo analysis, the estimation of 1,000 l/kg is appropriate and within the range of uncertainty predicted for PAH compounds. A more detailed discussion of EPA's assessment of bioaccumulation of PAHs in fish is provided in Section 4.5 of the uncertainty analysis for the nongroundwater pathway risk assessment, as well as in the response to comment document for this rule (see Section M of the response to comment document for the proposed rule).

One commenter questioned the air-to-plant biotransfer factors (Bv) used by EPA in the analysis conducted for the proposed rule. The commenter stated that EPA's calculations of Bv contain errors, and claimed that EPA did not adequately explain or provide the basis for its estimate of Bv values. In comments on the NODA, the same commenter argued EPA continued to overestimate air-to-plant transfer.

EPA responds that the errors noted by the commenter were corrected in the reanalysis presented in the NODA. The basis for EPA's estimate of Bv values is

as follows. Measured values for air-to-plant biotransfer factors are available for many PAH constituents. Where available, EPA used measured values. The remaining Bvs are estimated from the K_{OW} (using the Bacci equation). As previously noted, K_{OW} tends to overestimate the bioaccumulation of constituents with very large K_{OW} s such as PAHs. EPA compensated for this overestimate by reducing the calculated Bv by a factor of 40. This approach was first presented in the 1993 Addendum to Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions (EPA document number EPA/600/AP-93/003).

One commenter argues that the assumption of 100 percent bioavailability of deposited constituents is overly conservative because many constituents, particularly PAHs, bond tightly to soils and are unlikely to be available to an organism even if the soil is ingested.

In response, EPA contends that the 100 percent bioavailability represents a reasonably conservative estimate of risk that will result in a rule protective of health and the environment. The bioavailability of PAHs from ingested soil depends on several environmental and physiologic factors. The process by which ingested soil-bound PAHs are made more or less bioavailable in the digestive tract and the effect of soil characteristics are not well understood; study results are conflicting. A recent study on the oral bioavailability of PAHs from soil, reported that the oral absorption of PAHs in rats, hamsters, or humans from diet or oil is approximately 92 percent. Another recent abstract presented data for the bioavailability of the PAH benzo(a)pyrene (BaP) from soil in terms of fraction of the BaP in soil that is absorbed relative to the BaP ingested. Based on that report, the fraction of BaP absorbed varied from 0.07 to 0.75. (A more detailed discussion of this issue is provided in Section III.F of the response to comment document for the proposal in the docket). Due to the uncertainty regarding the bioavailability of PAHs in soil, the Agency believes it is appropriate to assume PAHs to be 100 percent bioavailable in order to be fully protective of human health.

Exposure Factors

Three commenters provided comments on risk to home gardeners from consumption of contaminated produce. In comments to the proposed rule, one commenter argued that EPA's estimate of risks from root vegetable consumption are overestimated by two orders of magnitude. EPA responds that,

based on this comment, the ingestion rates used for vegetables consumed by home gardeners and subsistence farmers were corrected and the corrected rates were used in the revised risk assessment presented in the NODA.

Another commenter states that the percentage of the population assumed to have gardens is overestimated because EPA did not account for the fact different rates of produce consumption by the home gardener correspond to different types of gardens. The commenter contends specifically that EPA's assessment of risk to the home gardener from CSO sediment is significantly overestimated due to overestimation of the amount of produce consumed. The commenter states that EPA should have used data from the National Gardening Association's 1994-95 survey for assumptions regarding percentage of the population with vegetable and fruit gardens and fruit and vegetable ingestion rates.

In response, EPA notes that the exposure factors (e.g., patterns of fruits and vegetables consumption by home gardeners) used in the analysis presented in the NODA were obtained from the 1997 Exposure Factors Handbook, which provides EPA's most recent data on the various factors used in assessing exposure. Furthermore, EPA addressed the variability in consumption rates within different subpopulations as a component of the uncertainty and variability analysis performed after the NODA. As previously noted, results from the uncertainty and variability analysis support the findings of the revised high-end risk analysis presented in the NODA.

Several commenters contend that EPA overestimated soil ingestion. One commenter asserts that EPA did not account for the fact that individuals ingest soil in proportion to the time spent at each location (i.e., away from home, indoors at home, outdoors at home). EPA responds that variability in soil ingestion rates has also been addressed in the uncertainty and variability analysis conducted in support of the risk assessment for this rule. The uncertainty analysis used data on soil ingestion rates provided in the 1997 Exposure Factors Handbook.

Background Contamination

One commenter notes that EPA's modeling assumes no background or other contaminant exposure to nearby receptors, an unjustifiable assumption given other waste management practices occurring at these facilities, the pre-existing contamination at many

refineries, and the routine and accidental releases associated with refinery operations.

As EPA noted elsewhere in today's notice when discussing existing groundwater contamination, the Agency does not believe this is appropriate to consider for this listing for several reasons. First, EPA does not have the type of specific information on off-site contamination that would be required, nor did the commenter provide any. Furthermore, without extensive site-specific data, EPA cannot conclude that existing soil contamination would occur at the same off-site locations that might be impacted by releases from LTUs containing the wastes under study. The proper consideration of existing contamination would call for the full analysis of many other site-specific factors, some of which may reduce constituent release, transport, bioaccumulation, and exposure. Such factors include specific LTU design, the direction of any slope from the unit, the existence of downgradient residential receptors, and corrective action requirements that may lead to clean up of any release.

Fate, Transport, and Toxicity of PAHs

Commenters to the proposal pointed out that EPA failed to consider the biodegradation of PAHs in LTUs and at off-site receptor locations, thus overstating risks from PAHs in soils. One commenter noted that failure to consider biodegradation of the PAHs, 7,12-dimethylbenz(a)anthracene (7-12-DMBA) and 3-methylcholanthrene (3-MC) in the risk analysis for CSO sediment resulted in the overestimation of risks, because these two compounds have high cancer slope factors. While biodegradation of PAHs within LTUs was considered in the analysis for the proposed listing, biodegradation that may occur during transport of soil from the LTU to the receptor location was not considered in that assessment.

EPA agrees that biodegradation during transport may be a significant removal process for PAHs and should be considered in analysis of PAH fate and transport. Therefore, in response to this comment, the nongroundwater risk analysis conducted for the NODA was expanded to include biodegradation of PAHs (including 7,12-DMBA and 3-MC) at the receptor location for the waste streams of concern. Detailed results of this analysis are provided in the revised risk assessment technical background document in the docket for the NODA. The reanalysis presented in the NODA did not significantly change the risk estimates for these waste streams; however, because some of the PAHs

have relatively long half-lives (e.g., 3-methyl cholanthrene's half-life is reported to be from 1.67 to 3.84 years) so they are unlikely to biodegrade significantly prior to reaching the receptor.

Contrary to the commenter's prediction, consideration of biodegradation at the receptor did not result in reduction of risk estimated for CSO sediment. For example, based on the analysis for the proposed rule, the high-end cancer risk for the home gardener scenario from CSO sediment managed on-site was estimated to be $9E-5$. Based on the NODA analysis, high-end risks for this scenario were estimated to be $1E-4$.

For the analysis conducted for the NODA, EPA used only the most conservative value for biodegradation rates in order to assure that biodegradation is not overestimated when conditions and locations are not ideal for biodegradation. However, biodegradation rates were varied as part of EPA's analysis of the uncertainty and variability associated with non-groundwater risk assessment presented in the NODA. As discussed above, the results of the uncertainty/variability analysis support the findings of the revised high-end risk analysis presented in the NODA.

C. Residual-Specific Comments

The most important risk and modeling issues raised by commenters that were general in nature, or were raised repeatedly for various wastes, are addressed in the preceding section. Below EPA discusses specific comments important for individual wastes and presents the Agency's rationale for the final listing decisions.

1. Crude Oil Storage Tank Sediment

Summary

EPA is listing as hazardous crude oil storage tank sediment from petroleum refinery operations. This waste stream meets the criteria set out at 40 CFR 261.11(a)(3) for listing a waste as hazardous, because it may pose a substantial or potential hazard to human health or the environment. The Agency has identified substantial risks to consumers of groundwater associated with releases from off-site Subtitle D landfilling due to benzene, which EPA has decided will not be adequately regulated under the TC. The revised groundwater risk assessment results are summarized in Table IV-2.

Discussion

The Agency proposed not to list as hazardous tank sediment from the

storage of crude oil at petroleum refineries, either on-site or at tank farms owned by or affiliated with the refineries or refinery companies. In the proposal, the Agency found risks at levels of potential concern (3E-5, high-end groundwater risk) associated with disposal in off-site landfills; however EPA believed that because the only constituent of concern, benzene, is already regulated under the TC, listing might not have been warranted. See 60 FR 57763. The proposal also reported low risks from carcinogenic PAHs potentially released from land treatment operations (60 FR 57762). The Agency solicited comment on the decision not to list this waste stream, particularly on whether the TC captures wastes of concern, whether the Agency adequately characterized the risk for this waste, and whether any other factors should be considered.

The revised risk analysis presented in the NODA for land treatment continues to show insignificant risks (<1E-6) for this residual, and EPA did not conduct any further analysis on this management scenario. The high-end groundwater risks from the NODA analysis for landfills were essentially unchanged. Also in the NODA, EPA presented risk results to assess the potential impact of the TC regulation, (i.e., input levels to the groundwater model were capped at the TC regulatory levels) assuming that wastes above this level would be properly handled as hazardous. The TC-capping reduced the risks only slightly (2E-5). In addition, EPA provided a Monte Carlo analysis of the groundwater risks that were somewhat lower than the high-end risk at the 95th percentile (5E-6), but comparable at the 99th percentile (4E-5).

In response to comments on the NODA, the Agency further revised the input data for the groundwater pathway analysis as noted elsewhere in this notice. As shown in Table IV-2, this final groundwater pathway analysis showed slightly higher high-end risks (4E-5) and Monte Carlo risks (1E-5 and 5E-5 at the 95th and 99th percentiles). As in the NODA analysis, the risks estimated with benzene input capped at the TC level were only slightly lower for the high-end analysis (3E-5) and Monte Carlo results (9E-6 and 2E-5 at the 95th and 99th percentiles).

Following careful consideration, the Agency has decided not to rely on the TC to control the risks for crude oil tank sediment, because, as the TC-capped results suggest (risk up to 3E-5), the TC may not fully capture benzene risks for this waste. Thus, even assuming refineries properly handle wastes above the TC level, wastes below this level

may present risk above 1E-5. Furthermore, this sediment waste appears to be stratified as it forms in the tank, and upper layers are often centrifuged to remove oil, but bottom layers may not be (see Listing Background Document, 1995, p. 32). Even if a refinery analyzes the waste, rather than simply using its "knowledge" as the generator waste determination regulations allow, collecting representative samples is challenging. Therefore, due to the oily, nonhomogeneous nature of this particular waste, sampling and TCLP analysis may be problematic.

Moreover, although nongroundwater risks from land treatment are not significant, the carcinogenic PAH content of the waste is moderately high (e.g., up to 26 ppm of BaP; see 60 FR at 57762). As noted earlier in the discussion on groundwater issues (see Existing Groundwater Contamination in Section V.B.6), while EPA could not quantify any PAH risks from TCLP samples of this waste, the presence of carcinogenic PAHs in the waste pose some potential for additional risk, especially if transport is facilitated by existing contamination. While EPA is not using the presence of carcinogenic PAHs as the overriding factor in listing this waste, the presence of carcinogenic PAHs is a contributing factor EPA considered in listing crude oil storage tank sediment.

Specific Comments

Some commenters supported EPA's proposed decision not to list crude oil storage tank sediment, noting that the Monte Carlo analysis strengthens this decision and highlights the conservatism in EPA's risk assessment for the high-end analysis. In response, EPA notes that the high-end risk (4E-5), in conjunction with the other factors noted above, merits listing of this waste. The revised Monte Carlo risk at the 95th percentile also are of concern (1E-5), albeit somewhat lower than the high-end analysis. (See Section V.B.6 for further discussion on the Monte Carlo analysis). Therefore, after considering a combination of factors, including significant groundwater risk (i.e., risks above 1E-5), and the levels of carcinogenic PAHs found in these wastes, EPA believes that a listing is warranted.

Commenters opposing EPA's proposed decision not to list presented extensive comments on the risk analysis. These issues are already discussed in the portion of today's notice devoted to the Modeling Approach and Risk Assessment. Numerous comments challenged EPA's

groundwater risk assessment, and one commenter provided alternative groundwater modeling that incorporated a variety of changes and purported to show higher risks for this waste than found by EPA. As noted in Section V.B.6, the Agency modified its modeling to reflect some changes, which resulted in somewhat higher groundwater risks for this waste, and EPA has now decided to list the waste.

Comments supporting a listing also argued that the Agency had not evaluated the risks posed by management practices such as landfill daily cover, road spreading, and other uses constituting disposal. EPA disagrees as described in Section V.B.2; these are practices that were rarely practiced for this waste. In any event, the disposal practice modeled provided sufficient risk for EPA to list the waste.

The comments also noted that the concentrations of key constituents in crude oil tank sediment (e.g., benzene and BaP) exceed those reported in other wastes EPA listed in 1990 (55 FR at 46365; November 2, 1990). As EPA noted in the earlier discussion on consistency with past listings, a simple comparison of constituent levels can be misleading, because the Agency must consider many factors in its listing decision. Furthermore, EPA's risk assessment methodology has evolved since 1990. However, as noted above, EPA agrees that limitations in detection limits for the PAHs in the TCLP make it difficult for EPA to rule out potential groundwater risks completely. In any case, EPA notes that it has decided to list crude oil tank sediment as hazardous, primarily because of the risks from benzene, thus these comments are not critical to the final decision.

One commenter stated that because of its variability, crude oil tank sediment is precisely the type of waste stream that is best regulated only if it exhibits hazardous characteristics. As noted above, however, EPA is not relying on the TC to control risks, because the results of the risk assessment show that this residual poses sufficient risk to warrant listing as hazardous even with the TC controls in place. Furthermore, the variability in this waste appears to exist even within wastes removed from the same tank. EPA's sampling visits indicate that this waste may form in layers in the tank, such that it is not homogeneous when removed and processed. During tank clean out, some of the oily sediment initially removed from the tank is often deoiled (e.g., via centrifuging), but other more viscous layers may not be (see Listing Background Document, October 1995).

Thus, even if a facility attempts to perform the TCLP test in good faith, sampling such a material is a difficult challenge and could lead to inaccurate results.

Finally, consistent with the proposal, it is EPA's intent that the listing for crude oil storage tank sediment from refinery operations be limited in scope to wastes generated from tanks that are either on the refinery site, or at tank storage areas owned or under contract to the refinery. Thus, the listing does not apply to storage tanks upstream at exploration and production sites, or associated with pipelines or other crude oil transportation conveyances. EPA's meaning with respect to the term "affiliated" was to extend the scope of the listing to all tanks containing crude oil that are owned by the refinery and used in refinery operations. EPA has not collected data necessary to characterize non-refinery sediments. Furthermore, many of these non-refinery materials are governed by special statutory provisions (i.e., the "Bevill" provisions), and are currently exempt from regulation as hazardous waste (See 60 FR at 57764.)

2. Clarified Slurry Oil Sediment

Summary

EPA is listing as hazardous CSO storage tank sediment and/or in-line filter/separation solids from the filtration of CSO from petroleum refinery operations. This waste stream meets the criteria set out at 40 CFR 261.11(a)(3) for listing a waste as hazardous, because it may pose a substantial or potential hazard to human health or the environment. The Agency identified substantial risks to residents and home gardeners near on-site and off-site LTUs through direct ingestion of contaminated soil released from these units. The contaminants of concern, PAHs, also tend to accumulate in food sources such that this waste causes even higher risks to nearby subsistence farmers and fishers. EPA is not promulgating any of the proposed options for conditional listing, because revised risk analysis for releases from off-site landfills showed some risks of concern to consumers of groundwater (see Table IV-2).

Discussion

The Agency proposed to list sediment from CSO storage tanks (including solids from in-line filtration or separation of CSO) as hazardous, due to high-end cancer risks of up to 9E-5 and 8E-5 arising from receptors exposed to contaminated soil released from on-site and off-site LTUs respectively. High-end risks associated with the landfill

disposal of this waste stream were below the 1E-6 level, and EPA proposed various options for a conditional listing that would allow nonhazardous landfill disposal, but prevent the practice of land treatment. (See 60 FR at 57776).

In response to comments on the proposal, EPA modified the landfill and land treatment risk assessments and published revised risks in a NODA (see 62 FR at 16748). The overall risk pattern did not change significantly for land treatment. Specifically, for the on-site land treatment, the revised high-end risks increased slightly (up to 2E-4), and for off-site land treatment the revised risks decreased slightly (risks up to 3E-5) (see 62 FR at 16753). The revised high-end groundwater risks due to benzene from off-site landfill disposal increased from <1E-6 to 3E-6, and the Monte Carlo risks ranged from 1E-6 to 3E-6 for the 95th and 99th percentiles.

In response to comments on the NODA, the Agency further revised the input data for the groundwater pathway analysis as noted elsewhere in this notice. As shown in Table IV-2, this final groundwater pathway analysis showed slightly higher high-end risks (4E-6) and Monte Carlo risks (2E-6 and 4E-6 at the 95th and 99th percentiles) for off-site landfills. Based on the substantial risks arising from PAHs in land treatment of this waste, EPA has determined to list this waste as hazardous. At the time of proposal, EPA believed disposal of this waste in nonhazardous landfills did not appear to pose significant risks, and so raised the possibility of a conditional listing that would allow this practice to continue. The Agency has now decided not to include a conditional listing for this waste, primarily because landfilling of CSO residuals appear also to pose some groundwater risk as a result of the revised risk analysis (4E-6). Therefore, the Agency has decided not to proceed with this new concept with this waste. Furthermore, EPA is reluctant to encourage the landfilling of wastes with very high carcinogenic PAH content (e.g., up to 230 ppm of BaP), which, as noted above for crude oil storage sediment, may present risks if mobilized in groundwater under certain conditions.

Specific Comments

Commenters responding to issues related to risk assessment of CSO tank sediment argued that results were insufficient for a listing determination because EPA found that 80 percent of the CSO tank sediment does not pose a risk to human health and the environment, and the remaining 20 percent of CSO tank sediment, disposed

of in off-site LTUs, was determined to pose risk in the discretionary range only after imposing conservative assumptions.

After revising its risk assessments and considering all comments, EPA disagrees with the commenter. Three subcategories of CSO sediment can be identified. The first consists of the residuals land treated, which were found to pose risk of concern via the risk assessment as described in the proposed rule and the NODA. This volume accounts for 22 percent of the volume generated in 1992. The second consists of the residuals landfilled, which were not thought to pose risk of concern via the risk assessment as described in the proposed rule, and which account for 50 percent of the volume generated in 1992. The third consists of the balance of the residuals subjected to management practices in 1992, which were not modeled because either the practices were exempt (e.g., recycling), the residuals were already hazardous, or the management practices for very small volumes of the residuals were rarely practiced and/or adequately modeled by land treatment or landfilling (e.g., on-site road material).

EPA reassessed the first two subcategories of CSO sediment (management in LTUs and landfills), after modifying a number of parameters and modeling considerations in response to public comment. CSO sediment, when land treated, continues to exhibit risk levels (up to 2E-4) supporting a listing determination, as described in the discussion above. Furthermore, the revised assessment showed that landfilled sediments also present some risks. Therefore, EPA has decided not to proceed with a conditional listing that would allow disposal in Subtitle D landfills, but rather is promulgating a full unconditional listing for this waste.

As noted elsewhere in today's notice (Section V.B), EPA does not agree with other comments that argued EPA should have assessed risks from other management practices, such as use of CSO sediment as on-site road material. In any case, EPA is listing this waste as hazardous, thereby preventing such practices in the future.

Some commenters argued that the waste constituent characterization related to analysis of the waste itself (not the TCLP extract) is uncertain and overestimates risks. Specifically, they argued that some PAHs were detected in only one sample at concentrations below the quantification limit (i.e., "J" values), and that where this concentration leads to an unacceptable risk estimate, CSO sediments for the

entire industry could be listed based on a single estimated concentration in one sample.

EPA does not agree that any uncertainty in the analysis resulted in an overestimation of risk. First, EPA notes that even constituents assigned a "J" value were reliably detected in the waste, although the precise level has increasing uncertainty as the measurement approaches the detection limit. More importantly, contrary to the commenter's assertion, the CSO listing determination did not hinge on a single estimated value, but rather considered all of the constituents that showed risk. Several highly toxic PAHs detected in CSO tank sediment (BaP, benz(a)anthracene, dibenz(a,h)anthracene, 7,12-DBMA) were measured at levels above the quantification limits, and these constituents in the waste presented substantial risks (i.e., $> 1E-5$) without any consideration of "J" values.

Commenters argued that EPA did not follow its own guidance in applying listing factors to CSO sediment, and that a description as to how each of the listing factors weighs for or against listing should be provided.

In response, EPA first notes that all the factors in 40 CFR 261.11(a)(3) are considered in this listing decision. The commenter has not specifically identified any § 261.11(a)(3) factors that were not considered. Furthermore, EPA disagrees with the commenter and notes that its revised risk assessment fully supports the listing determination for CSO sediment and is in accordance with applicable guidance. The guidance the commenter cites is contained in the December 22, 1994 proposed rule for the dye and pigment listings, in which EPA discussed the use of risk levels in making listing decisions (59 FR at 66075-66077). EPA's decision to list this waste is consistent with the guidance, i.e., the risks associated with this residual are well above the $1E-5$ listing benchmark.

EPA received comments that the Agency overstated the potential risks from CSO sediment that is land treated, and that there are no documented damage cases involving migration of PAH contaminated soils from land treatment of CSO sediments.

In response, EPA points out that it attempted to identify damage cases wherever possible to support its listing determinations (See Assessment of Risks from the Management of Petroleum Refining Wastes: Background Document, October 1995, in the docket). While EPA has identified damage cases resulting from releases at petroleum refineries, it was not possible to tie the

releases directly to CSO sediments (or other wastes under review in this rule) in LTUs due to (1) the management of multiple residuals in LTUs, (2) the infrequent generation of CSO sediments, and (3) the lack of a marker contaminant unique to CSO sediments that could be linked to documented releases. The lack of empirical evidence is not surprising, but does not prove that releases are not possible or even unlikely. For this reason, EPA did not rely heavily on damage cases that directly linked releases to the specific residuals of concern. Instead EPA's weight of evidence considerations emphasized its data collection efforts (i.e., the 3007 Questionnaire and field study) that provided EPA with the raw material to evaluate a wide variety of measures of risk (e.g., modeling of numerous pathways, groundwater modeling, hazardous waste characteristics). By using information beyond proven damage cases, EPA hopes to prevent releases that lead to environmental damage.

Several commenters requested that EPA clarify the definition of the K170 listing for CSO waste. Their questions relate to whether the listing: (1) applies just to CSO separately stored/managed or also to all mixtures of CSO and other fuels, (2) includes fluidized catalytic cracker (FCC) clean out/turnaround sediments, (3) includes sediments from "affiliated" tank farms, and (4) includes spills of CSO.

Concerning mixtures of CSO and other fuels, EPA points out that any sediments derived from CSO or CSO mixtures are considered K170 because of the contribution of the CSO sediment to the ultimate residual. All tanks that hold CSO have the potential to generate CSO sediment, and this sediment may mix with sediment generated by other materials stored in the tanks. Thus, the resulting sediment mixture would be classified as hazardous waste K170 under the "mixture" rule (see 40 CFR 261.3(a)). The Agency anticipates that refiners will use the 6-month period between the final rule date and the effective date to remove "marginal" storage tanks from service for sediment clean out and subsequently use dedicated tank service for CSO storage to minimize the number of tanks generating the listed hazardous waste.

Concerning clean out/turnaround sludges, throughout the EPA's industry study, the Agency intended to incorporate clean out/turnaround sludges from in-line particulate removal units within the scope of the CSO sediment definition (see the 1995 Listing Background Document at page 43). One primary component of these

sediments and storage tank sediments is FCC catalyst fines. Samples were collected from three storage tanks and one in-line filter. No samples of turnaround sediments were available during the Agency's field investigation; however, several refineries described the removal of sediments from other in-line separation units such as hydroclones during turnarounds. EPA believes that sediments removed from the hydroclone during turnarounds would be comparable to sludges removed from in-line filters which serve the same purpose, because both are designed to perform the same function, i.e., to remove solids from lines leading to CSO tanks. No information was submitted by the commenters to demonstrate that clean out/turnaround sediments from such in-line separation devices differ from storage tank sediments.

The Agency therefore continues to use the broader definition of CSO sediments, which includes sediments collected in filters and other separation devices in lines that move the CSO from the FCC unit to storage tanks. EPA does not, however, expect that all residuals generated during FCC turnaround would be classified as K170, but rather only those associated with in-line particulate removal equipment (e.g., hydroclones, in-line filters). This would not include sediments and tars that may accumulate within the distillation columns.

EPA's meaning with respect to the term "affiliated" was to extend the scope of the listing to all tanks containing CSO that are owned by the refinery that produced the CSO. (See 60 FR at 57766). This CSO has not yet been sold or transferred to another entity or corporation, and remains the property of the refinery from which it originated. All sediments settling from the CSO prior to sale are subject to the hazardous waste listing. Similarly, once the CSO has been sold or transferred in commerce, it is no longer under control of the producing refinery. The listing determinations in today's rule are for wastes generated from refinery operations, thus EPA has not examined for this rule whether other sediments might be generated, and if generated, under what conditions, after the CSO has been sold or transferred.

Concerning spills of CSO product, EPA does not intend to regulate as hazardous the CSO itself, only the sediments that are removed from this hydrocarbon product such as those generated in in-line separators and those sediments that gravitate to the bottom of storage tanks. CSO that is accidentally spilled on the ground may in fact

contain particulates that would have settled out as tank sediment. However, the Agency did not address such spills in the proposed rule and, in response to this comment, is clarifying that it does not currently intend to regulate CSO spills as K170. Spills of K170 waste, of course, would be regulated.

One commenter noted that EPA should consider an exemption from designation as hazardous for CSO sludges that are de-oiled, and claimed that de-oiled solids may be managed similarly to FCC catalyst and fines units because they are very similar in composition (i.e., the wastes would be landfilled and should not present a risk). The commenter argued that providing a conditional exemption for de-oiled sludges, perhaps with separate Land Disposal Restrictions (LDR) treatment standards, would be environmentally sound, and would tailor treatment to the nature of the waste stream.

EPA did consider whether the data available allow the Agency to distinguish between CSO sediment (as well as crude oil storage tank sediment) before and after de-oiling, especially for use in risk assessment. However, the Agency concluded that distinguishing between the two forms of CSO sediment was inappropriate based on the data available (see Listing Background Document, 1995, pages 46 and 29). Therefore, EPA disagrees with the commenter's suggestion to only list "non-deoiled" sediment because: (1) Available data do not provide a sufficient comparison differentiation of risks between oily and de-oiled CSO tank sludges, (2) the deoiling process may not remove the PAHs of concern, and (3) crafting a definition of de-oiled sludges would be difficult and may cause enforcement problems.

Furthermore, as shown by the high PAH content in CSO sediment, the solids appear to be more than just spent FCC catalyst. EPA believes the exclusion for recycled oil-bearing residuals that EPA is promulgating in today's rule is a more effective approach to encouraging the recycling of the material.

3. Catalyst From Hydrotreating and Hydrorefining

Summary

EPA is listing as hazardous spent hydrotreating and hydrorefining catalysts from refining operations. This waste stream meets the criteria set out at 40 CFR 261.11(a)(3) for listing a waste as hazardous, because it may pose a substantial or potential hazard to human health or the environment. The Agency identified substantial risks to consumers

of groundwater associated with releases from on-site and off-site Subtitle D landfilling due to benzene and arsenic, which EPA has decided will not be adequately regulated under the TC. The revised groundwater risk assessment results are summarized in Table IV-2. In addition, these materials also present a hazard because of their pyrophoric and self-heating properties.

Discussion

The Agency proposed to list spent hydrotreating and hydrorefining catalysts from refining operations due to high-end cancer risks of up to 1E-5 and 6E-5 respectively arising from releases of benzene and arsenic to groundwater from landfill disposal. (See 60 FR at 57766-57768). In addition, as the Agency discussed in the proposed notice, these materials also present a hazard because of their potential to spontaneously ignite when removed from the processing unit and exposed to air.

The revised groundwater risks in the NODA increased substantially for these scenarios when compared to the proposed rule. The high-end risks for hydrotreating catalyst were up to 7E-5 for off-site landfills and up to 8E-5 for on-site landfills. For hydrorefining catalyst, the high-end risks were up to 7E-4 for off-site landfills and 4E-4 for on-site landfills. The TC-capping assessment in the NODA resulted in some decrease in risks from benzene compared to the proposal, while the arsenic risks showed little or no decrease. Thus the maximum high-end risks were not materially affected. In addition, EPA provided a Monte Carlo analysis that yielded somewhat lower groundwater risks; however, as noted in an earlier section, EPA subsequently revised the Monte Carlo analysis.

As a result of the revised risk analysis completed in response to comments on the NODA, the off-site landfill groundwater risks increased further. As shown in Table IV-2, the revised off-site risks for hydrotreating catalyst are 1E-4 for benzene and 8E-5 for arsenic; the TC-capped results for this waste showed lower risk for benzene (3E-5), but arsenic was unchanged. Similarly, the revised off-site risks for hydrorefining catalyst are 7E-5 for benzene and 6E-4 for arsenic, and the TC-capped analyses for these wastes lowered the benzene risks (3E-5) but had no impact on arsenic risk. The revised Monte Carlo risks for hydrotreating catalyst (benzene 3E-5, arsenic 2E-5 at the 95th percentile) and hydrorefining catalyst (benzene 2E-5, arsenic 4E-4 at the 95th percentile) were somewhat lower, but still well above the listing benchmark of

1E-5. As in the NODA analysis, the high-end and Monte Carlo risks for arsenic were not lowered by the TC-capped analysis. The TC-capped benzene risks for both catalysts were somewhat lower in the high-end (both at 3E-5) and Monte Carlo analyses (9E-6 and 8E-6 for the hydrotreating and hydrorefining risks respectively).

EPA believes that the overall results are strongly supportive of listing both spent catalysts. Even in the TC-capping results, both catalysts present risks in off-site landfills that exceed 1E-5. Specifically, for both hydrotreating and hydrorefining catalysts, the TC-capped arsenic risks exceed 1E-5 for the Monte Carlo and high-end evaluations, and the benzene risks exceed this benchmark in the high-end evaluation and approaches this level in the Monte Carlo analyses. As shown by the TC-capped modeling analysis, the risk levels may remain at levels of concern, even assuming wastes above the TC level are not disposed of in nonhazardous landfills.

In addition to the groundwater risks posed by these materials, the pyrophoric and self-heating nature of these catalysts also support EPA's conclusion that these materials present a substantial hazard. During several site visits to catalyst reclaimers, EPA observed smoking catalyst storage areas used to stage the catalysts immediately prior to insertion into the reclamation process. One facility told EPA during the site visit that fires occur every few months. These areas were carefully monitored and controlled, but clearly the materials exhibited pyrophoric properties. In addition, the refineries generating these residuals described the significant risks during reactor turnaround associated with the potential pyrophoric nature of these catalysts. Therefore, EPA believes that it has solid basis for using the potential self-igniting characteristic of these catalysts to support its decision to list these residuals.

EPA wishes to clarify the scope of these listings, however. In the proposal, the Agency indicated that the listings would not include ceramic support media that are separated from the spent hydrotreating or hydrorefining catalyst prior to catalyst disposal or recycling, because these support media are inert, separate from the catalyst, and commonly reused or sent for cleaning prior to reuse. (See 60 FR at 57780). EPA continues to believe this is appropriate. Some commenters requested that EPA modify the regulatory language to refer to "inert support media," rather than the proposed "ceramic support media," because other types of inert materials are used, such as stainless steel. EPA agrees that the commenter's language

better reflects the Agency's intentions, and is modifying the exemption language in 40 CFR 262.3(c)(2)(ii)(E) and the listing descriptions for K171 and K172 to reflect this change.

In the proposed rule EPA also noted that the terms "hydrotreating" and "hydrorefining" are somewhat loosely used within the industry. Several commenters requested a more concise definition of the terms to clarify the definitions of hydrotreating, hydrorefining, and hydrocracking processes. EPA provides further discussion of the definitions of these wastes in the following section on residual-specific comments. EPA is modifying the final regulatory language slightly to clarify this issue, as noted in Section IV.B.

Specific Comments

Definition of Hydrotreating and Hydrorefining Catalysts

EPA examined three types of hydroprocessing catalysts identified in the EDF consent decree: hydrotreating catalyst (listing candidate), hydrorefining catalyst (listing candidate), and hydrocracking catalyst (study residual). Spent hydrotreating and hydrorefining catalysts have been proposed for listing and will be promulgated as hazardous wastes in today's rule; no action has been proposed to date for spent hydrocracking catalyst. (However, the listing of the spent hydrotreating and hydrorefining catalysts does not release the generator from determining whether spent hydrocracking catalyst is a hazardous waste due to the characteristics under 40 CFR 262.11). Public comment was submitted regarding EPA's hydroprocessing catalyst definitions.

All three processes are part of a continuum of catalytic hydroprocessing units. Definitions for the three categories of hydroprocessors are not universally established or accepted. In general, the three processes may be viewed in the following order of increasing degrees of severity of operating conditions and conversion of larger hydrocarbons to smaller molecules ("cracking"), and/or feeds: hydrotreating, hydrorefining, and hydrocracking. The types of catalysts used can be similar in all three processes.

The proposed regulatory language did not attempt to define these catalysts, or differentiate them from hydrocracking catalysts. The proposal referred to definitions used in the Oil and Gas Journal (60 FR at 57767, fn. 7), which indicates that hydrotreating includes

processes where essentially no reduction in the molecular size of the feed occurs, that hydrorefining includes processes where 10 percent of the feed or less is reduced in molecular size, and that hydrocracking includes processes where 50 percent of the feed or more is reduced in molecular size.

Commenters on the proposal noted that the preamble definitions did not provide a complete continuum, resulting in an unclear area between hydrorefining and hydrocracking. Specifically, since hydrorefining covered conversion rates up to 10 percent and hydrocracking covered conversion rates greater than 50 percent, as defined by the Oil and Gas Journal, it was not apparent how EPA would classify processes with conversion rates between 10 and 50 percent. Several solutions were suggested by the commenters:

One refiner suggested that EPA establish a definition of hydrocracking that assumes a conversion rate of 15 percent or greater and the use of downstream fractionation.

A catalyst reclaimer suggested extensive regulatory language describing the specific types of catalysts, catalyst support media, and catalytic applications associated with the different hydroprocessing categories.

Other refiners commented that EPA should clarify that any process with conversion rates greater than 10 percent should be classified as hydrocracking.

Each of the options is problematic. Reliance on specific conversion rates may allow for slight changes in operating and accounting practices to result in reclassification of units that would otherwise be considered hydrorefiners. Similarly, use of fractionation could be interpreted to include stripper columns commonly employed after hydrotreating and hydrorefining. The catalyst reclaimer's suggested language was an exhaustive attempt to distinguish the types of processes EPA intends to be within the scope of the listings; however, other commenters argued it was inappropriate to adopt the reclaimer's suggestion because EPA did not have sufficient basis to expand the definition in this way. At this time, the Agency is reluctant to adopt this extensive list within the regulatory language without additional review and perhaps further information collection.

Upon reviewing all of the relevant materials available in the docket, the Agency believes that the simplest way to differentiate between hydrocracking units and other hydroprocessing units is to rely on the categorization used in the DOE's Petroleum Supply Annual. Refineries are required to submit Form EIA-820 annually to DOE's Energy

Information Administration. This form includes the mandatory submission of data on operating capacity for catalytic hydrocracking and catalytic hydrotreating. Catalytic hydrocracking is defined in the Petroleum Supply Annual as:

A refining process that uses hydrogen and catalysts with relatively low temperature and high pressures for converting middle boiling or residual material to high-octane gasoline, reformer charge stock, jet fuel, and/or high grade fuel oil. The process uses one or more catalysts, depending upon product output, and can handle high sulfur feedstocks without prior desulfurization.

In addition, catalytic hydrotreating is defined in the Petroleum Supply Annual as:

A refining process for treating petroleum fractions from atmospheric or vacuum distillation units (e.g., naphthas, middle distillates, reformer feeds, residual fuel oil, and heavy gas oil) and other petroleum (e.g., cat cracked naphtha, coker naphtha, gas oil, etc.) [i]n the presence of catalysts and substantial quantities of hydrogen. Hydrotreating includes desulfurization, removal of substances (e.g., nitrogen compounds) that deactivate catalysts, conversion of olefins to paraffins to reduce gum formation in gasoline, and other processes to upgrade the quality of the fractions.

For the purposes of the K171 and K172 listing descriptions, catalytic hydrorefining is defined as a refining process with more severe (higher temperature and pressure) operating conditions than the catalytic hydrotreating process defined above for treating the heavier molecular weight petroleum fractions, residual fuel oil and heavy gas oil.

Based on the Petroleum Supply Annual definitions stated above, if a refinery has been classifying its hydroprocessor as a catalytic hydrocracker for the purposes of the DOE's Form EIA-820, spent catalyst from this unit would not be covered by K171 or K172 (with the exception of guard beds, as discussed further below). Conversely, if a refinery has been classifying its hydroprocessor as a hydrotreater processing feeds other than residual fuel oil or heavy gas oil, spent catalyst from this unit would be classified as K171; spent catalyst from a similar unit processing residual fuel oil or heavy gas oil would be classified as K172. Refineries have been reporting capacity information to DOE for many years and today's rulemaking should serve as a reference for the classification of these units.

In addition to the issue of defining hydrocracking units that are not subject to the K171/K172 listing, there is

disagreement among commenters from the petroleum industry and catalyst reclaimers regarding the classification of guard beds. These units, also known as desulfurization pretreaters, are used to extend the life of the downstream catalytic bed (e.g., reformer, hydrocracker, isomerization reactor) by removing sulfur, oxygen, nitrogen, and/or heavy metals. Reclaimers argued to include such pretreatment of hydrocracker feeds, sulfur guards, reformer pretreatment, and isomerization pretreatment as part of the definition of hydrorefining or hydrotreating. The petroleum refining industry disagreed, stating that these pretreatment processes use more severe conditions (much higher pressure, high ratio of hydrogen to hydrocarbon) to achieve contaminant removal, and also provide a significant reduction in feedstock molecular size, often greater than the 10 percent cutoff in the EPA/Oil and Gas Journal hydrorefining definition. Thus, industry contends such catalysts more appropriately belong in the hydrocracking category.

EPA agrees that these pretreatment units, or "guard units," should be covered under the listing descriptions in today's rule.

In reviewing the 3007 Questionnaire responses, EPA found that some refineries reported the catalysts from their guard beds under the category of the downstream unit. For example, nickel/molybdenum catalyst from a reformer pretreatment unit was sometimes reported as spent reforming catalyst, however, true reforming catalysts are based on precious metals such as platinum and palladium. EPA believes that these units were not reported as hydrotreaters because they often reside within the unit boundaries of the downstream units, are closely integrated with the downstream units, and such reporting simplified the refinery's response to the extensive 3007 Questionnaire. However, because this type of guard bed does not result in catalytic reforming (and similarly isomerization), these units were re-coded as hydrotreaters in the Agency's database. EPA has modified the regulatory language to clarify that the spent catalyst from all such pretreatment units should be classified as K171 or K172.

Risk Assessment and Basis for Listing

Some commenters stated that EPA's groundwater analysis understated the risks for these wastes. These comments reflected many of the issues already discussed in the portion of today's notice devoted to the Modeling

Approach and Risk Assessment, but the Agency notes a few issues specific to these wastes. Despite the commenters' arguments, EPA remains convinced that it is appropriate to use the TCLP to characterize the leaching potential of these residuals, as noted in Section V.B.1. The Agency's analysis of total oil and grease content of the catalysts showed very low oil and grease content (less than 0.2 percent) for the six samples for which EPA was able to conduct total oil and grease analysis, thus these are not the "oily" wastes that the commenter believes represent a problem for the TCLP. As the commenters noted, EPA did not consider codisposal for these wastes. However EPA believes it would be inappropriate to assess the impact of codisposal of the catalyst residuals with other refinery wastes because EPA is listing these wastes, and thus they must be disposed of in Subtitle C units in the future.

Several commenters argued that EPA's analysis overestimated risks in the Agency's assessment of spent catalysts from hydrotreating and hydrorefining for various reasons. These commenters argued that EPA data shows that 81 percent of these catalysts are already recycled or reclaimed, but EPA assumed in its risk analysis that all this material will go into landfills.

EPA disagrees with this comment. The Agency chose landfill disposal as the mismanagement scenario for the groundwater risk analysis for these wastes, because economic considerations and other information in the record show that the recycled material could plausibly go to landfills.

To calculate waste volumes to use as input to the modeling, EPA evaluated the data in two ways: (1) EPA arrayed the volumes disposed in on-site and off-site Subtitle D landfills in 1992 and determined the 50th and 90th percentile quantities (Tables 3.3.4 and 3.3.11 of the 1995 Listing Background Document), and (2) EPA arrayed the volumes for all volumes generated by any facility regardless of the actual management method (except for excluding wastes sent to Subtitle C), and determined the 50th and 90th percentile quantities for these wastes. EPA has used the second set of statistics in its risk assessment. Use of these data reflects the real potential that shifts might occur in management practices away from recycling and toward less expensive landfilling if the wastes are not listed (see a discussion of this issue in the Listing Background Document, 1995, pp. 78-79). Support for this assumption is found in industry comment that refineries may send spent catalysts to

either recycling or landfill disposal, depending on the associated costs. During site visits to both refineries and catalyst recyclers, EPA learned that factors affecting spent catalyst management include the price of metals, and consequently the value of spent catalyst, and corporate policies toward recycling versus landfilling. For example, one report from a visit to a refinery (document # 95-PRLP-S0041) states: "the spent catalyst is sent off-site for metals reclamation or to a special waste landfill, depending on market conditions." Another report from a site visit to a reclaimer (95-PRLP-S0057) states that the company's fee structure is driven by metals prices, and their costs and/or credits are dependent on the current metals market. The reclaimer noted that more spent catalyst is reclaimed when metal prices are high than when prices are low. EPA therefore believes that management patterns of these particular residuals could change in the future.

EPA only applied this assumption to three wastes (K171, K172, and spent catalyst from sulfur unit tail gas treating units), because these are all similar spent catalysts that are recycled at the same facilities. EPA did not project changes in waste management practices for other residuals, because the Agency has no specific information that such changes are plausible or that special trends in management practices exist. As noted in Section V.B.2, for the remaining residuals, EPA considered that 1992 provided a reasonable picture of the petroleum refining industry's practices.

Moreover, comparison of the two data sets shows the commenters' concern that the approach used overestimates risks is unfounded. The high-end (90th percentile) annual volumes calculated for both approaches are nearly identical for hydrotreating catalyst, 70 metric tons (MT) for the first approach versus 77 MT for the second. For hydrorefining catalyst, use of volumes that are recycled actually reduced the high-end volume somewhat, from 2,250 to 500 MT. (Note that the decrease in the 90th percentile in this case is because the addition of the recycled volumes creates a larger data set, and the 90th percentile point in the set is lowered for that in the smaller data set for volumes sent to landfills). Thus, EPA's approach does not overestimate risks.

TC-Capped Modeling

One commenter argued that EPA should not list hydrotreating catalyst because, based on the TC-capped modeling analyses EPA performed for the NODA, the risks for spent

hydrotreating catalyst disposal in landfills range from 2E-5 to 4E-6 from exposure to benzene (See 62 FR at 16752), and that these risk levels are within EPA's discretionary range for not listing. One commenter stated that EPA appropriately reported the risks from arsenic as not applicable because spent catalysts containing arsenic at levels sufficient to pose such risks are already covered by the TC Rule and regulated under RCRA. The commenter also argued that the risks found in the Monte Carlo analysis for hydrotreating catalyst were only 4E-6 at the 95th percentile, and, thus, support a no-list decision.

EPA disagrees with the commenters. First, the commenters are mistaken in suggesting that the arsenic risks are not applicable for the TC-capped analysis. On the contrary, the risks do not change under this assumption because none of the samples exceeded the TC level for arsenic. As such, under the TC-capped analysis the arsenic risks would remain the same as the uncapped analysis. As noted in the Discussion section above, EPA continues to believe that the risks from the high-end analysis fully support listing this waste, and the somewhat higher revised groundwater risks further support EPA's decision. Even for the TC-capped results, the revised arsenic high-end risks (8E-5) and Monte Carlo results (2E-5 at the 95th percentile), as well as the high-end risk for benzene (3E-5) clearly exceed the listing benchmark of 1E-5.

Commenters also argued that for hydrorefining wastes, TC-capped groundwater risks from benzene range from 2E-5 to 6E-6 (See 62 FR at 16752), and these risk levels are within EPA's discretionary range for listing (See 59 FR at 66073). While the comments conceded that the TC-capped risk for arsenic in this waste are in the range EPA could consider for listing (4E-4 to 1E-4), the fact that the peak arsenic concentrations may not reach the receptor well until 3400 to 8400 years after release, indicates that this is not significant. The commenters also noted that the risks from benzene and arsenic cannot be added because the time for peak concentrations at the well is much shorter for benzene (13-50 years). The commenters argued that EPA should base its decision on the lower Monte Carlo results (TC-capped risk of 6×10^{-6} at the 95th percentile for benzene).

EPA disagrees with the commenters. As noted in the Discussion section above, EPA continues to believe that the risk analyses fully support listing this waste, and the somewhat higher revised groundwater risks further support EPA's decision. Even for the TC-capped results, the revised Monte Carlo and

high-end risks for arsenic (4E-4 at the 95th percentile and 6E-4), and the high-end risk for benzene (3E-5) clearly exceed the listing benchmark of 1E-5. Contrary to what the commenter implied, EPA did not add the benzene and arsenic risks, because of the large differences in travel time. Further, EPA did not discard the arsenic risk results merely because the modeling suggested the constituent may not reach the receptor well in the near future. The timeframe for travel may be uncertain, but the results suggest arsenic will be a serious problem when it reaches the well.

EPA received comments stating that spent catalyst residuals should not be listed based on the characteristic of ignitability, because the spent catalysts do not demonstrate the property of self-heating, nor do they fail the ignitability test.

As noted in the discussion above, persistent smoldering fires that may propagate to other codisposed materials have been reported for these residuals. Thus, listing of these wastes is further supported by actual environmental and health damages. Actual damages constitute one of the factors to be considered in listing wastes as hazardous under 40 CFR 261.11(a)(3)(ix). As noted previously, it is rare to have actual damage cases to be attributable specifically to the wastes being listed. The fact that EPA has knowledge of actual damage cases for these wastes gives special support to their listing determination. Furthermore, under the mismanagement criterion of 40 CFR 261.11(a)(3)(vii), it is appropriate to consider the physical properties of these wastes that may result in hazards if there is improper management through co-management with combustibles. Therefore, EPA considers the self-heating physical property of these spent catalysts to be very important in its decision to list these wastes.

With regard to commenter opinion that a listing is not warranted to protect against fires resulting from spent catalyst being landfilled, EPA observed and was told by catalyst reclamation and refinery facility operators that these wastes exhibit pyrophoric properties and do result in fires. Even where catalysts are coated with heavy oils to reduce pyrophoric properties, this effect is not permanent as the oil coating degrades, particularly if the material is disturbed at a later date and exposed to the air, as could easily happen at landfills. EPA, therefore, has a solid basis for using the potential self-igniting characteristic of these catalysts to

support its decision to list these residuals

Impact of Listing on Recycling

EPA received a request for confirmation that solids generated from scrubbers used to control emissions during the reclamation and processing of spent hydrotreating and hydrorefining catalysts will not be designated hazardous under the "derived from" definition as a result of these proposed rules. The Agency points out that the commenter is incorrect. In general, wastes generated from the treatment of listed hazardous wastes are considered hazardous wastes, under 40 CFR 261.3(c)(2). This includes residuals generated by the recycling activities described by the catalyst reclaimers who submitted comments on this rule. Wastes generated in the manner described by the commenter (e.g., "derived from" air pollution control wastes) would continue to carry the hazardous waste code and be subject to land disposal restrictions.

EPA received several comments regarding the impact of this listing on recycling and management practices. Commenters noted that spent catalyst can be generated such that it meets the LDR UTS for organics, and that the metals of concern can be treated using metal fixation. This would be relatively inexpensive compared to the increased cost of recycling that will result from this listing, and might discourage recycling.

EPA does not agree with the commenters' scenario for several reasons. First, the treatment standards for the spent catalysts require that any treatment reduce levels of organics to low levels. For example, nonwastewater levels of benzene, toluene, and xylene must be 10 mg/kg or lower, and levels of naphthalene and phenanthrene are set at 5.6 mg/kg. Because the K171 and K172 wastes each frequently contain reactive sulfides and as a result may exhibit self-heating pyrophoric properties, the Agency also listed reactive sulfides as one of the hazardous constituents of concern in these wastes and specifically proposed to apply deactivation to these wastes. Thus, EPA does not believe it is likely that generators can meet all applicable LDR standards without appropriate treatment, such as treatment at a recycling facility. EPA concedes that listing may increase costs for recycling, however, EPA is not convinced that costs for other forms of treatment and disposal would be appreciably less. In any case, EPA's decision to list these materials is based on the risks they pose, and how this listing may

ultimately affect competing treatment technologies is not a central issue in the Agency's decision.

Other commenters pointed out that current recycling of these catalysts has been due, in part, to the economics of reclamation compared to disposal. A listing would, however, disproportionately increase costs of and liability concerns about recycling. Some commenters noted that by listing these wastes, transportation costs will become a significant factor as materials will need to be transported as hazardous, regardless of their characteristics; increased transportation costs would strongly favor local disposal at a Subtitle C facility, and generators would be less likely to ship wastes farther distances to recycling facilities. Another commenter suggested that a listing will decrease recycling, and increase the demand for virgin metals. Thus, the overall environmental benefits from the listing determination are likely to be negative, because there will be more disposed of catalyst, and more production of virgin metals.

EPA cannot know precisely what the ultimate costs will be for refineries to recycle or dispose of spent catalysts. The Agency believes the liability concerns described will continue to play a role in both landfilling and recycling decisions upon promulgation of this listing. The affected industry must first explore means to eliminate or minimize the newly listed waste, and then to optimize recycling, treatment, and management of remaining wastes. The basis of EPA's listing decision, however, centers on the results of its risk assessment, which demonstrates that these materials pose a potential risk to human health and the environment, and warrant Subtitle C control. The Agency also points out that, because of the listing, the recycling/disposal cost differential may arguably be reduced or reversed, because Best Demonstrated Available Technology (BDAT) and Subtitle C disposal costs will greatly increase the costs of disposal over the current practice of Subtitle D landfills. Thus, recycling is likely to continue to be an effective management option for these residuals.

Furthermore, based on EPA's discussions with the recycling industry (see discussion of metal reclaiming for hydrotreating catalyst in Listing Background Document, 1995, pages 76-79), many of the reclaimers currently have RCRA storage permits to allow them to manage characteristically hazardous catalyst, so it is not clear that the costs for recycling should increase significantly due to listing. Even if recycling costs may increase as a result

of this rule, EPA continues to believe that it is completely appropriate to bar these materials from Subtitle D disposal because of the risk levels identified through the Agency's risk assessment procedures. EPA has no evidence, nor did commenters provide any, to support the supposition that the listing would increase demand for virgin metals.

Many commenters requested that the Agency consider an exemption for the regeneration/reclamation/recycling of spent catalyst. The catalysts would be listed only if they are disposed of in a landfill (or, alternatively, not recycled). Other commenters proposed a conditional listing for catalyst residuals going to land disposal. The suggested conditions include that the residual is sent to metals reclaiming, catalyst regenerators, or other recycling or reuse (provided it is not a "use constituting disposal"), records are kept on recycling and reuse, and that self-heating residuals are shipped in Department of Transportation (DOT) bins. The commenters argue that such a listing would encourage recycling rather than landfilling.

EPA believes that the catalyst wastes present several risks beyond those necessarily associated with landfill disposal, including pyrophoric properties and significant levels of benzene and arsenic (all of which may pose risks via pathways other than groundwater exposure, including risks from improper storage or other handling, and risks from uncontrolled air emissions from thermal treatment). Thus, this waste is not a good candidate for a conditional listing. Given the hazardous nature of this waste, EPA believes it is entirely appropriate for it to be transported and stored as hazardous waste before recycling. (See 40 CFR 261.6 for regulations applicable to hazardous wastes that are recycled). EPA points out that examples of problems at sites recycling these wastes have been noted in the record (see enforcement case described in the docket, document #PRA-S0037).

4. Catalyst From Sulfuric Acid Alkylation

Summary

The Agency is not listing as hazardous catalyst from sulfuric acid alkylation, as proposed. EPA hereby incorporates, as a final decision, the proposed preamble discussion for this waste stream at 60 FR 57768-57769. The residual is managed almost entirely (> 99 percent) under an existing exemption from the definition of solid waste (40 CFR 261.4(a)(7)). Also, this residual consistently exhibits the

characteristic of corrosivity and is subject to regulatory control if not returned to the production of virgin sulfuric acid. No significant comments against this decision not to list were received during the public comment period. Therefore, EPA has no basis to change the decision not to list.

5. Spent Caustic From Liquid Treating

Summary

EPA is issuing a final decision not to list spent caustic from liquid treating as a hazardous waste. About 70 percent of the spent caustic is managed in ways that are exempt from RCRA regulation, because it is reused as an ingredient in producing other products. The Agency has identified certain management practices used for spent caustics for which the Agency is clarifying the application of the definition of solid waste, and in one case proposes a modification to the definition.

Almost all of the remainder is sent to regulated wastewater treatment systems in such small volumes relative to other discharges, that the diluted constituents of concern from the spent caustics are not expected to present any significant risk. Furthermore, any solids from the caustic that separate out prior to downstream biological treatment are already regulated as hazardous wastes.

After analyzing other potential exposure pathways, EPA concluded that with regard to any remaining risks, with the exception of air exposure pathways from open tank storage, there were no potential risk pathways that need to be modeled. EPA found that risks from air releases from the open tank storage scenario presented insignificant risk.

Moreover, this residual will frequently exhibit the characteristic of corrosivity (i.e., pH will be above 12.5) and toxicity due to cresol leachability (and sometimes ignitability) and is subject to all applicable regulatory controls when any of the hazardous waste characteristics are present.

Discussion

The Agency proposed not to list this waste as hazardous and has found no reason to change this decision after consideration of public comments and all other information available in the rulemaking record. EPA's 3007 Questionnaire showed that 51 percent of the waste stream is reused as an ingredient or substitute for virgin caustic and, is thus eligible for exclusion from the definition of solid waste under 40 CFR 261.2(e). The exclusion provides that secondary materials that are used or reused directly (i.e., without reclamation) are

not subject to regulation under RCRA and are therefore not subject to any listing determination. In addition, the proposal noted that characteristically hazardous spent materials that are reclaimed prior to reuse would still be hazardous wastes subject to pertinent management requirements. Therefore, as noted in the proposal and confirmed in this final decision, there is no reason to cover this portion of the waste stream in the listing.

In addition, 17 percent of the spent liquid treating caustics are used as valuable commercial feedstocks in the manufacture of cresylic or naphthenic acids. Accordingly, EPA in today's final rule, for reasons stated in the preamble to the proposed rule at 60 FR 57769-57770, is amending 40 CFR 261.4(a)(19) to clarify that spent caustics used in this manner are not solid wastes and, therefore, should not be subject to listing.

For the 29 percent of the wastes sent to wastewater treatment systems, EPA's analysis in the proposed rule found that risks from this practice are unlikely. As noted in the proposed rule, risks from such treatment are unlikely to be of concern because: (1) Treatment is already regulated under Federal water (NPDES) and air (benzene National Emissions Standards for Hazardous Air Pollutants (NESHAP), Maximum Air Control Technology (MACT) standards) programs; (2) sludges generated from wastewater treatment are already regulated as hazardous waste (i.e., K048, K051, F037, F038); (3) volumes of the discharged residuals under evaluation are relatively small in comparison to the volumes typically treated in wastewater systems; and (4) the wastewater treatment systems are designed to treat refinery wastes effectively (see discussion below).

The Agency concluded that there were no potential risk pathways that needed to be modeled except air exposure pathways from open tank storage. For open tank storage, the Agency's bounding risk assessment estimates resulted in no significant risks (see 60 FR at 57770). In addition, this waste consistently exhibits the characteristic of corrosivity (and often toxicity due to cresols), and, therefore, could not be otherwise discarded without being subject to regulation as a hazardous waste.

Specific Comments

In comments on the proposed rule, one commenter argued EPA only evaluated potential risks associated with tank storage, that EPA must evaluate the groundwater impacts from surface impoundment management, since that

method of management is both an actual and plausible mismanagement scenario. The commenter stated that several refineries reported managing spent caustic in surface impoundments in 1992, and that the high-end volume of 596 MT managed in surface impoundments exceeds volumes EPA modeled for other waste practices. The commenter also noted that controls on surface impoundment risks by Phase III and Phase IV LDR rules cited by EPA in the proposal as being able to effectively regulate these wastes were not finalized.

In response, EPA wishes to clarify a few points. First, in every case described in the 1992 database, these surface impoundments were part of the refineries' wastewater treatment systems. EPA has no data indicating that undiluted caustics were managed in surface impoundments. Therefore, to model this scenario appears unreasonable. Second, EPA did, in fact, conduct a screening analysis of the impact spent caustic would have on the wastewater treatment plant, as described in the docket to the proposed rule, but found that the dilution with other process wastewaters was so great that no impact was observed (see page 152 of the Listing Background Document, 1995). In further considering this scenario, EPA estimates that the 90th percentile quantity of spent caustic discharged to wastewater treatment in 1992 (approximately 4,000 MT) would be diluted by a factor of about 3000. Thus, EPA does not believe that additional risk assessment is necessary. In addition, the constituents of concern (relatively low levels of certain volatile organics and metals, see the 1995 Listing Background Document for details) in these residuals are generally indistinguishable from those found in other residuals (many already listed as hazardous waste) typically discharged to wastewater treatment, making it virtually impossible to attribute any subsequent concentrations in sludges or environmental releases to the contribution from spent caustics. The combination of dilution and the expected toxicant removal and destruction that the wastewater treatment plants are designed to accomplish should effectively treat the spent caustic.

In addition, the Agency continues to believe that significant regulatory control of any spent caustic-derived treatment sludges already exists. Sludges and other residuals from the initial oil/water/solids separator are already regulated as K048 and K051. Sludges from oil/water/solids removal surface impoundments are also regulated as hazardous in the petroleum

refining industry, through the F037/F038 listings. Clearly, risks associated with biological treatment sludges and wastewaters downstream from these units are reduced as a result of the prior removal and treatment, including biodegradation. Further regulatory controls also exist for these sludges and wastewaters via the TC. In addition, the benzene NESHAP (58 FR 3072, January 7, 1993) and the planned air standards for volatile organics emissions (MACT standards proposed in 61 FR 17358, April 19, 1996) provide regulatory mechanisms for control of air emissions, and wastewater discharges are covered by the NPDES program.

EPA does agree that it is no longer appropriate to rely on the regulatory controls originally anticipated via the Phase III and IV land disposal restrictions. The Land Disposal Program Flexibility Act of 1996 caused the Agency to withdraw the LDR Phase III treatment standards (see 61 FR 15660, April 8, 1996), and not to finalize the proposed LDR Phase IV provisions (see 62 FR 25997, May 12, 1997). However, as required under the Act, EPA is currently conducting a 5-year study of surface impoundment usage, and if the study indicates that risks from impoundments are significant, EPA will then consider the need for further regulatory controls.

One commenter noted that EPA's sampling indicates that spent caustic from liquid treating "consistently exhibits" a characteristic (the corrosivity characteristic, and TC for cresols and benzene), thus it should be listed as hazardous under EPA's listing criterion in 40 CFR 261.11(a)(1). The commenter argued that current regulatory control depends upon whether the particular waste exhibits a characteristic (a determination the generator can reach based solely upon his or her "knowledge" of the waste).

EPA agrees that this residual frequently and typically exhibits one or more of the characteristics. However, because the majority of caustic management practices are either exempt from regulatory control or are adequately regulated under other regulations (e.g., the characteristics), the Agency believes that listing as hazardous waste is not necessary. In response to the commenter's concern regarding knowledge that this residual exhibits a characteristic, EPA notes that this material is commonly acknowledged as corrosive due to its highly caustic nature (hence its name), and managed in a manner to minimize corrosion problems during storage. Thus, the Agency believes that generators of spent caustic are well

aware of the potential for this residual to exhibit hazardous waste characteristics, and manage their spent caustic accordingly. Given the existing regulatory controls and management practices for this waste, EPA continues to believe that listing is not warranted.

Several commenters believed that the use of caustics in the manufacture of cresylic acid and naphthenic acid has always been excluded from the definition of solid waste under 40 CFR 261.2(e)(1)(I) and that a promulgation of the proposed specific exclusion might indicate that up until now, these caustics have not been excluded. Thus, the commenters requested clarification.

In response, EPA notes that the Agency and several states have been involved in a longstanding discussion with industry regarding the regulatory status of these materials. The promulgation of this rule presents EPA's final findings, and is intended to put an end to discussions regarding possible ambiguities in the current rules. The purpose is to settle this matter once and for all, and we are doing so by providing a clear regulatory exclusion.

6. Off-Specification Product and Fines From Thermal Processes Summary

EPA is not listing as hazardous off-specification product and fines from thermal processes. No risks of concern were identified for those materials that actually are discarded. Most of the materials generated from these thermal processes are coke product and are stored in piles with other coke product before they are resold. These piles are not, therefore, subject to RCRA jurisdiction or they are exempt from RCRA regulations.

Discussion

The Agency proposed not to list these materials, which are generated from various refinery coking operations. Of the 194,300 MT of these materials generated, approximately 87 percent is collected and combined with product inventory to be sold. However, more than 7,250 tons (3.7 percent) are landfilled in on-site or off-site Subtitle D landfills. These discarded materials were the wastes on which the Agency conducted its risk assessment.

EPA determined that other management practices, including fines sent to wastewater treatment, would not serve as a basis for listing and adopts the reasoning in the proposal for this determination as part of its final decision. (See 60 FR at 57770-57771). In summary, fines sent to wastewater treatment are insoluble and will be incorporated in primary treatment sludges that are already listed as K-and

F-wastes; LTUs received very small waste volumes; and other management practices do not actually isolate the materials from the coking process and, thus, are not wastes.

Commenters questioned why EPA did not assess risks from coke fines placed on piles of coke product, arguing that the waste does not become a product simply because it is placed on the pile and combined with another material. In the NODA, EPA provided further clarification on the jurisdictional basis for not evaluating the majority of off-specification product and fines that are managed as coke product. The Agency explained that only particle size distinguishes coke fines from other coke product. The majority of coke is removed from the coker by hydraulic drilling and coke fines are merely the smaller pieces of coke generated during this process.

In addition, EPA explained there is a jurisdictional distinction between coke fines produced from non-hazardous materials and coke fines produced from hazardous wastes (waste-derived fines).²⁴ Fines generated from non-hazardous materials are simply coke product, as would be expected because they are produced from the same coking drum. In the case of waste-derived fines, so long as the fines are legitimate coke product, they are exempt from RCRA regulation unless the material exhibits a characteristic as provided in 40 CFR 261.6(a)(3)(v). (See also RCRA section 3004(q)(2)(A)). EPA had no information that waste-derived coke fails any hazardous waste characteristic. The Agency invited comment or data to the contrary but received none.

In any event, EPA determined that the use of hazardous waste in the production of coke would result in little, if any, change to the qualities and the properties of the coke and fines produced. These coke fines would have essentially the same composition as fines generated from non-hazardous feed materials. The waste-derived fines are combined with other coke in a product pile for storage prior to sales and are coke product. The NODA also provided additional analyses on the similarity of coke fines to existing coke product, and the potential impact of recycling hazardous waste to the coker.

EPA has no reason to change this jurisdictional determination or the determination that management scenarios other than Subtitle D landfilling could not serve as a basis for

²⁴ See the discussion on oil-bearing hazardous secondary materials inserted into the petroleum refining process, including the coke, in today's preamble for modifications to the definition of solid waste concerning these materials.

listing. Therefore, the Agency adopts these determinations as part of the basis for issuing the final decision not to list this waste stream as hazardous.

With respect to the Subtitle D landfilling scenarios EPA evaluated for the off-specification product and coke fines that were discarded, EPA notes that groundwater risk estimate of 1E-5, as well as the revised high-end risks in the NODA of 5E-6 to 2E-5 were within the Agency's initial risk level of concern.

However, EPA noted significant problems with the groundwater risk assessments. First, this risk was based entirely on the detection of one PAH, benzo(a)anthracene, in only one out of six leaching samples at a level 8-fold below the analytical quantification limit. Thus, EPA had low confidence in this value and the subsequent modeling based on this number. Second, the water solubility of this chemical is also very low, indicating that its aqueous concentration is likely to be very low. Third, this chemical is tightly adsorbed to organic material in soils and sediment, indicating that the constituent is relatively immobile in groundwater.

The NODA analysis, therefore, led EPA to determine that it is highly unlikely that this waste would present a significant risk in a groundwater scenario. EPA finds no reason to change that determination either based on NODA comments or any other information in the rulemaking record. In addition, further assessments in the NODA showed no significant risks from the relatively small volumes that were disposed in LTUs.

EPA's decision not to list is further supported by additional analysis after comments received on the NODA. In its reexamination of the groundwater analysis EPA found that it had mistakenly used the wrong carcinogenic risk factor for benzo(a)anthracene. As shown in Table IV-2, when the revised groundwater analysis was performed with the longer active life and municipal landfill areas, using the correct health-based number caused the risks to drop 20-fold, such that even the maximum high-end risk was 2E-6. See Additional Groundwater Pathway Analyses, 1998, contained in the public docket for this rule for details. Given the even lower groundwater risk calculated, still using the suspect benzo(a)anthracene measurement, EPA finds even further reason to believe that the listing of off-specification product and fines is not warranted.

Specific Comments

One commenter claimed EPA data indicates that several respondents store

off-specification products and fines in surface impoundments as an "interim" management method, and therefore the Agency should model this management. In response, EPA finds only one respondent, not several, that reported managing off-specification product and fines in a "surface impoundment" in 1992. This "surface impoundment" acts as a drilling water clarifier. All delayed coking units recycle their drilling water, and to do so, any entrained fines in the drilling water must be recovered. Typically, the concrete coke storage pad is sloped so that drilling water drains to one end and proceeds through a series of baffles that separate out the coke fines. This is the type of "surface impoundment" the refinery identified. Thus it is not a typical surface impoundment, but rather an integral part of the decoking process. These are lined (concrete) drilling water collection and recycle systems, confined within the coke battery, and are unlikely to pose significant risk.

Comments related to the aspects of the groundwater modeling are discussed earlier in this notice (see Section V.B.6); however, EPA makes several points for this specific waste. Regarding the commenters' criticism of EPA's use of TCLP results as input values to the landfill groundwater modeling for this material because it is "oily," the Agency points out that off-specification product and fines are generally not oily. The Agency conducted total oil and grease analyses on four samples and the average level of oil and grease (measured as Total Oil and Grease, i.e., not truly "free" oil) was two percent (three samples were below one percent). Furthermore, the data from the 3007 Questionnaire show that the typical material has relatively low oil content (90th percentile value was five percent). Therefore, EPA believes that the use of the TCLP was valid.

With regard to commenter concern over free-phase flow of contaminants from off-specification product and fines due to oil content, it is particularly important to note that none of the six off-specification product and fines from thermal processes samples exhibited multi-phase behavior, and that the measured oil content was low, as noted above.

The commenter went on to state that a risk assessment EPA conducted for this waste as part of the 1995 proposal showed that risks associated with air releases from uncovered landfills made up of coke fines exceeded $1E-3$ for home gardeners, subsistence farmers, and subsistence fishers, and a high risk to subsistence fishers from mercury exposure was also predicted. The

commenter also noted that the NODA risk modeling for disposal in LTUs was not a meaningful surrogate for evaluating the risks posed by pile storage, because the annual volumes modeled were small (high-end volumes of 21–34 MT).

The commenter is attempting to use a bounding analysis EPA undertook for nongroundwater risks for coke fines disposed in landfills as an indication that air releases from piles containing this material would present similar risks. In response, EPA first notes that bounding estimates are used as an initial screening estimate that overestimates the exposure or dose for the purpose of screening out exposures of little concern. The purpose of the bounding analysis is simply to determine what pathways and scenarios require further evaluation and does not represent an assessment of risks. The bounding analysis included worst-case assumptions (no cover or dust suppression, highest constituent levels, largest waste volumes and landfill area, worst climate, etc). Furthermore, the levels near $1E-3$ arose from indirect pathways (ingestion of beef, dairy, fish, and plant products); the direct pathway of soil ingestion, even in the bounding analysis, was on the order of $1E-6$. Most importantly, the biotransfer factors used in the bounding analysis for beef, dairy, and plant indirect paths have been determined to overestimate risks by at least two orders of magnitude; likewise the apparent problem from mercury also was traced to an error in units for the bioaccumulation factor used. Thus, EPA believes that the bounding analysis was flawed and grossly overestimated risks.

EPA notes that the subsequent high-end analyses for nongroundwater risks from landfill disposal of off-spec product and fines did not show significant risk. While the high-end analysis included the assumption of daily cover for the landfill, and thus may not be the best surrogate for air releases from piles, the scenario did consider windblown dust from on-site roads and particulate release caused by traffic (i.e., dump trucks), loading, unloading, etc. The high-end analysis showed risks no higher than 2×10^{-6} for any receptor (see U.S. EPA, Assessment of Risks from the Management of Petroleum Refining Wastes Background Document (F-95-PRLP-S0006), page 10–3). Therefore, some of the possible release mechanisms that could occur in a waste pile scenario (e.g., unloading/loading, traffic) were addressed in the risk assessment supporting the proposal and the pathway was not significant.

EPA also points out that some important characteristics of the coke

pile and details of management practices used by refineries would tend to mitigate potential risks. The piles are not comprised simply of coke fines, but are mixtures of much larger pieces of coke product that are drilled from coker units; the larger chunks of coke would make up the bulk of the pile. Furthermore, coke is drilled out of the coker approximately once a day with hydraulic drills; thus, new wet coke/fines from drilling are added to the coke pile, making air releases of dry particulates less likely. EPA also has found that coke piles are managed using various practices to control release of dust, including: (a) Contained product storage areas (b) dust-suppression water spray systems (c) covered conveyor systems and, (d) direct loading from coke-drums into railcars (see NODA response to comment document for a summary of these practices). In addition, EPA expects that particulate releases from these areas would be controlled by Federal, State, or local air regulations and permit programs.

Finally, the commenter also argued that, pursuant to the Consent Decree in *EDF v. Browner*, EPA is required to issue a listing determination for off-specification products and fines, and that because piles present a substantial risk to human health and the environment based upon the assessments conducted to date, the required listing determination must include a decision as to whether off-spec products and fines warrants listing pursuant to 40 CFR 261.33 as a commercial chemical product. The commenter suggested that, if EPA argues that the piles of coke fines are product, then the material that blows off the piles and cannot be recovered is discarded commercial chemical product and should become a listed U-waste under 40 CFR 261.33(f).

EPA disagrees with the commenter. The Agency has, in fact, made a listing decision for the off-specification product and fines that are known to be discarded by refineries, i.e., the volumes of wastes that are disposed. EPA believes it has fulfilled the requirements of the consent decree for production wastes from petroleum refining. While the Agency is not constrained to making decisions required under the consent decree, EPA is not making a listing decision on product use in this rulemaking. Furthermore, at this time the Agency has no valid assessment that indicates these wastes present a "substantial risk" when added to coke piles.

7. Catalyst and Fines From Catalytic Cracking

Summary

As proposed, EPA is not listing as hazardous Fluidized Catalytic Cracking (FCC) catalyst and fines. Two subcategories of this waste were evaluated due to their physical difference in particle size: spent equilibrium catalyst and catalyst fines. The usual constituents of concern found in other petroleum residuals (i.e., carcinogenic PAHs and benzene) were not detected in spent FCC catalysts. More than 70 percent of the equilibrium catalyst and 20 percent of the catalyst fines are reused (in other FCC units) or recycled (primarily by cement plants). For the reasons stated in the proposal, the Agency chose to model the monofill and surface impoundment scenarios (see 60 FR at 57771) for FCC catalyst and FCC fines. Bounding estimates (run under worst-case assumptions using multiple high-end assumptions for critical parameters) for the nongroundwater exposures from volatile and particulate emissions from monofills showed no significant risk for either FCC equilibrium catalyst or FCC fines. The Agency also found no significant risk, for either subcategory, from the high-end analysis for the groundwater pathway from the monofill or surface impoundment scenarios. Furthermore, the revised risk analyses in the NODA in response to comments showed no significant risks for this waste. The few comments EPA received on this waste agreed with EPA's decision not to list. Therefore, the Agency continues to believe that a no-list decision is warranted and adopts that final decision incorporating the reasoning in the preamble to the proposal.

8. HF Alkylation Sludge

Summary

The Agency is not listing as hazardous sludge from hydrofluoric acid (HF) alkylation processes. As noted in the proposal and confirmed by analysis of comments and all other relevant information in the record, only marginal risk was identified for the groundwater ingestion pathway in off-site landfiling due to benzene. Also, no significant risks were found from land treatment of this material.

Discussion

In the proposal, EPA found a high-end groundwater risk for landfills of $3E-6$ due to benzene (see 60 FR at 57772). The Agency also noted that benzene was found in only one out of five TCLP

samples, indicating that the risk attributed to this chemical would generally be lower. EPA did not model other waste management practices because they were already regulated under RCRA (e.g., combustion in an industrial furnace), extremely rare (discharge to a surface impoundment that has been closed), recycling practices (on-site recovery), and/or would present no significant risk (discharge of small volumes to wastewater treatment systems).

In the NODA, the Agency revised the groundwater risk analysis for landfill disposal and found slightly higher high-end risks for groundwater for off-site and on-site landfills (both $6E-6$) due to benzene. EPA also presented a groundwater Monte Carlo analysis in the NODA that showed risks of $2E-7$ for on-site, and $2E-6$ for off-site landfills. Revised nongroundwater risks from disposal in LTUs remained insignificant (less than $1E-7$; see 62 FR at 16753).

Further groundwater pathway analysis performed in response to comments on the NODA showed a slight increase in the high-end risk to $1E-5$ for off-site landfills. The revised Monte Carlo analysis yielded no change in the risk ($2E-6$). (See Table IV-2, and Additional Groundwater Pathway Analyses, 1998, contained in the public docket for this rule).

EPA decided not to list this waste based on the relatively low groundwater high-end risks of $1E-5$ due solely to benzene, and the fact that benzene is not frequently found in the TCLP analysis (one of five samples). Furthermore, this waste typically does not have high oil or PAH content; none of the carcinogenic PAHs were detected in the samples collected by EPA. Therefore, the Agency is issuing a final decision not to list this waste stream.

Specific Comments

The Agency received comments arguing that sludges from HF alkylation are frequently generated and managed in surface impoundments and were not evaluated by EPA because it is a "rare" management practice. The commenter stated that there are an ample number of surface impoundments at refineries that could be used in this manner, there is no legal or other barrier to surface impoundment management of HF alkylation sludge, and that this practice should be considered a plausible management scenario. The commenter noted that the waste is sometimes generated in "pits," and this means management in an impoundment is a reasonable assumption.

EPA disagrees with the comment that HF sludge is commonly generated or

managed in surface impoundments. From site visits, EPA found that HF alkylation sludge is commonly generated in concrete lined pits or tanks within the HF process unit boundary; these are not unlined surface impoundments. The one case of actual management of this waste in a surface impoundment in 1992 was reported to be discontinued that year (see Listing Background Document, October, 1995). Therefore, EPA does not believe management in surface impoundments is plausible.

One commenter criticized EPA's modeling of risks from LTUs, and these are addressed elsewhere in today's notice (see Section V.B.7). However, EPA would like to note that nongroundwater risks are unlikely to be significant for this waste because HF alkylation sludge has none of the carcinogenic PAHs that were of concern for other wastes. For example, while CSO sediment samples had an average of 132 ppm of the PAH benzo(a)pyrene, none was detected in any sample of HF alkylation sludge.

One commenter argued that EPA should list this waste based on the groundwater risks estimated by EPA, as well as the risk calculated by the commenter using alternative groundwater modeling ($2E-5$). EPA disagrees with the commenter, and continues to believe the risks do not justify listing this waste. As noted in the discussion above, EPA's revised high-end risk was $1E-5$, and the revised Monte Carlo risk only $2E-6$. EPA has decided not to list this waste after considering other factors. Most importantly, the risk was due to the presence of one constituent, benzene, that was detected in only one of the five TCLP samples. Thus, the constituent was not found frequently or typically in this waste. Furthermore, EPA found none of the carcinogenic PAHs in samples of this waste that were so pronounced in other wastes of concern (e.g., CSO sediment).

9. Sludge From Sulfur Complex and Hydrogen Sulfide Removal Facilities

Summary

As proposed, the Agency is not listing as hazardous sludge from sulfur complex and hydrogen sulfide removal facilities. No significant risks were found for any exposure pathway from disposal in on-site or off-site landfills, or in on-site and off-site LTUs, nor from potential air releases from storage in dumpsters (well below $1E-6$ in all cases). In addition, the Agency noted that the sludges that may be generated from treatment of this waste in the

primary wastewater treatment system are already listed. Furthermore, the revised high-end risk analyses in the NODA in response to comments also showed no significant risks for this waste (well below $1E-6$ in all cases). The few comments EPA received on this waste agreed with EPA's decision not to list. Therefore, the Agency continues to believe that a no-list decision is warranted and adopts the final decision incorporating the reasoning in the preamble to the proposal.

10. Catalyst From Sulfur Complex and Hydrogen Sulfide Removal Facilities

Summary

The Agency is not listing as hazardous any of the spent catalysts generated from H_2S removal and sulfur complex operations. The Agency divided this residual into two subcategories: Spent Claus unit catalyst, and spent SCOT-like tail gas catalyst. For the first subcategory, no significant risks were found from bounding estimates (run under worst-case assumptions using multiple high-end assumptions for critical parameters) for the groundwater exposure pathway as well as for the direct and indirect pathways of volatile emissions and particulate emissions. For the second subcategory, the Agency also did not find significant risks associated with the disposal of this waste in on-site and off-site landfills. Furthermore, the revised risk analyses in the NODA in response to comments continued to show no significant risks for this waste stream. Therefore, the Agency continues to believe that a no-list decision is warranted and adopts the final decision incorporating the reasoning in the preamble to the proposal.

11. Unleaded Gasoline Storage Tank Sediment

Summary

EPA is not listing as hazardous sediment from the storage of unleaded gasoline in tanks. The Agency assessed the potential risks associated with four selected management practices, on-site and off-site Subtitle D landfilling, and on-site and off-site land treatment. Only marginal risk was identified for the groundwater ingestion exposure pathway. Although revisions to the risk assessment showed higher risks above the level of concern, EPA has still decided not to list this waste because: (1) The waste is primarily rust and scale and has none of the carcinogenic PAHs or high oil content of potential concern in other wastes, (2) the TC is expected to control some risks, (3) the volume of waste is relatively small, and (4) the

reduction of benzene levels in reformulated gasoline should reduce levels in wastes in the future.

Discussion

EPA proposed not to list unleaded gasoline tank sediment as hazardous due to the absence of any significant risks, except for the marginal risks found for the groundwater ingestion pathway for off-site landfill disposal (high-end risk, $2E-6$). The Agency also noted that this waste was infrequently generated, volumes of this waste disposed were relatively modest, and that the only constituent of concern, benzene, would be controlled by the TC.

The revised modeling completed by EPA in response to comments on the proposal and the NODA included a full sensitivity analysis to determine the most critical high-end parameters, and resulted in off-site landfill groundwater risks increasing to $3E-5$ (see Table IV-2). The high-end risk was lowered slightly to $2E-5$ in the TC-capped results. However, the revised Monte Carlo risk, $6E-6$, is below EPA's level of concern ($1E-5$), and the TC-capped Monte Carlo risks drop to $4E-6$, suggesting the TC may control most risks of concern for this waste. After considering these risk results, and the other factors discussed below, EPA finds that the listing of this waste is not warranted.

First, while the levels of benzene in the waste and TCLP samples are of potential concern, the TC for benzene should provide some measure of control of wastes with high benzene levels. Nearly 40 percent (52) of the 141 unleaded gasoline tank sediment wastes streams generated in 1992 were reported in the 3007 Questionnaire to be coded as hazardous waste (due primarily to the TC for benzene and occasionally for ignitability). While EPA's risk analysis using TCLP input data capped at the TC level still showed some risk ($2E-5$), many of the wastes that are not TC-hazardous will likely have benzene levels below the TC level. Thus, given the existing regulatory control afforded by the TC, the incremental benefit to listing this waste appears limited.

Furthermore, this waste does not have the features that EPA found compelling in deciding to list other wastes examined in this rule. Specifically, this waste lacks the pyrophoricity and arsenic concerns exhibited by the spent catalysts, and it has low oil content and PAH levels compared to the crude oil and CSO tank sediments. The oil content of this waste is typically low as evidenced by the median TOG levels reported in the 3007 Questionnaire (6 percent), and samples taken by EPA (<1

percent). This contrasts with much higher TOG levels in Crude Oil Storage Tank Sediment (34 percent average from the 3007 Questionnaire, and 21 percent average from the six samples EPA analyzed) and CSO Tank Sediment (30 percent average from the 3007 Questionnaire, and 37 percent average from EPA's samples). EPA's analyses of samples of unleaded gasoline storage tank sediments also showed none of the carcinogenic PAHs that were of concern in sediment from CSO and crude oil tanks. For example, average benzo(a)pyrene levels found in sediment from CSO and crude oil storage were 132 ppm and 12 respectively, but none was found in sediment from unleaded gasoline storage. In addition, one of the major constituents measured in the unleaded gasoline tank sediment was iron (e.g., the average iron level for the three samples was 41, thus this waste appears to be largely rust and scale, rather than the higher organic content of the other tank sediments. Therefore, EPA is more confident that the other constituents of gasoline tank sediment will not present any potential problem.

Also, as noted in the proposed rule, the total volume of the waste reported for 1992 is relatively small (3,583 MT), and the volumes sent to landfills are even smaller (633 MT, 22 MT average per waste stream). These volumes are significantly smaller than the volumes of crude oil storage tank sediment generated (22,017 MT) and sent to landfills (2,338 MT, 123 MT average).

Finally, EPA has promulgated regulations under the Clean Air Act (CAA) that will result in the reduction of benzene levels in gasoline (see the Reformulated Gasoline Rule, February 16, 1994; 59 FR 7716). This rule sets a 1.0 percent (by volume) benzene limit on reformulated gasoline for non-attainment areas of the United States. In conventional gasoline, benzene is incorporated into gasoline to increase the octane rating, and the average amount of benzene in conventional gasoline is 1.6 percent, ranging up to 5.0 percent. Therefore, as the levels of benzene in gasoline are reduced, sediment from storage of gasoline should also show a corresponding reduction in the levels of benzene. This will reduce the potential groundwater risks resulting from benzene in unleaded gasoline storage tank sediment.

Specific Comments

One commenter noted that EPA did not model the use of unleaded gasoline tank sediment waste as landfill cover or road spreading. In response, the Agency

points out that no refineries reported use of unleaded gasoline tank sediment as landfill cover or in road spreading. The Agency has no data supporting these management scenarios and therefore does not see the need to model this pathway.

While the Agency already discussed the general issues related to the appropriateness of the TCLP for the wastes examined in this rulemaking due to oil content, EPA notes that for this specific waste the total oil and grease levels in the available samples collected by EPA were well below 1 percent. Thus, the commenter's concern about problems with the TCLP and oily waste are clearly unfounded for this waste.

One commenter criticized EPA's modeling of risks from LTUs, and these are addressed elsewhere in today's notice (see Section V.B.7). However, EPA would like to note that nongroundwater risks are unlikely to be significant for this waste under any scenario because unleaded gasoline tank sediment has none of the carcinogenic PAHs that were of concern for other wastes, such as CSO.

One commenter argued that EPA should list this waste based on the groundwater risks calculated by the commenter using alternative groundwater modeling ($8.8E-5$). EPA disagrees with many of the commenter's suggested modifications to the modeling (see Section V.B.6) and continues to believe that the risks do not justify listing this waste. As noted in the discussion above, EPA's revised high-end risk was $3E-5$, and the revised Monte Carlo risk was $6E-6$ (see Table IV-2), and after considering the other factors noted, EPA has decided not to list this waste. Furthermore, the revised Monte Carlo risks for this waste were $6E-6$, below EPA's $1E-5$ level of concern. In addition, the Monte Carlo TC-capped risk of $2E-6$ suggests that the TC will be effective in controlling much of the risk for this waste.

12. Catalyst From Reforming

Summary

The Agency is not listing as hazardous spent catalyst from reforming operations, as proposed. The proposal noted that 94 percent of the wastes generated in 1992 were recycled at reclamation facilities for the precious platinum content. The remaining 6 percent consist primarily of other materials generated during catalyst replacement, e.g., ceramic support media that are inert. The Agency conducted risk analysis of the potential air exposure pathway from the combustion of the reforming catalyst

prior to reclamation, and no significant risk was found from this pathway. In addition, the Agency believes generator site environmental release other than potential de minimis spills would be unlikely because the valuable spent reforming catalysts are controlled and tracked between the refining and reclamation facilities to prevent loss. The one comment EPA received on the Agency's assessment agreed with the decision not to list. Therefore, the Agency continues to believe that a no-list decision is warranted and adopts the final decision incorporating the reasoning in the preamble to the proposal.

13. Sludge From Sulfuric Acid Alkylation

The Agency is not listing as hazardous sludge from sulfuric acid alkylation. In the proposal, the Agency noted that this waste was infrequently generated, and the volumes generated in 1992 were very small (608 MT). Based on the bounding estimates (run under worst-case assumptions using multiple high-end assumptions for critical parameters) conducted for land treatment and landfilling practices, no significant risk was found. Furthermore, the revised land treatment risk analyses in the NODA in response to comments showed no significant risks for this waste stream. Therefore, the Agency continues to believe that a no-list decision is warranted and adopts the final decision incorporating the reasoning in the preamble to the proposal.

D. Headworks Exemption

As noted in Section III.A in the proposed rule, EPA proposed to extend the existing exemption for wastewaters from cleaning of petroleum tanks to include those generated for CSO tank sediment, and if listed, crude oil storage tank sediment. In the NODA, EPA proposed to extend the exemption to include wastewaters generated from the clean out of processing units holding spent hydrotreating and hydrorefining catalysts.

1. Application to Listed Catalysts

Many commenters requested clarification that the headworks exemption would include wastewaters from spent hydrotreating and hydrorefining catalysts. This would allow refiners to continue the practice of using water to cool and wash out these spent catalysts from the process units prior to further management. One commenter stated that sufficient controls are in place within refineries to manage minor residuals that are drained

to the refinery sewer systems. These residuals will be removed in the system and become listed hazardous wastes. Without these exemptions, refiners would be forced to either use more costly or more dangerous methods in managing catalyst or be forced to collect and ship these wash waters off-site.

As described in the NODA, EPA considered the commenters' request and conducted an assessment to determine the appropriateness of expanding the headworks exemption. The results of this analysis show that little risk is likely to be incurred by this practice. The use of water during the catalyst changeout process provides a number of benefits, including lowering emissions of volatile organics (if the wash water is treated to remove volatiles prior to discharge to the sewer system), lowering the risks associated with the catalysts' potential self-heating nature, and minimizing risk to workers entering the confined space of the catalytic reactors during changeouts. Therefore, EPA, has concluded that it is appropriate to include this low risk, beneficial practice under the headworks exemption.

Many commenters approved of expanding the proposed headworks exemption to cover water associated with catalyst management. These commenters saw the exemption as consistent with EPA's listing criteria in 40 CFR 261.11(a)(3), and agreed with EPA that the exposure pathways from wastewater management associated with CSO sediment and hydroprocessing catalysts in the refinery wastewater treatment system are sufficiently regulated under the Clean Water Act (CWA), the CAA NESHAP, and the existing RCRA hazardous waste listing for refinery wastewater treatment sludges (K048, K051, F037, and F038).

EPA agrees that existing NESHAP and effluent guideline controls on these materials, as well as the existing sludge listings (F037, F038, K048, K051), and the inherent differences between the wastes modeled and the aqueous residuals generated during tank and unit washings, support EPA's decision to finalize the headworks exemption.

2. Clarification of Scope

EPA received a request for clarification about whether the proposed exemption is limited to dilute wastewaters resulting from the cleanout of tanks or other units containing these wastes, or whether the proposed exemption applies to the listed waste (sediment) itself. One commenter stated that the exemption would be abused and would encourage wholesale discharge of the sediments to the wastewater treatment system. EPA

reiterates that the headworks exclusion is not meant to serve as an incentive to discharge tank sediments (or spent catalyst) to the wastewater treatment plant. This was not the Agency's intent, and EPA requested comment in the NODA on how to ensure that the headworks exemption is not a loophole to dump catalyst or CSO sediment in the sewer.

One commenter argued that the exemption would not be a loophole for two important reasons. First there would be a significant economic penalty for this action, because solid material dumped in the sewer will emerge again as hazardous waste sludges upstream of biological treatment (F037, F038, K051 and K048). The commenter stated that any wastewater sludge that these solids generate would likely be many times the original weight of the solids in the water (up to 10-fold due to the oil water-bacteria emulsion that forms around these solids). The commenter claimed that the increased costs associated with increased volumes of difficult to manage emulsions would be a severe economic penalty for allowing excess solids into a sewer. Secondly, the commenter noted that sewers are critical to a refinery's operation, such that any discharge of solids into a sewer runs the risk of interrupting refinery operations (with heavy costs), or at least overloading the system with solids, endangering compliance with water discharge permits. Therefore, the commenter concluded there is no need for EPA to further define allowable wastewater solids content, and this would only create unneeded analytical, record keeping, and related compliance burdens.

The Agency agrees with this commenter that there are financial disincentives to discharging excess solids to the refinery wastewater treatment system. Furthermore, the Agency observes that many refineries conduct deoiling of tank contents and sediments prior to disposal and tank inspection. This practice reduces sediment quantities by an average of 40 percent, with a substantial savings of raw materials (*i.e.*, oil recycled back to the refining operations) and disposal costs. Upon promulgation of today's listings and the exclusion for oil-bearing residuals, EPA believes even greater amounts are likely to be subjected to oil recovery and waste minimization. Any water in the tank clean out material will likely be separated as a part of the deoiling process, and would be discharged to the wastewater treatment plant. Thus, with respect to some commenters' concerns regarding impacts on the wastewater treatment

system, these recycling activities will likely increase and further reduce the load on the treatment system.

A commenter asked EPA to clarify the scope of the exemption in the final rule, since water is used in any number of different ways in the proper handling of CSO sediment and spent hydroprocessing catalysts. They stated that EPA should clarify in the final rule that the exemption extends to all wastewaters derived from the management of the residuals, as long as the wastewaters are managed in a system subject to the Clean Water Act.

EPA is aware of the following uses of water associated with the generation of K169 to K172. In reference to crude oil storage and CSO tank sediments (K169 and K170), wastewater is generated (1) by dewatering (*e.g.*, centrifuging) sediment removed from the tank, and (2) by conducting a "rinse" as mentioned by the commenter. In reference to K171 and K172, wastewater is generated from drilling out the catalyst, steam stripping or washing, and pad drainage.

EPA believes that the headworks exemption is appropriate for waters generated from all of these practices, because these aqueous residuals would be dilute and contain low levels of the original listed wastes. Therefore, the Agency is finalizing the exemption for all the wastes that are being listed: CSO sediment, crude oil sediment, spent hydrotreating catalysts, and spent hydrorefining catalysts. As noted in the proposal, however, the exemption is not intended to allow the discharge of the entire waste stream (*i.e.*, tank sediments or spent catalysts), but rather dilute waters generated during tank or unit clean outs and dewatering.

Another commenter requested clarification that the headworks exemption extends to zero discharge facilities that have CWA equivalent wastewater treatment units. The Agency wishes to clarify that the exemption would extend to facilities subject to regulation under section 402 or section 307(b) of the CWA and would include facilities that have eliminated the discharge of wastewater. However, this clarification is already included in the regulations in 261.3(a)(iv) and specifies that wastewaters at facilities that have eliminated discharges are included.

Facilities that elect to use the headworks exemption should understand the potential compliance implications for Subpart FF, the benzene waste operations NESHAP, (40 CFR 61.340). Subpart FF conditions the need for air pollution controls and waste treatment on the total annual benzene quantity (TAB) from a facility's

waste. Facilities must include any waste stream "that has a flow-weighted annual average water content greater than 10 percent or that is mixed with water or other wastes at any time and the mixture has an annual average water content greater than 10 percent." Since 1995, refineries with a TAB of 10 MT per year or greater must treat all benzene wastes and control emissions from drains, sewers, tanks, oil-water separators, impoundments, and containers. Thus, if facilities elect to use the headworks exemption, any wastes put in sewers that did not previously count toward the TAB will have to be included in TAB calculations. If refineries have TAB that exceeds 10 MT/yr, they would be out of compliance with Subpart FF.

3. Comments Opposing the Exemption

One commenter urged the rejection of EPA's proposal to exempt from regulation previously listed refinery wastes (K050), CSO residuals, and crude oil storage tank sediment, because it encourages waste constituent volatilization and dilution, rather than pollution prevention and responsible waste management. The commenter noted that EPA's sole justification for the proposal was the Agency's belief that the hazardous constituents in these wastes would wind up in RCRA regulated wastewater treatment sludges. The commenter asserted that EPA failed to address why hazardous constituents in the discharges would not be released into the air, or remain in the wastewater and bypass the primary sludge only to settle in the unregulated treatment sludges further down the treatment train.

As noted earlier in today's notice (see discussion on Waste Management Assumptions in Section V.B.2), EPA does not believe that discharges to wastewater treatment systems are likely to present significant risks. EPA also notes it did not find air releases of volatiles, such as benzene, to be a significant risk for any of these wastes for any disposal practice evaluated. Thus, EPA does not believe that any air releases from a much more dilute waste generated during tank or unit clean outs are likely to present significant risk. The Agency notes that the benzene NESHAP (58 FR 3072; January 7, 1993) provides significant control of emissions from the wastewater conveyance system at larger refineries, and that the reported amount of sediments managed in this manner is small relative to the total volume of waste being given this exemption. Refineries also avoid overloads to their biological treatment trains in order to maintain their effectiveness.

EPA also notes that the discharge of aqueous wastes generated during tank cleaning are generated only infrequently. EPA's data from the 3007 Questionnaire, shows that, on average, a single CSO tank is cleaned every 9 years and, on average, a refinery has four tanks containing CSO (for those that generate the residual). Therefore, a typical refinery generates CSO tank cleaning wastewaters less than once per year. Discharges of tank cleaning waters are infrequent and are expected to generate relatively small volumes of water in comparison with the typical wastewater flow through a refinery treatment system (see analysis noted below).

Tank cleanings are used to facilitate tank inspections, which are critical to ensuring tank integrity and to avoiding catastrophic tank failure. Without this exemption, tank washing would become much more difficult because of the need to find alternative Subtitle C disposal methods for these wastewaters. Also, the tank washings are dramatically different in nature from the sediments characterized for the listing determination. While these washes are primarily water, the sediments are primarily solid, subject to land disposal methods such as the landfilling and land treatment evaluated in EPA's risk assessment.

To respond fully to this commenter, EPA presented a further analysis in the NODA to illustrate the magnitude of treatment and dilution that would occur at the headworks of a refinery for both CSO tank sediment and spent hydrotreating/hydrorefining catalysts. (See Sections 8 and 9 in Supplemental Background Document-Listing Support Document, March 1997). EPA notes that it completed a similar analysis for crude oil storage tank sediment to respond to the commenter's concerns expressed about this waste also (see Additional Listing Support Analysis, 1998 in the docket). EPA concluded from these analyses that any impact on the downstream wastewater treatment sludge or wastewaters would be negligible.

Comments on the NODA analysis for the headworks exemption argued that EPA based the assessment for CSO sediment on disposal of the waste itself in the wastewater treatment system, and that the exemption should be limited to dilute wastewaters. The commenter suggested that EPA set limits on maximum concentrations for contaminants in discharges, and limit the exemption to rinsate from the cleaning of tanks or other units. The commenter stated that these limitations should also apply to the existing

exemption for heat exchanger bundle cleaning sludge, currently listed as hazardous waste K050, because the existing exemption suffers from the same flaws as the proposal. The commenter also indicated that if EPA does not limit the exemption to rinsate, the CSO assessment is flawed because it was based on the waste volume of the one facility reporting waste discharge into a wastewater treatment system in 1992. The commenter recognized that the facility no longer intends to employ the practice, but argued the potential exists for any generator of the waste to do so.

In response, EPA notes that the purpose of the NODA exercise was to develop a "what if" scenario, representing the extreme case of CSO washwater loading to wastewater treatment. EPA concluded that because its "what if" scenario showed negligible risk, then no specific restrictions on washwater composition would be required. Furthermore, as discussed above in this section, EPA believes that there are significant disincentives for refineries to discharge high solids content waste to their wastewater treatment system. Finally, EPA notes that the existing exemption for heat exchanger bundle cleaning sludge (K050) was not explicitly reopened for comment, therefore the Agency is not considering any modification of this exemption in today's rule.

Certainly, on-site wastewater treatment systems are available for this purpose throughout the refinery industry. EPA based its evaluations on the actual waste quantities used in particular management scenarios. EPA has no reason to believe, for example, that a quantity of waste destined for land treatment would be managed in a wastewater treatment system. EPA points out that a significant fraction of the wastes being listed must already be handled as hazardous, because they exhibit the TC or other characteristics. Yet despite this apparent incentive to avoid costly Subtitle C management, the disposal of tank sediment directly into the wastewater treatment system was extremely rare (i.e., only once each for CSO and crude oil storage tank sediments).

The commenter also questioned whether the Agency accurately estimated the impact posed by the exemption, because EPA ignored the possibility that contaminants from other wastes and wastewaters would be codisposed with the potentially exempt waste in the wastewater treatment system. In response, EPA notes that its analysis was an attempt to gauge the significance of a worst-case discharge

into the treatment system to determine if any significant incremental risks would result from the practice. EPA found no such incremental risks and therefore concluded that the exemption was appropriate. In fact, EPA found that risks due to the exempted wastes would be extremely small.

The commenter expressed concern that the exemption would likely be encouraging the generation of larger quantities of hazardous wastewater treatment sludge, which would be incompatible with the waste minimization policy and objectives articulated by Congress in Section 1003 of RCRA.

In response, EPA believes that refineries have no incentive to discharge solids to wastewater treatment, because the solids would end up as F037 or other hazardous waste. As discussed above, other comments noted that the quantity of such primary sludge would be much greater than the quantity of solids initially dumped into the system.

E. Third Party Recycling of Spent Petroleum Catalysts

In the November 20, 1995 proposal, the Agency suggested that it might be appropriate to exempt these thermal petroleum catalyst recovery units from RCRA Subtitle C regulation. The Agency solicited important additional information needed to adequately assess the basis for promulgating this potential exemption (see 60 FR at 57780). This information included the extent to which petroleum catalyst recovery units are currently equipped with emission control devices, the adequacy/efficiency of existing controls, and the amounts and concentrations of emissions of HAPs regulated under section 112 of the CAA as well as under Subtitle C of RCRA. (*Id.*)

The Agency's preliminary findings in 1995, based on very limited data, indicate that these units may already be equipped with pollution controls comparable to those required under RCRA regulations for boilers and industrial furnaces (BIFs) that burn hazardous waste. However, EPA pointed out in 1995 the importance and need for additional air emissions data, in particular, information on the types and levels of HAPs being emitted from these offsite hazardous waste reclamation and regeneration units. (*Id.*)

No information on these key factors was forthcoming on these units. Only one facility submitted a copy of its state air permit. The nature of, and data associated with, this facility's state permit are much too limited to provide an adequate record for the Agency to make a determination on whether to

exempt from RCRA controls this entire class of reclamation and regeneration units. The information in the permit is manifestly insufficient for such a determination. Even if it were more complete, EPA could likely not extrapolate the information from this single facility to all thermal units with an adequate degree of confidence. For instance, the permit contains limits only on emission rates of CAA criteria air pollutants carbon monoxide (CO), sulfuric oxides (SO_x), nitrogen oxides (NO_x), particulate matter (Method 10) (PM₁₀), and volatile organic constituents (total-VOCs) on an average annual basis. Daily/hourly mass discharge rates or concentrations for these pollutants were lacking, as was any information on HAPs of concern under Section 112 of the CAA (and, because of their hazardousness, under RCRA as well), or the means by which such HAPs might be controlled. Also, this permit report lacks information on the destruction and removal efficiency (DREs) that the combustion unit can achieve for potential principal organic constituents (POCs) fed to the regeneration process (see 40 CFR 266.104(2)). Finally, the permit report lacks information on the kind of controls for metal emissions as well as the types and levels of metals being emitted.

EPA has no additional data on similar units and on the key factors to be considered in determining whether to finalize the proposed exemption. At this point, therefore, the administrative record for this rule is simply not sufficient to support a final decision one way or the other.

Given the current state of the administrative record and the other circumstances discussed above, EPA is deferring to a later day any final decision on whether or not to exempt these units from RCRA Subtitle C air emission standards. The timing of this decision depends, in large part, on the gathering and submittal of additional data on the key factors identified above, especially the types and levels of HAP emissions from these units and the adequacy of air pollution controls for these emissions.

EPA encourages owners and operators of these facilities to supplement the record with design, operation, and emissions information so that further progress toward a final determination on the potential exemption can be made. In the interim, EPA reiterates that nothing in today's rule (or indeed the proposed rule) changes the current RCRA status of facilities managing these hazardous wastes.

VI. Land Disposal Restrictions

A. Treatment Standards for Newly Identified Wastes

The land disposal prohibition statutory provisions essentially require pretreatment of hazardous wastes so that threats to human health and the environment posed by land disposal of the waste are minimized (RCRA sections 3004(g)(4) and (m)). Land disposal prohibitions for hazardous wastes are to be promulgated pursuant to a phased schedule, the determination for newly listed wastes—those listed after adoption of the 1984 amendments—to be made within six months of promulgation of the listing (RCRA section 3004(g)(4)); see generally, 55 FR 22523, June 1, 1990.) A determination to prohibit hazardous wastes from land disposal is essentially automatic, since only land disposal that satisfies the exacting statutory no-migration standard may be disposed without first satisfying the section 3004 (m) treatment standards. (Id.) A method of land disposal may not be determined to be protective of human health and the environment until the waste has complied with 3004(m) pretreatment regulations, unless upon application of an interested person, it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous (RCRA section 3004(d)). No one contends that disposal of the petroleum wastes listed in this rulemaking satisfies the no-migration standard.

EPA has traditionally developed treatment standards for prohibited hazardous wastes based upon the performance of BDAT. The Agency further refined this approach to use the same set of technology-based numerical treatment standards whenever factually justified. These are the so-called UTS set out in § 268.48, which provide numerical treatment standards for all hazardous constituents (i.e., constituents listed in Appendix VIII of Part 261).

As part of the proposed rule, EPA proposed to apply the UTS applicable to the hazardous constituents in the newly listed petroleum refining industry wastes (see 60 FR 57783, November 20, 1995). EPA further requested data to adjust the numerical treatment standards applicable to the subject wastes to be consistent with the revisions to the UTS being considered in the Agency's Phase IV Land Disposal Restrictions rulemaking (see 62 FR 16751, April 8, 1997). EPA has in fact recently slightly amended the treatment

standards for the hazardous constituents antimony (see 63 FR 28562, May 26, 1998) and nickel (see 63 FR 28569, May 26, 1998). EPA also has amended the treatment standard for vanadium, which is not an underlying hazardous constituent (40 CFR 268.2(i)), but is being regulated in these wastes for the reasons given below. The constituents of concern as proposed and the treatment standards as revised are being promulgated for the newly identified K169, K170, K171, and K172 wastes. In accordance with section 3004(g)(4), EPA is also prohibiting the underground injection of these wastes (unless the wastes meet the treatment standard before injection without being diluted impermissibly, or unless the wastes are injected into a no-migration unit). Since underground injection is a type of land disposal (see section 3004(k)), this action is automatic, and implements the mandatory directive to prohibit land disposal of newly listed hazardous wastes found in section 3004(g)(4).

B. Response to Comments

Additional comments, along with EPA's responses, are provided in the Response to Comments Background Documents for the proposed rule and the NODA located in the docket for this rule. Key comments are discussed below.

1. Constituents of Concern

EPA received comment asking that, if listed, the LDR constituents of concern should be limited to benzene and arsenic. The commenter determined that these are the only two compounds which have significant risk associated with their management. The commenter maintains that the inclusion of the PAH compounds and other metals is not warranted and will require additional cost to characterize the material prior to management, and that their inclusion may prevent beneficial recycling practices due to unnecessary LDR requirements on reclaimer residuals.

The Agency disagrees. EPA is required by statute to set "...levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized" (RCRA section 3004(m), 42 U.S.C. 6924(m)). While the commenter is correct in that for K171 and K172 only benzene and arsenic were given as the basis of listing, treatment standards were also proposed for additional metals and PAHs. PAH compounds are highly carcinogenic, even at low

concentrations, and are present at significant concentrations in some petroleum residuals at levels exceeding the treatment standards. Although these constituents were not modeled to show significant risks through the pathways considered, the presence of these carcinogens in the wastes remains a potential threat to human health and the environment when the wastes are land disposed. Certainly, there is no basis for finding that threats posed by these constituents have been minimized without treatment (see *Chemical Waste Management v. EPA*, 976 F.2d at 16.) The Agency also notes that treatment standards for PAHs and nickel are currently required for other similar listed petroleum wastes (F037, F038, and K048-K052) and that damage cases associated with these wastes have noted environmental effects due to both metals and PAHs (see Background Document to Support Listing of Primary Oil/Water Separation Sludges, August 20, 1990, pages 6-8). Thus, the Agency is convinced that treatment of these constituents is necessary to minimize threats posed by the wastes' land disposal, and further convinced that the treatment standards are not established below levels at which such threats are minimized. The Agency is therefore promulgating treatment standards for all the constituents that were proposed to be regulated.

2. Sulfides

The commenter recommended that if a new treatment standard for K171 and K172 is adopted, it must include a concentration level for sulfides. The commenter believes a level of 500 ppm reactive sulfide should be specified as an exit level for land disposal restrictions, because the level has been used in Agency guidance to identify wastes that exhibit a hazardous waste characteristic for reactive sulfides as per OSWER policy memorandum No. 9443.1985(04). The commenter believes that without a numerical treatment level, the regulated community may be held to a double standard of having to meet the treatment standards for both a Listed Waste and a Characteristic Waste.

EPA responds by clarifying that those K171 and K172 wastes that exhibit the hazardous waste characteristic of reactive sulfide are currently prohibited from land disposal unless first being treated to remove the characteristic by deactivation. Underlying hazardous constituents also must be treated (see existing § 268.35 (prohibition on land disposal of reactive hazardous wastes) and § 268.40 (e) (underlying hazardous constituents in reactive wastes must also be treated)). Furthermore, even after

the listing takes effect, listed wastes may also exhibit one or more characteristics of a hazardous waste. Listed wastes which also exhibit characteristics of a hazardous waste must comply with all applicable treatment standards for characteristic wastes (unless the treatment standard for the listed waste contains a standard for the constituent that causes the waste to exhibit a characteristic; see § 268.9(b)). Finally, treatment must reflect the "minimize threat" level for land disposal (3004 (d)(1) and (g)(4) (land disposal is prohibited "unless the Administrator determines the prohibition on one or more methods of land disposal of such waste is not required in order to protect human health and the environment..."), and so may require treatment of constituents not technically hazardous constituents, but which make a waste more dangerous to land dispose (see 56 FR at 41168 (Aug. 19, 1991) and other sources there cited). Thus, although sulfides are not hazardous constituents (since they are not listed in Appendix VIII of Part 261), they nevertheless are present in these wastes at concentrations sufficient to provide harmful properties, including self-heating pyrophoric properties and potential reactivity which must be minimized for safe disposal (See 60 FR 57783-57785).

As a point of clarification, the newly listed K171 and K172 wastes, which also are reactive, would have to comply with the UTS numerical levels for the specified hazardous constituents and deactivation for reactive sulfide prior to land disposal, but would not have to demonstrate compliance with all the underlying hazardous constituents (see § 268.9 (b)). This is because the treatment standard itself already indicates what other constituents are present in these wastes requiring treatment so as to minimize threats posed by the wastes' land disposal. The Agency will continue to determine if a separate UTS number is required to access the deactivation of sulfide from reactive wastes and, if so, will propose a number in the future.

3. Underlying Hazardous Constituents

A commenter stated that EPA should not subject listed hazardous wastes to LDR regulations regarding Underlying Hazardous Constituents (UHCs). The Agency wishes to clarify that listed wastes are not subject to UHCs per se. UHCs are regulated in characteristic wastes (40 CFR 268.1). Listed wastes are regulated for the constituents which caused the waste to be listed and any other hazardous constituents specified in the specific treatment standard that

are found to be present at levels where they could possibly cause harm to human health and the environment when the wastes are land disposed (see also discussion in the preceding paragraph). The basis for the distinction is that EPA has already studied the listed wastes to determine the hazardous constituents that are typically present, but is unable to do so for characteristic wastes, since, as a class, they are much more diverse. The Agency is promulgating treatment standards for each of the proposed hazardous constituents.

4. High Temperature Metals Recovery

EPA received comments suggesting the designation of High Temperature Metals Recovery (HTMR) as an exclusive method of treatment. The Agency has finalized numerical standards for the newly listed wastes. Treaters may use any method they choose to achieve those standards, so long as the treatment is not considered impermissible dilution. The Agency believes this degree of flexibility is highly desirable to provide as many treatment options as possible, so long as the treatment satisfies the standards.

In the case of the vanadium containing K171 and K172 wastes, metals recovery may be required to reduce the constituent to levels that can be subsequently treated to comply with the LDR treatment standard. Vanadium treatment is discussed more fully in the following section.

5. Vanadium

Vanadium is not an underlying hazardous constituent of hazardous wastes that requires treatment in all characteristically hazardous wastes. (see 268.48 note 5). However, vanadium in the form of ammonium vanadate or vanadium pentoxide, are underlying hazardous constituents (since they are included in Appendix VIII of Part 261). In the course of the combustion of coke residues on the spent catalysts, vanadium compounds adsorbed on the catalysts are converted to vanadium pentoxide and the wastes are typically subjected to metals recovery for the vanadium pentoxide. Because the presence of vanadium pentoxide would impart acute toxicity to the wastes and can be readily measured as the vanadium metal, the Agency proposed treatment standards for vanadium as a constituent of concern in K171 and K172 as a surrogate measure to limit the presence of vanadium pentoxide in the wastes and to insure that the toxicity of the waste was diminished prior to disposal (see also 60 FR 57784, November 20, 1995). Without reduction

of their vanadium content, the K171 and K172 wastes would contain significant levels of vanadium in the form of toxic vanadium pentoxide.

Commenters claimed that the proposed treatment standard for vanadium is not feasible and appropriate, based on EPA's testing. In response, EPA evaluated additional data from the stabilization of wastes containing vanadium at levels below which metals recovery is feasible and, based on this data, calculated a standard of 1.6 mg/L TCLP for nonwastewaters. The Agency proposed that this higher standard replace the 0.23 mg/L TCLP standard originally proposed and believes that this standard is readily achievable (see 62 FR 26047, May 12, 1997). A facility unable to comply with the treatment standard may apply for a treatability variance under 40 CFR 268.42 (assuming the waste has been treated using the properly-operated technology on whose performance the treatment standard is based and is still unable to meet the treatment standard).

One commenter claims that the Agency incorrectly assumed that spent catalysts and their residuals are physically and chemically similar to K048-K052 and K061 wastes. The commenter noted that the chemical composition of K048-K052 and K061 wastes is quite different than that of the K171 and K172 spent catalysts. The commenter identified other physical differences between spent catalysts and K048-K052 and K061 wastes, and argued such differences apparently prevent the stabilization of vanadium in spent catalysts.

The commenter is correct that the residuals are chemically and physically quite different at their respective points of generation, the principal difference is the higher concentration of vanadium in K171/K172. However, both K061 and K171/K172 contain similar constituents of concern which are largely metal oxides once K171/K172 is deactivated. Data assembled by the commenters show that K048-K052 contain 1-350 ppm vanadium and that K061 concentrations range from 0-830 ppm, while vanadium in K171 ranges from 10-3300 ppm and, in K172, vanadium ranges from 25-31000 ppm. The commenter also states that K172 has been observed as high as 150,000 ppm vanadium and notes that after deactivation to remove the D003 characteristic, the vanadium present is highly leachable. However, the commenter presents data reflecting attempts to stabilize the deactivated waste with cement and lime, rather than proceeding through the reclamation of a vanadium pentoxide product normally

produced by metal reclaimers. The Agency maintains that following such reclamation, the treated waste would be very comparable to K046-K052 and K061 in vanadium content since little vanadium would remain. Data from reclaimers indicate that these processes recover over 90 percent of the vanadium present. Without such reclamation, it would be unlikely that high vanadium wastes, like K171/K172, could be stabilized to the UTS level. The level of vanadium remaining after reclamation would still require stabilization to reduce the mobility of the toxic forms of vanadium. The Agency believes the vanadium UTS level can be achieved, therefore, through proper treatment which includes a reclamation step. Data on stabilization alone for high vanadium wastes do not reflect proper and effective treatment, and the Agency therefore is not compelled to modify the level based on this data.

One commenter asserted that the treatment standard for vanadium could not be rationally based on International Mill Service (IMS) K061 data and, to the extent that the standard could be based on INMETCO's K061 waste, the standard cannot be automatically transferred to spent catalysts because the resulting standards would not be achievable. The Agency responds that the prior treatment standard for vanadium was based on data obtained from IMS's HTMR facility. As revised in the recent Phase Four LDR Rule, the vanadium standard is derived from stabilization data. The performance levels promulgated were achievable by the other facilities from whom the Agency had also collected data (see 59 FR 47980, September 19, 1994). The Agency believes that the residuals following vanadium metal recovery of the K171 and K172 wastes can achieve the treatment standards measured on the basis of vanadium and provide protection against the significant presence of acutely toxic vanadium pentoxide in the land disposed waste. The commenter provided no data demonstrating that the treatment standards could not be met when metals recovery is performed.

6. Revisions to Proposed Standards

The Agency requested data to adjust the numerical treatment standards applicable to the petroleum wastes subject of this rulemaking to be consistent with the treatment standards proposed in the Phase IV Land Disposal Restrictions (see 62 FR 26041, 26047-26048; May 12, 1997). Commenters supported the proposed revisions to the treatment standards. In each case, the proposed standards reflect the higher of

the stabilization-based or HTMR-based calculations, in order to provide flexibility to use various well-performing treatment technologies which substantially reduce toxicity or mobility of hazardous constituents. The commenter believes the revised treatment standards that EPA has proposed for antimony, nickel, and vanadium are supported by the underlying data and are achievable by both major treatment technologies.

The Agency concurs with the commenters and also believes the BDAT methodology has been properly applied to the available data to calculate the revised treatment standards and that the levels are achievable by both major treatment technologies. Based on data submitted in the Phase IV rulemaking for nonwastewaters, the treatment level for antimony is finalized at 1.15 mg/L TCLP, the treatment level for nickel is finalized at 11.0 mg/L TCLP, and the treatment standard for the vanadium, which is applicable only to K061, K171, and K172 as a constituent of concern in these wastes, is finalized at 1.6 mg/L TCLP. The Agency is therefore promulgating these standards consistent with the levels finalized in the Phase Four Rulemaking. All other standards are promulgated as proposed.

C. Capacity Determination for Newly Identified Wastes

1. Introduction

This section summarizes the results of the capacity analysis for the wastes covered by today's rule. For a detailed discussion of capacity analysis-related data sources, methodology, and detailed response to comments for each group of wastes covered in this rule, see the following document: "Background Document for Capacity Analysis for Land Disposal Restrictions: Newly Identified Petroleum Refining Process Wastes (Final Rule)" (i.e., the Capacity Background Document).

EPA's decisions on whether to grant a national capacity variance are based on the availability of alternative treatment or recovery technologies. Consequently, the methodology focuses on deriving estimates of the quantities of waste that will require either commercial treatment or the construction of new on-site treatment or recovery as a result of the LDRs. The resulting estimates of required commercial capacity are then compared to estimates of available commercial capacity. If adequate commercial capacity exists, the waste is restricted from further land disposal before meeting the LDR treatment standards. If adequate capacity does not exist, RCRA

section 3004(h)(2) authorizes EPA to grant a national capacity variance for the waste for up to two years or until adequate alternative treatment capacity becomes available, whichever is sooner.

2. Capacity Analysis Results Summary

For this capacity analysis, EPA examined data on waste characteristics and management practices that have been gathered for the petroleum refining industry study in the 1992 RCRA Section 3007 survey. The Agency analyzed the capacity-related information from the survey responses, reviewed the public comments received in response to the proposed rule, contacted several commenters to obtain more specific information, and identified the following annualized quantities of newly identified hazardous wastes requiring commercial treatment: 4,400 tons of K169; 3,200 tons of K170; 3,400 tons of K171; and 7,400 tons of K172. The available data sources indicate that there are no quantities of K169-K172 wastewaters that will require alternative commercial treatment.

EPA is finalizing the rule to apply UTS to these wastes. The treatment standards for nonwastewaters containing organic constituents are based on combustion. The Agency determined that the available combustion capacity to treat these wastes far exceeds the waste quantities requiring alternative treatment when the listing determinations for these wastes become effective. Also, the Agency recognizes that the treatment residuals from these wastes may require additional treatment capacity (e.g., stabilization) to achieve the UTS for metal constituents. The Agency estimated that there several million MT per year of available commercial stabilization capacity. EPA also identified several metal recovery technologies that are commercially available, and some of these technologies are being used currently by the petroleum refining industry to recycle K171 and K172, although permitting and regulatory concerns expressed by some catalyst recyclers may need additional time to upgrade or expand their storage units. Since EPA is finalizing numerical standards for these wastes, all the technologies capable of achieving the final LDR treatment standards are not prohibited. Sufficient alternative treatment or recovery capacity exists to treat these wastes to meet the LDR standards. Therefore, EPA is not granting a national capacity variance under LDR for these wastes. The LDR standards for these wastes will

become effective when the listings become effective.

For soil and debris contaminated with the newly listed wastes, EPA proposed to not grant a national capacity variance. EPA received no comments regarding this issue. EPA believes that the majority of contaminated soil and debris will be managed on-site and therefore would not require substantial off-site commercial treatment capacity. Therefore, EPA is not granting a national capacity variance to hazardous soil and debris contaminated with the newly listed wastes covered under this rule. Based on the questionnaire, there were no data showing the mixed radioactive wastes with the newly listed wastes. There were also no comments concerning the radioactive wastes mixed with the newly identified wastes. EPA is not granting a national capacity variance for mixed radioactive wastes or soil and debris contaminated with these mixed radioactive wastes.

EPA received comments concerning the availability of treatment and recovery capacity. One commenter requested a six-month delay in the effective date of the final rule, and two commenters requested that EPA grant a one- to two-year capacity variance to obtain permit modifications and construct any necessary plant upgrades. Commenters requested additional time to comply with various Subtitle C requirements, particularly relating to permitting and upgrading of areas used for storing K171 and K172 prior to the catalyst recycling process. Commenters requesting a two-year capacity variance for recycling facilities expressed concern about the potential economic impact on the facilities the Agency is relying on to provide the required treatment capacity. The commenters noted that, if promulgated as proposed, the Agency's listing would also mandate the application of the "mixture" and "derived from" rule for all management activities after the point of generation, placing additional regulatory burden (LDR treatment standards, upgrading of storage areas, potential Subpart CC compliance, and obtaining permits/variances) on environmentally sound management practices.

Based on the results of the Agency's capacity analysis, adequate commercially available treatment or recovery capacity does currently exist for K171 and K172 wastes. Furthermore, granting a national capacity variance only exempts the waste from treatment standards prior to land disposal during the variance period, but does not exempt the waste from other Subtitle C requirements, such as the requirement to have a permit for storage of hazardous

waste for greater than 90 days (at generator's sites). EPA believes that six months is sufficient to allow facilities to determine whether their wastes are affected by this rule and identify and locate alternative treatment or recovery capacity if necessary. Therefore, LDR treatment standards will become effective when the listing determinations become effective for the wastes covered under this rule (see RCRA section 3004(h)(1)(land disposal prohibitions must take effect immediately when there is sufficient protective treatment capacity for the waste available).

VII. Compliance and Implementation

A. State Authority

1. Applicability of Rules in Authorized States

Under section 3006 of RCRA, EPA may authorize qualified States to administer and enforce the RCRA hazardous waste program within the State. (See 40 CFR Part 271 for the standards and requirements for authorization.) Following authorization, EPA retains enforcement authority under Sections 3007, 3008, 3013, and 7003 of RCRA, although authorized States have primary enforcement responsibility.

Before the Hazardous and Solid Waste Amendments of 1984 (HSWA) amended RCRA, a State with final authorization administered its hazardous waste program entirely in lieu of the Federal program in that State. The Federal requirements no longer applied in the authorized State, and EPA could not issue permits for any facilities located in the State with permitting authorization. When new, more stringent Federal requirements were promulgated or enacted, the State was obligated to enact equivalent authority within specified time-frames. New Federal requirements did not take effect in an authorized State until the State adopted the requirements as State law.

By contrast, under section 3006(g) of RCRA, 42 U.S.C. 6926(g), new requirements and prohibitions imposed by the HSWA (including the hazardous waste listings finalized in this notice) take effect in authorized States at the same time that they take effect in non-authorized States. While States must still adopt HSWA-related provisions as State law to retain final authorization, EPA is directed to implement those requirements and prohibitions in authorized States, including the issuance of permits, until the State is granted authorization to do so.

Authorized States are required to modify their programs only when EPA

promulgates Federal standards that are more stringent or broader in scope than existing Federal standards. Section 3009 of RCRA allows States to impose standards more stringent than those in the Federal program. See also 40 CFR 271.1(i). For those Federal program changes, both HSWA and non-HSWA, that are less stringent or reduce the scope of the Federal program, States are not required to modify their programs. Less stringent regulations, both HSWA and non-HSWA, do not go into effect in authorized States until those States adopt them and are authorized to implement them.

2. Effect on State Authorizations

Today's rule is promulgated pursuant in part to HSWA authority and in part pursuant to non-HSWA authority. The listing of the new K wastes is promulgated pursuant to RCRA section 3001(e)(2), a HSWA provision. Therefore, the Agency is adding this rule to Table 1 in 40 CFR 271.1(j), which identifies the Federal program requirements that are promulgated pursuant to HSWA and take effect in all States, regardless of their authorization status. The land disposal restrictions and the UTS for these wastes are promulgated pursuant to RCRA Section 3004(g) and (m), also HSWA provisions. Table 2 in 40 CFR 271.1(j) is modified to indicate that these requirements are self-implementing. States may apply for either interim or final authorization for the HSWA provisions in 40 CFR 271.1(j), as discussed below.

Until the States receive authorization for these more stringent HSWA provisions, EPA will implement them. EPA will also implement the exemptions that are directly related to the new listings, such as the headwork exemption and the catalyst support media exemption. These exemptions are relevant only when regulating the newly listed wastes.

Today's rule also includes several non-HSWA provisions that reduce the scope of the Federal program. These are the exclusions from the definition of solid waste of certain oil-bearing hazardous secondary materials from petroleum refining and certain recovered oils from associated petrochemical facilities. Although the States do not have to adopt these provisions, EPA strongly encourages them to do so, because the exclusions encourage material recovery within those industries.

Today's revision to the listing description for F037 wastes at § 261.31 neither broadens nor narrows the scope of the current program. This revision was made to ensure that residuals

derived from recycling listed wastes, that are otherwise excluded under today's revised § 261.4(a)(12), would remain listed. Because today's revision to the F037 waste code only applies in situations where the exclusion at § 261.4(a)(12) applies, these provisions (the exclusion and the associated revised listing) should be adopted together, and taken together are considered to reduce the scope of the existing Federal requirements.

Today's rule also amends the existing regulations to clarify that certain spent caustic solutions used as feedstock are not solid waste. This clarifying amendment (40 CFR 261.4(a)(19)) does not change the scope of the RCRA program because it does not actually change the current definition of solid waste. States do not need further authorization to interpret their regulations in accordance with this clarification.

Lastly, regarding the non-HSWA amendments to the definition of solid waste (i.e., exclusions), a number of States qualified for final authorization prior to being required to adopt the redefinition of solid waste rulemaking of January 4, 1985 (50 FR 614). Since the January 4, 1985, rule is more stringent than the rule under which such States were authorized, such States were required to revise their programs in accordance with § 271.21. Today's changes will not preclude EPA's ability to authorize States which have subsequently adopted the January 4, 1985, rule since it would reduce the scope of the Federal requirements. However, certain aspects of the State's regulation will be broader in scope than the Federal program and therefore not part of the authorized State program. This means that while they are enforceable under State law, they are not subject to Federal regulatory enforcement.²⁵

A State submitting a program modification for the portions of this rule promulgated pursuant to HSWA

²⁵ Today's rule affects only the regulatory definition of solid waste. It does not interpret the term "solid waste" for purposes of the non-regulatory authorities in RCRA sections 3007, 3013, 7002, and 7003. thus, for purposes of those authorities, the Agency would have the benefit of the full jurisdictional reach of the statutory definition of solid waste. See *Connecticut Coastal Fishermen's Association v. Remington Arms Co.*, 989 F.2d 1305, 1314-15 (2d. Cir. 1993) (comparing the narrower regulatory definition of solid waste for determining the scope of Subtitle C regulation with the broader statutory definition); *Comite. Pro Rescate de la Salud v. Puerto Rico Aqueduct and Sewer Authority*, 888 F.2d 180, 187 (1st Cir. 1990) (noting that under RCRA EPA could implement two different definitions of solid waste: a broader definition for imminent and substantial endangerment authority and a more narrow definition for regulatory purposes).

authority may apply to receive either interim authorization under RCRA section 3006(g) or final authorization under 3006(b), if the State requirements are, respectively, substantially equivalent or equivalent to EPA's requirements. States can only receive final authorization for program modifications implementing non-HSWA requirements. The procedures and schedule for final authorization of State program modifications are described in 40 CFR 271.21. It should be noted that all HSWA interim authorizations are currently scheduled to expire on January 1, 2003 (see 57 FR 60129, February 18, 1992).

Section 271.21(e)(2) of EPA's State authorization regulations (40 CFR part 271) requires that States with final authorization modify their programs to reflect Federal program changes and submit the modifications to EPA for approval. The deadline by which the States must modify their programs to adopt this regulation is determined by the date of promulgation of a final rule in accordance with section 271.21(e)(2). Table 1 at 40 CFR 271.1 is amended accordingly. Once EPA approves the modification, the State requirements become RCRA Subtitle C requirements.

States with authorized RCRA programs already may have regulations similar to those in this rule. These State regulations have not been assessed against the Federal regulations being finalized to determine whether they meet the tests for authorization. Thus, a State would not be authorized to implement these regulations as RCRA requirements until State program modifications are submitted to EPA and approved, pursuant to 40 CFR 271.21. Of course, States with existing regulations that are more stringent than or broader in scope than current Federal regulations may continue to administer and enforce their regulations as a matter of State law. In implementing the HSWA requirements, EPA will work with the States under agreements to avoid duplication of effort.

B. Effective Date

The effective date of today's rule is February 8, 1999, except as specified in the Effective Dates section. As discussed above, since today's rule is issued pursuant to HSWA authority, EPA will regulate the management of the newly identified hazardous wastes until States are authorized to regulate these wastes. Thus, EPA will apply Federal regulations to these wastes and to their management in both authorized and unauthorized States.

C. Section 3010 Notification

Pursuant to RCRA section 3010, the Administrator may require all persons who handle hazardous wastes to notify EPA of their hazardous waste management activities within 90 days after the wastes are identified or listed as hazardous. This requirement may be applied even to those generators, transporters, and treatment, storage, and disposal facilities (TSDFs) that have previously notified EPA with respect to the management of other hazardous wastes. The Agency has decided to waive this notification requirement for persons who handle wastes that are covered by today's listings and have already (1) notified EPA that they manage other hazardous wastes, and (2) received an EPA identification number. The Agency has waived the notification requirement in this case because it believes that most, if not all, persons who manage these wastes have already notified EPA and received an EPA identification number. However, any person who generates, transports, treats, stores, or disposes of these wastes and has not previously received an EPA identification number must obtain an identification number pursuant to 40 CFR 262.12 to generate, transport, treat, store, or dispose of these hazardous wastes by November 4, 1998.

D. Generators and Transporters

Persons that generate newly identified hazardous wastes may be required to obtain an EPA identification number if they do not already have one (as discussed in section VI.C, above). In order to be able to generate or transport these wastes after the effective date of this rule, generators of the wastes listed today will be subject to the generator requirements set forth in 40 CFR part 262. These requirements include standards for hazardous waste determination (40 CFR 262.11), compliance with the manifest (40 CFR 262.20 to 262.23), pretransport procedures (40 CFR 262.30 to 262.34), generator accumulation (40 CFR 262.34), record keeping and reporting (40 CFR 262.40 to 262.44), and import/export procedures (40 CFR 262.50 to 262.60). It should be noted that the generator accumulation provisions of 40 CFR 262.34 allow generators to accumulate hazardous wastes without obtaining interim status or a permit only in units that are container storage units or tank systems; the regulations also place a limit on the maximum amount of time that wastes can be accumulated in these units. If these wastes are managed in surface impoundments or other units that are not tank systems or

containers, these units are subject to the permitting requirements of 40 CFR parts 264 and 265, and the generator is required to obtain interim status and seek a permit (or modify interim status or a permit, as appropriate). Also, persons who transport newly identified hazardous wastes will be required to obtain an EPA identification number as described above and will be subject to the transporter requirements set forth in 40 CFR part 263.

E. Facilities Subject to Permitting

1. Facilities Newly Subject to RCRA Permit Requirements

Facilities that treat, store, or dispose of wastes that are subject to RCRA regulation for the first time by this rule (that is, facilities that have not previously received a permit pursuant to section 3005 of RCRA and are not currently operating pursuant to interim status), might be eligible for interim status (see section 3005(e)(1)(A)(ii) of RCRA). In order to obtain interim status based on treatment, storage, or disposal of such newly identified wastes, eligible facilities are required to comply with 40 CFR 270.70(a) and 270.10(e) by providing notice under section 3010 and submitting a Part A permit application no later than February 8, 1999. Such facilities are subject to regulation under 40 CFR part 265 until a permit is issued.

In addition, under section 3005(e)(3) and 40 CFR 270.73(d), not later than February 8, 1999, land disposal facilities newly qualifying for interim status under section 3005(e)(1)(A)(ii) also must submit a Part B permit application and certify that the facility is in compliance with all applicable groundwater monitoring and financial responsibility requirements. If the facility fails to submit these certifications and a permit application, interim status will terminate on that date.

2. Existing Interim Status Facilities

Pursuant to 40 CFR 270.72(a)(1), all existing hazardous waste management facilities (as defined in 40 CFR 270.2) that treat, store, or dispose of the newly identified hazardous wastes and are currently operating pursuant to interim status under section 3005(e) of RCRA, must file an amended Part A permit application with EPA no later than the effective date of today's rule, (i.e., February 8, 1999). By doing this, the facility may continue managing the newly listed wastes. If the facility fails to file an amended Part A application by that date, the facility will not receive interim status for management of the newly listed hazardous wastes and may not manage those wastes until the

facility receives either a permit or a change in interim status allowing such activity (40 CFR 270.10(g)).

3. Permitted Facilities

Facilities that already have RCRA permits must request permit modifications if they want to continue managing newly listed wastes (see 40 CFR 270.42(g)). This provision States that a permittee may continue managing the newly listed wastes by following certain requirements, including submitting a Class 1 permit modification request by the date on which the waste or unit becomes subject to the new regulatory requirements (i.e., the effective date of today's rule), complying with the applicable standards of 40 CFR parts 265 and 266 and submitting a Class 2 or 3 permit modification request within 180 days of the effective date.

Generally, a Class 2 modification is appropriate if the newly listed wastes will be managed in existing permitted units or in newly regulated tank or container units and will not require additional or different management practices than those authorized in the permit. A Class 2 modification requires the facility owner to provide public notice of the modification request, a 60-day public comment period, and an informal meeting between the owner and the public within the 60-day period. The Class 2 process includes a "default provision," which provides that if the Agency does not reach a decision within 120 days, the modification is automatically authorized for 180 days. If the Agency does not reach a decision by the end of that period, the modification is permanently authorized (see 40 CFR 270.42(b)).

A Class 3 modification is generally appropriate if management of the newly listed wastes requires additional or different management practices than those authorized in the permit or if newly regulated land-based units are involved. The initial public notification and public meeting requirements are the same as for Class 2 modifications. However, after the end of the 60-day public comment period, the Agency will grant or deny the permit modification request according to the more extensive procedures of 40 CFR part 124. There is no default provision for Class 3 modifications (see 40 CFR 270.42(c)).

Under 40 CFR 270.42(g)(1)(v), for newly regulated land disposal units, permitted facilities must certify that the facility is in compliance with all applicable 40 CFR part 265 groundwater monitoring and financial responsibility requirements no later than February 8, 1999. If the facility fails to submit these

certifications, authority to manage the newly listed wastes under 40 CFR 270.42(g) will terminate on that date.

4. Units

Units in which newly identified hazardous wastes are generated or managed will be subject to all applicable requirements of 40 CFR part 264 for permitted facilities or 40 CFR part 265 for interim status facilities, unless the unit is excluded from such permitting by other provisions, such as the wastewater treatment tank exclusions (40 CFR 264.1(g)(6) and 265.1(c)(10)) and the product storage tank exclusion (40 CFR 261.4(c)). Examples of units to which these exclusions could never apply include landfills, LTUs, waste piles, incinerators, and any other miscellaneous units in which these wastes may be generated or managed.

5. Closure

All units in which newly identified hazardous wastes are treated, stored, or disposed after the effective date of this regulation that are not excluded from the requirements of 40 CFR parts 264 and 265 are subject to both the general closure and post-closure requirements of Subpart G of 40 CFR parts 264 and 265 and the unit-specific closure requirements set forth in the applicable unit technical standards Subpart of 40 CFR parts 264 or 265 (e.g., Subpart N for landfill units). In addition, EPA promulgated a final rule that allows, under limited circumstances, regulated landfills, surface impoundments, or LTUs to cease managing hazardous waste but to delay Subtitle C closure to allow the unit to continue to manage non-hazardous waste for a period of time prior to closure of the unit (see 54 FR 33376, August 14, 1989). Units for which closure is delayed continue to be subject to all applicable 40 CFR parts 264 and 265 requirements. Dates and procedures for submittal of necessary demonstrations, permit applications, and revised applications are detailed in 40 CFR 264.113(c) through (e) and 265.113(c) through (e).

F. Landfill Leachate

Just weeks before the date for signature of this rule, one waste management company raised to the Agency an issue not addressed in their (or any other commenters') public comments. The issue is that the company claims to operate landfills in which some or all of the wastes being listed today have already been disposed. These landfills generate substantial volumes of leachate, which is collected and managed—mostly by shipment via

truck for treatment at Publicly Owned Treatment Works (POTWs). On the date the listings take effect, the wastes become hazardous, and a consequence is that this leachate would likewise be a hazardous waste by virtue of the derived-from rule. See generally 53 FR at 31147 (August 17, 1988); see also Chemical Waste Management v. EPA, 869 F.2d 1526, 1536–37 (D.C. Cir. 1989) (sustaining this interpretation).

Although the landfills in which the wastes have been previously disposed do not thereby become subject to Subtitle C regulation, *id.*, leachate which is collected and actively managed would be regulated under Subtitle C. *Id.*

EPA's Office of Water recently proposed national effluent limitations guidelines and pretreatment standards for wastewater discharges (e.g., leachate) from certain types of landfills. 63 FR 6426 (February 6, 1998). In support of this proposal, EPA conducted a study of the volume and chemical composition of wastewaters generated by both Subtitle C and Subtitle D landfills. EPA did not propose pretreatment standards for Subtitle D landfill wastewaters sent to POTWs because the Agency's information indicated that such standards were not required due to several factors, including (1) raw leachate data was below published biological inhibition levels, and (2) lack of pass-through of toxics (including lack of showing of adverse impact on POTW sludge quality). 63 FR at 6444. EPA initially found, among other things, that "the majority of pollutants typically found in raw [non-hazardous landfill] leachate were at levels comparable to wastewater typically found at the headworks of a POTW." *Id.*

Leachate from non-hazardous waste landfills that have historically managed the newly-listed wastes would be leachate from a Subtitle D facility, and so could ultimately be determined not to require pretreatment under this pending proposal. However, if Subtitle C regulation were to apply to leachate generated from such landfills, leachate now trucked to POTWs would, as a practical matter, no longer be managed by POTWs, since POTWs would not wish to become RCRA Subtitle C facilities. Given the pending proposal that directly addresses the treatment of landfill leachate under the Clean Water Act, EPA believes it worthwhile to study whether RCRA regulation of such leachates may be duplicative within the meaning of RCRA section 1006(b)(1) (which requires EPA to integrate regulations under RCRA with other statutes implemented by EPA in a manner that avoids duplication to the maximum extent possible, consistent

with the goals and policies of RCRA and the other statutes).

Since this leachate issue was not brought to the Agency's attention in a timely manner, EPA is taking no action on this issue in this rulemaking. The final rule thus simply finalizes four of the proposed listings (K169, K170, K171, and K172), therefore the possibility exists that some leachate may be classified by one or more of these waste codes (after the effective date of today's rule) for the reasons outlined above. However, the Agency is seeking public comment on the issue by means of a Notice of Data Availability (NODA), published elsewhere in today's **Federal Register**. EPA plans to take some type of action addressing this issue, after considering any public comments to this projected NODA, before today's listings take effect. One of the options the Agency might consider (after consideration of comments and information in response to the NODA) would be temporarily deferring the application of the listings to the leachate.

VIII. CERCLA Designation and Reportable Quantities

All hazardous wastes listed under RCRA and codified in 40 CFR 261.31 through 261.33, as well as any solid waste that is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b) and that exhibits one or more of the characteristics of a RCRA hazardous waste (as defined in §§ 261.21 through 261.24), are hazardous substances under CERCLA, as amended (see CERCLA section 101(14)(C)). CERCLA hazardous substances are listed in Table 302.4 at 40 CFR 302.4 along with their reportable quantities (RQs). If a hazardous substance is released in an amount that equals or exceeds its RQ, the release must be reported immediately to the National Response Center (NRC) pursuant to CERCLA section 103.

A. Reporting Requirements

Under CERCLA section 103(a), the person in charge of a vessel or facility from which a hazardous substance has been released in a quantity that is equal to or exceeds its RQ must immediately notify the NRC as soon as that person has knowledge of the release. The toll-free telephone number of the NRC is 1-800-424-8802; in the Washington, DC, metropolitan area, the number is (202) 267-2675. In addition to this reporting requirement under CERCLA, section 304 of EPCRA requires owners or operators of certain facilities to report releases of extremely hazardous substances and CERCLA hazardous substances to State

and local authorities. EPCRA section 304 notification must be given immediately after the release of an RQ or more to the community emergency coordinator of the local emergency planning committee for any area likely to be affected by the release and to the State emergency response commission of any State likely to be affected by the release.

Under section 102(b) of CERCLA, all hazardous substances (as defined by CERCLA section 101(14)) have a statutory RQ of one pound, unless and until the RQ is adjusted by regulation. In today's final rule, EPA is adding waste streams K169, K170, K171, and K172 to the CERCLA list of hazardous substances and adjusting the one-pound statutory RQs for these wastes.

B. Standard and Alternative RQ Adjustment Methodology

EPA's methodology for adjusting the RQs of individual hazardous substances begins with an evaluation of the intrinsic physical, chemical, and toxicological properties of each hazardous substance. The intrinsic properties examined-called "primary criteria"-are aquatic toxicity, mammalian toxicity (oral, dermal, and inhalation), ignitability, reactivity, chronic toxicity, and potential carcinogenicity.

Generally, for each intrinsic property, EPA ranks the hazardous substance on a five-tier scale, associating a specific range of values on each scale with an RQ value of 1, 10, 100, 1,000, or 5,000 pounds. Based on the various primary criteria, the hazardous substance may receive several tentative RQ values. The lowest of the tentative RQs becomes the "primary criteria RQ" for that substance.

After the primary criteria RQ is assigned, the substance is evaluated further for its susceptibility to certain degradative processes, which are used as secondary RQ adjustment criteria. These natural degradative processes are biodegradation, hydrolysis, and photolysis (BHP). If a hazardous substance, when released into the environment, degrades relatively rapidly to a less hazardous form by one or more of the BHP processes, its primary criteria RQ is generally raised one level. Conversely, if a hazardous substance degrades to a more hazardous product after its release, the original substance is assigned an RQ equal to the RQ for the more hazardous substance, which may be one or more levels lower than the RQ for the original substance.

The standard methodology used to adjust the RQs for RCRA hazardous waste streams differs from the

methodology applied to individual hazardous substances. The procedure for assigning RQs to RCRA waste streams is based on an analysis of the hazardous constituents of the waste streams. The constituents of each RCRA hazardous waste stream are identified in 40 CFR part 261, Appendix VII. EPA determines an RQ for each constituent within the waste stream and establishes the lowest RQ value of these constituents as the adjusted RQ for the waste stream. In a November 20, 1995, proposed rule (60 FR 57747), EPA proposed one-pound RQs for waste streams K169, K170, K171, and K172 based on this standard methodology.

In the same rule, however, the Agency also proposed an alternative method for adjusting the RQs of these four petroleum refining wastes. The proposed alternative method involved developing "concentration-weighted" RQs for the four wastes. Using this alternative method, EPA first determined the maximum observed concentrations of each hazardous constituent in the wastes. EPA then used these concentrations to calculate the amount of each petroleum refining waste necessary to contain the RQ of each constituent of concern.

Based on these calculated amounts, EPA assigned a "concentration-weighted" RQ value of 1, 10, 100, 1,000, or 5,000 pounds to each waste stream constituent. If the calculated amount for a particular constituent was greater than the maximum RQ level of 5,000 pounds, the "concentration-weighted" constituent RQ would be 5,000 pounds. If the calculated amount fell between two RQ levels, then the "concentration-weighted" constituent RQ would be the lower of the two levels. Finally, under this alternative method, the lowest of the concentration-weighted constituent RQs would become the RQ for the waste stream.

C. Basis for RQ Adjustments in Final Rule

In today's final rule, EPA has decided to use the standard RQ adjustment methodology to assign RQs to petroleum refining wastes K169, K170, K171, and K172. The Agency believes that introduction of a second methodology (i.e., the alternative method described above), in addition to the standard method already in use, may be difficult to implement and may unnecessarily confuse the public and the regulated community.

EPA considered three specific implications of adopting the alternative RQ adjustment methodology in making its determination to retain the standard method. First, promulgation of RQs

based on the alternative methodology for the four petroleum refining wastes would have introduced a potentially confusing situation in which RQs for currently listed hazardous waste streams would be based on two different methodologies. Second, since EPA's initial RQ adjustment rulemakings were first published in 1983, EPA has consistently applied the standard methodology to adjust the RQs for all previously listed RCRA wastestream. Members of the public and the regulated community understand and are complying with this methodology and related reporting requirements. Third, the reduced reporting burden expected from the application of the alternative method (i.e., reporting based on constituent concentrations) to the four petroleum refining wastes can be achieved by applying the mixture rule (as described in Section VIII.D, "Responses to Comments," of this preamble), without creating a second, different RQ adjustment methodology.

Based on these considerations, the Agency has decided to use the standard methodology, rather than the alternative method, to adjust the RQs for the petroleum refining wastes in today's final rule. Using the standard method, EPA today is assigning one-pound adjusted RQs (as proposed) for waste streams K170, K171, and K172 based on the constituent(s) within each of these newly listed waste streams with the lowest RQ. The Agency, however, is modifying its interpretation of the mixture rule (as described in detail in Section VIII.D below) to allow facilities to use the maximum observed concentrations of the constituents within the petroleum refining wastes in determining when to report releases of these wastes.

In addition, EPA mentioned in the preamble to the November 20, 1995, proposed rule that the Agency was considering listing waste stream K169 (crude oil storage tank sediment). Subsequent to the proposal, EPA has decided to list K169 as a RCRA hazardous waste and a CERCLA hazardous substance, and to adjust its RQ.

In the November 20, 1995 rule, EPA was considering a one-pound RQ for K169 based on the one-pound RQs of three substances (benzo(a)pyrene, dibenzo(a,h)anthracene, and benzo(b)fluoranthene) originally identified by the Agency as constituents of this waste stream. After further evaluation of the constituent data, however, the Agency has decided in today's final rule to identify only one hazardous constituent (i.e., benzene) for waste stream K169 in Appendix VII to

40 CFR part 261 (see Section V.B.2 for a discussion of the basis for listing K169). Thus, using the standard RQ adjustment method, EPA is promulgating a 10-pound RQ for K169 in today's final rule based on the 10-pound RQ of the waste's single hazardous constituent, benzene.

D. Response to Comments

As noted above, the Agency has decided to use the standard methodology to adjust the RQs for K169, K170, K171, and K172. The commenters on the proposed rule, however, favored the alternative RQ adjustment methodology. These commenters suggested that reporting should be based on actual concentration levels observed in each of the petroleum refining wastes and that these levels are more likely to warrant notification of government authorities.

In addition, one of the commenters asked EPA to clarify that a waste generator could retain the option of applying the mixture rule to releases of these petroleum refining wastes. Specifically, this would allow the generator to report at a higher level if

the generator knew that the concentrations of the constituents in the waste were lower than the maximum observed concentrations identified by EPA.

EPA acknowledges the commenters' support for less burdensome reporting requirements and agrees with the commenters' assertion that reporting for the four petroleum refining wastes should be based on actual concentration levels observed in each of these wastes. The Agency, however, believes that reductions in the reporting burden for these four wastes can be achieved through the use of the mixture rule, without creating a second, distinct RQ adjustment methodology. In response to the commenters' concerns, the Agency is modifying its interpretation of the mixture rule, as described below, to allow facilities to use the maximum observed concentrations of the constituents within K169, K170, K171, and K172 in determining when to report releases of these wastes.

For K169, K170, K171, and K172, where the person in charge does not know the actual concentrations of the hazardous constituents, that person will

have the option of reporting on the basis of the maximum observed concentrations that have been identified by EPA (see Table VIII-1 below). The change in EPA's interpretation of the mixture rule that will allow use of these maximum concentrations is codified in 40 CFR 302.6(b)(1) as a new subparagraph (iii) in today's rule. Thus, although the person in charge lacks actual knowledge of constituent concentrations, constructive knowledge of the EPA-identified maximum concentrations is assumed. This assumption is reasonable and conservative because the sampling data presented in the Technical Listing Document accurately identify the maximum observed concentrations of the hazardous constituents in each of the petroleum refining wastes. Table VIII-1 below identifies the hazardous constituents for waste streams K169, K170, K171, and K172, their maximum observed concentrations in ppm, their constituents' RQs as listed in Table 302.4 of 40 CFR part 302, and the number of pounds of the waste needed to contain an RQ of each constituent.

TABLE VIII-1.—POUNDS REQUIRED TO CONTAIN RQ FOR EACH CONSTITUENT

| Waste | Constituent | Max ppm | RQ (lb) | Pounds required to contain RQ |
|-------|--|---------|---------|-------------------------------|
| K169 | Benzene | 220 | 10 | 45,455 |
| | Benzene | 1.2 | 10 | 8,333,333 |
| K170 | Benzo (a) pyrene | 230 | 1 | 4,348 |
| | Dibenz (a,h)anthracene | 49 | 1 | 20,408 |
| | Benzo (a)anthracene | 390 | 10 | 25,641 |
| | Benzo fluoranthene | 110 | 1 | 9,090 |
| | Benzo (k) fluoranthene | 110 | 5000 | 45,454,545 |
| | 3-Methylcholanthrene | 27 | 10 | 370,370 |
| | 7,12-Dimethylbenz (a) anthracene | 1,200 | 1 | 833 |
| K171 | Benzene | 500 | 10 | 20,000 |
| | Arsenic | 1,600 | 1 | 625 |
| K172 | Benzene | 100 | 10 | 100,000 |
| | Arsenic | 730 | 1 | 1,370 |

For example, if waste stream K171 is released from a facility and the person in charge does not know the actual concentrations of the benzene and arsenic constituents, the person may assume that the concentrations of benzene and arsenic are 500 and 1,600 ppm, respectively. Thus, applying the mixture rule, 625 pounds of the K171 waste would need to be released (assuming the maximum concentrations indicated in the table) to reach the RQ for arsenic in this waste.

Where the person in charge knows the concentration levels of all the hazardous constituents in a particular petroleum refining waste, the traditional mixture rule can be applied. Under this scenario,

reporting would be required only when an RQ or more of any hazardous constituent is released. As applied to the petroleum refining wastes in this rule, EPA's overall reporting approach reduces the burden of notification requirements for the regulated community and adequately protects public health and welfare and the environment. In addition, EPA believes that the approach described above is consistent with the view expressed by the commenters that reporting for the four wastes should be based on actual concentration levels.

In the proposed rule preamble, EPA identified "self-heating solids" as a hazardous constituent of waste streams

K171 and K172. Two of the commenters disagreed with the Agency's use of this term and indicated that most K171 and K172 wastes do not demonstrate the RCRA characteristic of ignitability. According to these commenters, the few wastes that do exhibit this characteristic will already be subject to the 100-pound RQ that applies to ignitable characteristic wastes. Finally, the commenters stated that EPA's use of the term "self-heating solid" as a constituent of K171 and K172 wastes would unfairly lower the RQ for those wastes that do not possess the RCRA characteristic of ignitability. EPA agrees with the commenters and has removed the term "self-heating solids" from the

list of constituents of K171 and K172 in Table VIII-1 of today's final rule.

IX. Executive Order 12866

Under Executive Order 12866, "Regulatory Planning and Review" (58 FR 51735, October 4, 1993), the Agency must determine whether the regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) have an annual effect on the economy of \$100 million or more or adversely affects in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities

(2) create a serious inconsistency or otherwise interferes with an action taken or planned by another agency

(3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof

(4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive order.

Pursuant to the terms of Executive Order 12866, it has been determined that this rule is a "significant regulatory action" because of policy issues arising out of legal mandates. As such, this action was submitted to OMB for review. Changes made in response to OMB suggestions or recommendations are documented in the public record.

X. Economic Analysis

Summary

This section of the preamble develops the costs and the industry economic impact for the petroleum refining waste listings including land disposal restriction (LDR) impacts. Based on this economic analysis, the Agency estimates that the listing of the four refinery wastes discussed above, including LDR impacts, the oil-bearing hazardous secondary material exclusion (oil-bearing exclusion) and the wastewaters from the headworks exemptions for crude oil storage tank sediment (K169) and CSO sediment (K170), will result in nationwide annualized compliance costs between \$20 and \$40 million, with an expected value of about \$30 million (\$1997)²⁶ (see Table X-2 below). Although Table X-2 shows a range from approximately

\$12 million to \$60 million (columns 5 and 6), the likely range will be narrower due to the available refinery choices and expected waste volumes. The wide variance is nonetheless due to a high degree of uncertainty in costing and, particularly, in volumes to be processed.

Of special note is the relationship of previously listed petroleum refinery wastes to this rulemaking. The ability to recycle wastes through coker processing, as described herein, will enable refineries to process previously listed wastes in a like manner. These wastes include FO37, FO38, KO48, KO49 and KO51. A conservative estimate of the volume of these wastes that may be processed, yielding oil that may be converted to product, results in feedstock having a value of some \$14 million to \$28 million (\$1997); see background document entitled "Other Benefits From Recovery of Oil in Coker Processing Units", dated August 24, 1995. Clearly, the impact of this "other" benefit as a potential offset to the costs of the rule described herein can be substantial. If the volumes available from previously listed wastes are higher than estimated, the value of oil generated may substantially offset the costs of this rulemaking. It is important to note that EPA has insufficient data to judge the extent to which the industry may already be generating this added feedstock.

Industry pricing and operating impacts, developed using partial equilibrium analysis, are expected to be minimal. This is due both to the size of the industry and the latitude afforded industry in this rulemaking. The full economic analysis is available in the regulatory docket titled "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

In the cited background document, supplemental cost impact analyses accounting for the cost savings of the oil-bearing exclusion and the headworks exemption are included, as well as impacts resulting from the new Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) and the potential for unfunded mandates. Finally, as noted above, cost savings from the recovery of oil in coker processing units are evaluated for five previously listed petroleum refining industry wastes but, also as noted, are not included as offsets to the costs estimated for this rulemaking.

A. Compliance Costs for Listings Including LDR Impacts and the Exclusion for Oil-Bearing Hazardous Secondary Materials

This Section describes (1) the universe of petroleum refineries and volumes of petroleum refining wastes in the four waste groups listed, including LDR impacts, (2) an overview of the industry impact methodology, later described in detail, and detail of the methodology for determining incremental compliance cost, (3) the potential remedial action costs, and (4) a summary of incremental compliance cost results.

1. Universe of Petroleum Refineries and Waste Volumes

In order to estimate costs, it was first necessary to estimate total annual generation of petroleum refining wastes. The domestic petroleum refining industry affected by this ruling is composed of 162 refineries owned/operated by 80 companies. The quantity of waste at the point of generation (i.e., entering the waste management system) could range from 91,600 to 177,900 metric tons per year, with an expected value of approximately 134,800 metric tons per year.²⁷

2. Methodology for Estimating Industry Economic Impact and Incremental Compliance Cost

Industry Impact, Overview

Partial equilibrium analysis, as was noted, was used to evaluate possible changes in market demand, estimate the post-control shift in market supply, predict the change in market equilibrium (price and quantity), and estimate plant closures. Petroleum refineries produce several hundred products. The economic impact analysis evaluates the impact of the listings based on ten petroleum products (i.e., ethane/ethylene, butane/butylene, normal butane/butylene, isobutane/isobutylene, finished motor gasoline, jet fuel, distillate and residual fuel oil, asphalt, and petroleum coke), which represented 91 percent of domestically refined petroleum products in 1992. Because compliance costs for the hazardous waste listings cannot be allocated to any specific products, output in the partial equilibrium model is defined as a composite, bundled product equal to the sum of price

²⁶The range of cost estimates is explained in Document 5 of the "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

²⁷Waste quantity estimates for the point of generation and final management are presented in Table 3.3 of Document 1 of the "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

multiplied by the weighted production volumes of all ten products.

Due to the wide range of potential costs, as shown in the table at the end of this section, a bounding analysis was conducted to evaluate the maximum potential industry economic impact of this listing determination. Highest cost options bounded the industry economic impact analysis. The upper bound LDR Scenario assumes a pretreatment management method of solidification prior to Subtitle C landfill for metal-based wastes, combustion in a Subtitle C incinerator/BIF for organic-based wastes, and a listing exemption granted for organic-based wastes that are recycled to a coker. The lower bound LDR Scenario uses the same assumptions except on-site incineration costs are assumed for those refineries generating sufficient quantities to warrant construction of an incinerator. EPA's judgement that industry impact is minimal is based on upper-bound costs to the industry.

Incremental Compliance Cost

EPA's approach to the compliance cost analysis for this rule was to compare the cost of current management practices, as reported in the RCRA section 3007 Questionnaire of petroleum refineries, with the projected cost of management to comply with the RCRA Subtitle C hazardous waste program. This difference in cost, when annualized²⁸, represents the incremental annual compliance cost attributable to the rule.

Three scenarios are evaluated in this Cost and Economic Impact Analysis. The first scenario, Listing Scenario, assesses the costs incurred by the petroleum refining industry to comply with Subtitle C regulation excluding LDR regulations. The Listing Scenario assumes an end disposal management of Subtitle C landfilling or continued combustion of wastes, where indicated as the baseline management practice, in a Subtitle C incinerator/BIF.

The second scenario, LDR Scenario, expands on the Listing Scenario by adding in cost impacts attributable to LDR regulations. Two options are assessed for the LDR Scenario. In Option 1, the upper-bound estimate, oil-based crude oil storage tank sediment (K169) and CSO sediment (K170) are combusted in off-site Subtitle C incinerators and spent hydrotreating and hydrorefining catalysts (K171, K172, respectively) are combusted in off-site incinerators followed by vitrification and Subtitle C landfill of

the ash. In Option 2, the lower-bound estimate, oil-based crude oil storage tank sediment (K169) and CSO sediment (K170) are assumed to be managed in on-site Subtitle C incinerators for those refineries generating sufficient quantities and currently in the RCRA permitting program (thereby avoiding potential corrective action costs). Spent hydrotreating and hydrorefining catalysts (K171, K172) are assumed to be regenerated/reclaimed in RCRA-exempt off-site metal recovery units.²⁹ Compliance with LDR requirements is presumed to be mandatory.

The third scenario, Oil-Bearing Exclusion Scenario, modifies the Listing and LDR Scenarios by assuming the refinery will process crude oil storage tank sediment (K169) and CSO sediment (K170) in coking units where it is more cost-effective than Subtitle C management. Two options are assessed for the Oil-Bearing Exclusion Scenario. In Option 1, the upper-bound estimate, crude oil storage tank sediment (K169) and CSO sediment (K170) are processed in on-site and intracompany (i.e., "same company") coking units when it is more economical than management in off-site Subtitle C incinerators. In Option 2, the lower-bound estimate, crude oil storage tank sediment (K169) and CSO sediment (K170) are processed in intercompany (i.e., "not same company") coking units when it is technically feasible and/or more economical than management in off-site incinerators. "Not same company" costs are lower because more companies will avail themselves of this option if permitted to do so. Spent hydrotreating and hydrorefining catalysts (K171, K172, respectively) are combusted in off-site incinerators followed by vitrification and Subtitle C landfill of the ash.³⁰

Baseline or Current Management Scenario

Relying on 3007 Questionnaire responses and engineering site visits, EPA was able to determine the current (i.e., 1992) management practices for the handling and disposal of petroleum refining wastes. Current management practices varied among facilities and waste streams, and included such practices as on-/off-site Subtitle C/D landfill, off-site Subtitle C incinerator/BIF, on-site surface impoundment,

recycling, recovery, regeneration, and reclamation. These "current" management practices at each facility represent the baseline scenario of the analysis.

As part of the 3007 Questionnaire, EPA asked each facility to identify current costs for the management of petroleum refining wastes. For this analysis, EPA relied on and has not changed the industry's own waste-specific estimates concerning the cost of current management. Industry average unit costs were developed for each baseline management practice from the 3007 Questionnaire data. EPA estimated costs for baseline management practices when limited or no cost data were provided in the 3007 Questionnaire. These calculated industry average and estimated unit costs were used when a facility did not provide its own unit cost estimates. EPA realizes that future events such as waste minimization efforts or increased demand for refinery products may change waste generation volumes and, thus, future waste management costs.³¹ It is important to note that EPA also estimated missing quantities to associate costs with these quantities.

Post-Regulatory Management Scenarios

In predicting how industry would comply with the listing of petroleum refinery wastes as RCRA hazardous wastes, EPA developed the three post-regulatory management scenarios, previously noted, that represent reasonable management reactions on the part of industry. Details of the compliance assumptions are presented by baseline management practice in Table X-1. EPA developed these post-regulatory management categories based on knowledge of current waste management and the physical and chemical properties of the wastes. These scenarios are further described as follows:

The "Listing" Scenario assumes an end disposal management method of Subtitle C landfill or continued combustion of wastes, where indicated as the baseline management practice, in a Subtitle C incinerator/BIF. The use of the word "Listing" is intended to emphasize that this scenario embodies only Subtitle C costs.

The LDR Scenario presents two options. In the first option, the metal-based spent catalyst wastes are combusted in a Subtitle C incineration followed by vitrification, and Subtitle C landfill of the ash and the oil-based sediment wastes are combusted in off-

²⁹ These cost estimates are presented in Document 1 of the "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

³⁰ These cost estimates are presented in Document 5 of the "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

³¹ Baseline unit cost estimates are presented in Tables 3.8 and 3.10 of Document 1 in the "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

²⁸ Costs are discounted at a rate of 7 percent over a 20-year period.

site Subtitle C incinerator/BIF units. This option reflects the highest cost situation of all those examined. Other technologies may be applicable (e.g., solvent extraction instead of incineration or solidification instead of vitrification for metal-based wastes) to meet LDR standards, but these are lower cost options and will not provide an upper-bound to the cost and economic analysis. In the second option, the spent hydrotreating and hydrorefining catalysts (K171, K172, respectively) are reclaimed/recovered to take advantage of the recycling exemption under RCRA Subtitle C regulation. However, recordkeeping, storage, and transportation activities are regulated under RCRA Subtitle C, while no LDR treatment costs are included. The oil-based wastes are combusted in either an on- or off-site Subtitle C incinerator/BIF depending on the economic feasibility of constructing on-site incinerator units. If a facility does not currently have a RCRA Part B permit, EPA assumed the facility would choose not to construct an on-site incinerator in order to avoid incurring potential costs under the RCRA corrective action program.

The Oil-Bearing Exclusion Scenario also presents two options. Because of the

uncertainty regarding plant-specific coker capacity availability, access limitations, cost limitations, feedstock quality limitations, and State regulatory restrictions, the two options given in Table X-2 were evaluated to bound the possible results of the LDR scenarios with an oil-bearing exclusion. Refiners will seek new cost optimization solutions since coking is now economical when compared to Subtitle C management instead of Subtitle D management. The first cost option considers that, when economical, facilities will transport crude oil storage tank sediment (K169) and CSO sediment (K170) to the nearest refinery within the same company (i.e., intracompany) that currently operates a coker. As a lower-bound cost option, it is assumed that technology allowing insertion of de-oiled crude oil storage tank sediment (K169) and CSO sediment (K170) into coker feedstocks will be developed and intercompany transfers will occur, without the transferring company paying the receiving company for the right to avoid Subtitle C costs. However, it is not likely that there will be no market pricing given potential profits (compared to Subtitle C management costs) and potential benefits

received by both the generator and recycler; thus the lower bound.

Incremental compliance costs are determined for each management and transportation practice by subtracting the baseline management cost from the compliance management cost. For example, the incremental unit compliance cost for wastes currently managed in off-site municipal Subtitle D landfills that now will be managed in Subtitle C landfills is \$202/MT (\$260/MT—\$58/MT). This incremental unit cost is then multiplied by the quantity of waste generated by the facility to estimate the total incremental compliance cost.³² Note that from Table X-2 it is possible to select various mixes of compliance options. For this rulemaking, EPA believes that the 2 right hand columns bound the compliance costs. However, Option 1 (LDR Scenario) was used in developing the worst case industry impact analysis.

TABLE X-1.—BASELINE VS. COMPLIANCE PRACTICES

| Baseline management practice | Wastes managed | Compliance assumptions |
|----------------------------------|---|---|
| Storage Methods: | | |
| Tank | K169—crude oil storage tank sediment K170—CSO sediment K171—spent hydrotreating catalyst K172—spent hydrorefining catalyst. | Upgrade to Subtitle C accumulation tank system. ^a |
| Container (e.g., drum) | K169, K170, K171, and K172 | Upgrade to Subtitle C accumulation container storage area. ^(a) |
| Pile | K169, K170, and K172 | Construct new Subtitle C accumulation tank storage system. ^(b) |
| Roll-on/Roll-off Bin | K169, K170, K171, and K172 | Upgrade to Subtitle C accumulation container storage area. ^(a) |
| Other | K169, K170, K171, and K172 | Assume most common storage type reported by the industry for that waste type. |
| Treatment methods: | | |
| On-site Industrial Furnace | K170 | In compliance. Add RCRA Part 264 and 270 administrative costs to permit unit. |
| Other On-site Thermal Treatment. | K169 | On-site industrial furnace. |
| Off-site Incineration | K169 and K171 | In compliance. Construct a new on-site Subtitle C incinerator if more economical than off-site management. |
| Washing with Distillate | K169 and K170 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Washing with Water | K169 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Other Cleaning/Extraction | K171 and K172 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Sludge Thickening | K169 and K170 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Sludge De-watering | K169 and K170 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Settling | K169 and K170 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Filtration | K169 and K170 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Pressure Filtration/Centrifuging | K169 and K170 | Upgrade to Subtitle C accumulation tank system for existing units. ^(a) Construct a new on-site Subtitle C pressure filtration/centrifuge unit for a waste minimization opportunity for oily sludges. ^(b) |
| Chemical Emulsion Break | K169 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Thermal Emulsion Break | K169 and K170 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Other Phase Separation | K169, K171, and K172 | Upgrade to Subtitle C accumulation tank system. ^(a) |

³² Compliance unit cost estimates are presented in Table 3.9 and 3.10 of Document 1 in the "Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C," January 10, 1998.

TABLE X-1.—BASELINE VS. COMPLIANCE PRACTICES—Continued

| Baseline management practice | Wastes managed | Compliance assumptions |
|--|----------------------------------|---|
| On-site Land treatment | K169, K170, and K171 | <i>Listing Scenario:</i> Abandon on-site land treatment unit and dispose waste in off-site Subtitle C landfill. <i>LDR Scenario:</i> K169/K170—On-/Off-site incineration; K171—Option 1: Off-site incineration and ash vitrification; Option 2: Transfer precious or non-precious metal catalysts for reclamation or regeneration. |
| Off-site Land treatment | K169 and K170 | <i>Listing Scenario:</i> Off-site Subtitle C landfill. <i>LDR Scenario:</i> On-/Off-site incineration. |
| Discharge to On-site WWT Facility. | K169 and K170 | In compliance due to the headwaters exemption for wastewaters discharged to NPDES or POTW. |
| Drying on a Pad | K169 and K170 | Construct new Subtitle C accumulation tank system. ^(b) |
| On-site Oxidation of Pyrophoric Material. | K171 and K172 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| On-site Stabilization | K169, K170, K171, and K172 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Off-site Stabilization | K171 | <i>Listing Scenario:</i> In compliance. <i>LDR Scenario:</i> Ash vitrification following off-site incineration. |
| Other Treatment | K169 | Upgrade to Subtitle C accumulation tank system. ^(a) |
| Transfer Methods: | | |
| Transfer of Precious or Non-precious Metal Catalysts for Reclamation/Regeneration. | K171 and K172 | Reclamation/regeneration facility will increase Subtitle C storage capacity and upgrade to Subtitle C transportation and management. |
| Transfer to Non-Petroleum Refinery for Direct Use as a Fuel or to Make a Fuel. | K169 and K170 | Off-site Subtitle C BIF. |
| Transfer for Use as an Ingredient in Products that are Placed on the Land. | K169 | Off-site Subtitle C BIF. |
| Transfer to Other Off-site Entity. | K169 and K171 | Assume most common reported transfer method reported by industry for each waste type. |
| Disposal methods: | | |
| NPDES | K169 | In compliance. |
| Off-site Municipal Subtitle D Landfill. | K169, K170, and K171 | <i>Listing Scenario:</i> Off-site Subtitle C landfill. <i>LDR Scenario:</i> On-/Off-site incineration. |
| Off-site Industrial Subtitle D Landfill. | K169, K170, K171, and K172 | <i>Listing Scenario:</i> Off-site Subtitle C Landfill. <i>LDR Scenario:</i> On-/Off-site incineration. |
| Off-site Subtitle C Landfill | K169, K170, K171, and K172 | <i>Listing Scenario:</i> In compliance. <i>LDR Scenario:</i> K169/K170—On-/Off-site incineration; K171/K172—Option 1: Off-site incineration followed by ash vitrification; Option 2: Transfer precious or nonprecious metal catalysts for reclamation or regeneration. |
| On-site Subtitle D Landfill | K170, K171, and K172 | <i>Listing Scenario:</i> Off-site Subtitle C landfill. <i>LDR Scenario:</i> K170—On-/Off-site incineration; K171/K172—Option 1: Off-site incineration followed by ash vitrification; Option 2: Transfer precious or nonprecious metal catalysts for reclamation or regeneration. |
| On-site Subtitle C Landfill | K169, K171, and K172 | <i>Listing Scenario:</i> In compliance. <i>LDR Scenario:</i> K169—On-/Off-site incineration; K171/K172—Option 1: Off-site incineration followed by ash vitrification; Option 2: Transfer precious or nonprecious metal catalysts for reclamation or regeneration. |
| On-site Surface Impoundment | K169 | Dredge impoundment sludge and dispose in off-site Subtitle D Landfill prior to final listing and then recommission impoundment for non-hazardous waste use; Upgrade existing on-site filtration system to a Subtitle C accumulation system for sludge management. ^(a) <i>Listing Scenario:</i> Off-site Subtitle C landfill. <i>LDR Scenario:</i> On-/Off-site incineration. |

^(a)Management costs (i.e., operation and maintenance costs) for baseline and compliance are the same for this management method. Secondary containment is included where appropriate.

^(b)Management costs (i.e., O&M costs) for baseline and compliance are the same for this management method. Secondary containment is included where appropriate. The compliance cost will involve closure of the drying pad and construction of a drying tank system with secondary containment.

3. Potential Remedial Action Costs Within the Refining Industry

In addition to the refinery waste management costs themselves, the petroleum refining hazardous waste listing could affect the management of soils, leachates, groundwater, and

remedial materials. The Agency's "contained in" policy defines certain remediation wastes "containing" a listed hazardous waste as a RCRA hazardous waste (see *Chemical Waste Management v. EPA*, 869 F.2d 1526, D.C.C., 1989). Industry sites where

newly identified hazardous wastes have been managed prior to the effective date of the new listings may still have contaminant concentrations which exceed "contained in" levels. Any firm actively managing such material could become a generator of RCRA hazardous

waste. Releases from all solid waste management units at these TSDFs, including those that in the future would be found to contain a waste meeting the petroleum listing descriptions, are covered by facility-wide corrective action under 40 CFR 264.101.

Associated costs, e.g., RCRA Facility Assessment, were addressed in the draft proposed corrective action rule.

4. Summary of Compliance Cost Results

Table X-2 presents a summary of estimated incremental annualized compliance costs for each waste due to (1) listing, (2) listing including potential

LDR pre-treatment regulations, and (3) listing including LDR impacts and oil-bearing exclusion cost benefits.

Under the oil-bearing exclusion scenarios, the expected value represents recycling of 65 percent of the oil-based crude oil storage tank sediment (K169) and CSO sediment (K170) in either on-site coking units or intracompany transfers when it is economically feasible, off-site incineration of the remaining 35 percent of the oil-based crude oil storage tank sediment (K169) and CSO sediment (K170) quantity, and off-site incineration and vitrification of the spent hydrotreating and

hydrorefining catalysts. It is estimated that 65 percent of the oil-based crude oil storage tank sediment (K169) and CSO sediment (K170) quantity is recycled into coking units.

All of the above cost estimates, under each scenario, assume implementation of waste minimization for filtering "oily" crude oil storage tank sediment (K169) and CSO sediment (K170) and recycling the oil filtrate back into process units. Revenues from the recycled oil are roughly estimated at about \$1 million per year but are not included as an offset to costs in this table.

TABLE X-2.—SUMMARY OF COST OF COMPLIANCE (1997 \$millions per Year)^{1,2}

| Waste stream | Listing Scenario | LDR Scenario Option 1—Off-site Incineration of K169, K170 and Off-site Incineration and Vitrification of K171, K172 | LDR Scenario Option 2—On/Off-site Incineration of K169, K170 and Regeneration or Reclamation of K171, K172 ³ | Oil-Bearing Exclusion Scenario Including LDR Impact Option 1—De-oil K169, K170, "Not Same Company" Recycling to Coker, Off-site Incineration of Remaining Sludge, and Regeneration or Reclamation of K171, K172 ⁴ | Oil-Bearing Exclusion Scenario Including LDR Impact Option 2—De-oil D169, K170, "Same Company" Recycling to Coker, Off-site Incineration of Remaining Sludge, and Regeneration or Reclamation of K171, K172 ⁴ |
|----------------------------------|----------------------|---|---|--|--|
| | | Average Cost [Low-High] | Average Cost [Low-High] | Average Cost [Low-High] | Average Cost [Low-High] |
| Crude Oil Storage Tank Sediment. | 2.5 [1.1–4.4] | 24.1 [10.4–43.3] | 18.6 [9.0–31.6] | 8.7 [4.1–14.9] | 13.0 [5.9–22.6]. |
| Clarified Slurry Oil Sediment. | 3.1 [1.6–5.4] | 25.1 [12.5–42.0] | 18.8 [10.5–29.6] | 8.1 [3.9–13.8] | 13.5 [6.8–22.4]. |
| Spent Hydrotreating Catalyst. | 1.5 [0.9–3.2] | 5.6 [3.9–8.5] | 2.6 [1.3–5.0] | 2.6 [1.3–5.0] | 2.6 [1.3–5.0]. |
| Spent Hydrorefining Catalyst. | 1.7 [0.8–4.2] | 13.0 [9.3–18.4] | 4.4 [2.1–8.8] | 4.4 [2.1–8.8] | 4.4 [2.1–8.8]. |
| RCRA Administrative Costs. | 0.6 [0.4–0.7] | 0.6 [0.4–0.8] | 0.9 [0.7–1.1] | 0.6 [0.4–0.8] | 0.6 [0.4–0.8]. |
| Total | 9.4 [4.8–17.9] | 68.4 [36.5–113.0] | 45.3 [23.6–76.1] | 24.4 [11.8–43.3] | 34.1 [16.5–59.6]. |

¹ Cost uncertainty (Low-High) is estimated using a +/-50% adjustment of any estimated quantities and a +/-25% adjustment of any estimated costs. Management practices and transportation unit costs were provided in the 1992 RCRA 3007 Questionnaire responses. If unit costs were not reported, an industry-based average unit cost was used. If data were not available to derive an industry-based average, EPA estimated a unit cost for the management practice based on previous listing determinations, land disposal restrictions analyses, and engineering cost documents. Compliance management practice, transportation, and RCRA administrative unit costs, prices, and cost equations were obtained from industry-based averages derived from the 1992 RCRA 3007 Questionnaire, previous listing determinations and land disposal restrictions analyses, and engineering cost documents.

² In the analysis, 1992 costs were inflated to 1997 dollars using an inflation factor of 1.11657. The inflation factor is based on Engineering News-Record construction (25% weighted) and common labor (75% weighted) cost indexes. The inflation factor is weighted towards labor factors because compliance costs are more operational in function. Costs are annualized assuming a discounted rate of 7% over a 20-year period.

³ On-site incinerators are assumed only for those facilities that manage a large enough quantity of waste so that an on-site incinerator is more economical for the facility and which are currently in the RCRA program. All other facilities are assumed to continue managing wastes off-site.

⁴ All crude oil storage tank sediment (K169) and CSO sediment (K170) wastes are assumed to be de-oiled in the cost estimate. The recovered oil is recycled back into process units. For those refineries that reported oil recovery fractions, that data were used. For refineries that did not provide data, using an industry average for crude oil storage tank sediment (K169) and CSO sediment (K170), 60 percent of the quantity entering the filtration unit is assumed to be recovered as oil and the remaining 40 percent goes on for further management. Of the remaining de-oiled sediment quantity (i.e., 40 percent fraction), 65 percent is assumed to be recycled into coking units. The remaining 35 percent is subject to Subtitle C management. If crude oil storage tank sediment (K169) and CSO sediment (K170) are recycled into coking units, they are assumed to be subject to the oil-bearing exclusion. Therefore, all storage, treatment, and transportation of these wastes are not subject to RCRA Subtitle C regulation. Option 1 reflects management of crude oil storage tank sediment (K169) and CSO sediment (K170) in coking units owned by any company (i.e., "not same company"). Option 2 reflects management of crude oil storage tank sediment (K169) and CSO sediment (K170) in coking units as an option only within those companies that own them (i.e., "same company").

B. Details of Industry Economic Impact

As noted, a partial equilibrium model was used to estimate primary and secondary impacts from implementation of the listings. Primary economic

impacts include changes in market equilibrium price and output levels, changes in the value of shipments or revenues to domestic producers, and plant closures. Secondary impacts

include changes in employment, use of energy inputs, balance of trade, and regional refinery distribution. Impacts associated with the two Oil-Bearing Exclusion compliance scenarios will fall

between the range of primary and secondary economic impacts predicted for the Listing and LDR compliance scenarios as shown in Table X-2 (the low and high cost scenarios).

Predicted price increases and reductions in domestic output are less than 1 percent for the ten products evaluated under both the Listing and LDR compliance scenarios.³³ The projected 1992 price increase for the ten products combined ranges from 0.03 to 0.76 percent under the low- and high-cost scenarios, respectively.³⁴ Under the low- and high-cost scenarios, 1992 production is expected to decrease, ranging from 1.3 to 30.9 million barrels per year, representing a 0.02 to 0.59 percent decrease in annual production, respectively. The value of shipments or revenues for domestic producers are expected to increase for the ten products combined, ranging from \$9.0 to \$213 million (1992 dollars) annually for the low- and high-cost scenarios, respectively. This revenue increase results given that the percent increase in price exceeds the percent decrease in quantity for goods with inelastic demand. The model estimates that up to two refineries may close as a result of the predicted decrease in production under both regulatory scenarios. Those refineries with the highest per unit control costs are assumed to be marginal in the post-control market. No significant regional impacts are anticipated from implementation of the listings since only up to two facilities are anticipated to close and impacts overall are estimated to be minimal. Primary economic impacts are not anticipated to be significantly different in the later years of this decade and even beyond (even though 1992 data were used herein) in that the industry is mature and not one that changes often or dramatically absent an external shock.

Under the low- and high-cost scenarios, the number of workers employed in 1992 by firms in SIC 2911 are estimated to decrease ranging from 12 to 282 workers annually, representing a 0.03 and 0.59 percent

decrease in total employment, respectively. The small magnitude of predicted job loss directly results from the relatively small decrease in production anticipated and the relatively low labor intensity in the industry. An estimated decrease in energy use ranging from \$1.02 to \$24.32 million (\$1992) per year is expected for the industry, under the low- and high-cost scenarios, respectively. As production decreases, the amount of energy input utilized by the refining industry also declines. The change in energy use does not consider the increased energy use associated with operating and maintaining the regulatory control equipment due to the lack of available data. Finally, imposition of the listings will further increase the negative balance of trade. Under the low- and high-cost scenarios, net exports are anticipated to decline ranging from 0.2 to 4.7 million barrels per year, representing a 0.1 and 2.8 percent decline, respectively. The dollar value of the total decline in net exports ranges from \$6.35 to \$152.6 million (\$1992) per year. Given the magnitude of the estimated compliance costs, refineries are expected to incur minimal economic impacts. Secondary economic impacts are not anticipated to be significantly different in 1997.

Economic impacts may be slightly underestimated as a result of the following model input changes:

The economic analysis was based on a lower CSO sediment quantity estimate of 9,000 MT/yr managed in final management practices. This quantity was revised to 13,100 MT/yr. As a result, impacts for facilities generating this sediment are underestimated for all scenarios.

The regulatory options (i.e., waste management options) used to evaluate economic impacts differ slightly from those that were used to calculate the cost of compliance for the lower- and upper-bound LDR Scenarios, such that waste management costs were understated by \$3 and \$31 million (\$1992), respectively. As a result, economic impacts may be understated for the lower- and upper-bound LDR Scenarios. However, the Oil-Bearing Exclusion Scenario, with estimated costs from \$31 to \$67 million

(\$1992) and an expected value of \$45 million, fall within the range of costs used in the economic impact analysis for the LDR Scenarios. Therefore, the lower- and upper-bound LDR Scenarios bound the anticipated cost of the rule (i.e., the Oil-Bearing Exclusion Scenario).

Economic impacts may be overestimated as a result of the following model assumptions:

The model assumes that all refineries compete in a national market. In reality, some refineries are protected from market fluctuations by regional or local trade barriers and may therefore be less likely to feel impact.

The total cost of compliance is assigned exclusively to ten petroleum products, rather than the entire product slate for each refinery.

Some refineries may find it profitable to expand production in the post-control market. This would occur when a firm found its post-control incremental unit cost to be smaller than the post-control market price. Expansion by these firms would result in a smaller decrease in output and increase in price than otherwise would occur.

The economic analysis was initially based on the listing of five waste streams including unleaded gasoline sediment, which has since been removed from the list of wastes included in this listing determination. As a result, economic impacts for the 98 facilities generating unleaded gasoline sediment will be overestimated.

With the combined effects of analyzing five waste streams and using a lower CSO sediment quantity and a less costly upper-bound LDR Scenario management option, the total cost of compliance for the Listing Scenario is understated by \$2 million and the lower-bound and upper-bound LDR Scenarios are understated by \$5 million and \$31 million (\$1992), respectively. As a result, economic impacts may be understated for the Listing and LDR Scenarios. However, as noted, economic impacts estimated for the Listing and LDR scenarios bound the anticipated economic impacts associated with the Oil-Bearing Exclusion Scenario.

Under any realistic set of assumptions associated with this listing, industry economic impact is likely to be very slight. The results of the economic impact analysis are summarized in Table X-3.

TABLE X-3.—SUMMARY OF ECONOMIC IMPACTS^{1, 2}

| Economic impacts | Listing scenario lower-bound | LDR scenario lower-bound | LDR scenario upper-bound |
|--|------------------------------|--------------------------|--------------------------|
| Primary Economic Impacts | | | |
| Average Price Increase: Over All Products | 0.03% | 0.08% | 0.76% |

³³The ten petroleum products include ethane/ethylene, butane/butylene, normal butane/butylene, isobutane/isobutylene, finished motor gasoline, jet

fuel, distillate and residual fuel oil, asphalt, and petroleum coke.

³⁴ Similar percentage increases would apply to current prices.

TABLE X-3.—SUMMARY OF ECONOMIC IMPACTS ^{1, 2}—Continued

| Economic impacts | Listing scenario lower-bound | LDR scenario lower-bound | LDR scenario upper-bound |
|-----------------------------------|------------------------------|--------------------------|--------------------------|
| Annual Production Decrease: | | | |
| Amount (MMbbl) | (1.3) | (3.27) | (30.93) |
| Percentage Change | (0.03%) | (0.06%) | (0.59%) |
| Annual Value of Shipments | | | |
| Amount (MM\$92) | \$9.0 | \$22.59 | \$213.34 |
| Percentage Change | 0.01% | 00.02% | 0.16% |
| Number of Plant Closures | 0-2 | 0-2 | 0-2 |
| Secondary Economic Impacts | | | |
| Annual Job Loss:. | | | |
| Number | (12) | (30) | (282) |
| Percentage Change | (0.03%) | (0.06%) | (0.59%) |
| Annual Decrease In Energy Use: | | | |
| Amount (MM\$92) | (\$1.02) | (\$2.57) | (\$24.32) |
| Percentage Change | (0.03%) | (0.06%) | (0.59%) |
| Annual Net Foreign Trade Loss: | | | |
| Amount (MMbbl) | (0.20) | (0.49) | (4.70) |
| Percentage Change | (0.12%) | (0.3%) | (2.8%) |
| Dollar Value (\$/MMbbl) | (\$6.35) | (\$15.96) | (\$152.60) |

¹ Assumes listing of five waste streams: crude oil storage tank sediment, clarified slurry oil sediment, unleaded tank sediment, spent hydrotreating catalyst, and spent hydrorefining catalyst. Unleaded tank sediment was not listed. Impact will be reduced with four.

² The analysis was conducted using 1992 cost and price data. Costs and prices were not inflated to 1997 dollars and the economic impact analysis was not revised because the economic impacts are not anticipated to change significantly. Anticipated costs with the granting of a oil-bearing exclusion fall within the range used in the economic impact analysis.

XI. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) of 1980 as amended by SBREFA requires Federal agencies to consider "small entities" throughout the regulatory process. EPA policy suggests that an initial screening analysis be performed to determine whether small entities will be affected by the regulation. If affected small entities are identified, regulatory alternatives should be considered which mitigate the potential impacts. Small entities as described in the Act are only those "businesses, organizations and governmental jurisdictions subject to regulation." In addition, the Agency must prepare an IRFA, unless the head of the Agency certifies that the rule will not have a *significant* impact on a *substantial* number of small entities.

The Small Business Administration (SBA) size standards criteria apply to firm size, whereas the economic impact analysis for this rulemaking was conducted at the facility level (i.e., refinery level). Few companies employ more than 1,500 employees, and data on the number of employees at company level were much less readily available than were capacity data. For single-plant firms, the SBA criteria were applied directly. For firms (i.e.,

companies) owning more than one refinery, crude capacity was aggregated for all plants (i.e., refineries) to determine the overall size of the company.³⁵ Despite the high percentage of small entities in the population of refinery companies affected by the listing determination, anticipated impacts as a result of implementation of the listings were minimal, with a maximum of two plant closures predicted under the most conservative assumptions used in each of the scenarios evaluated.

Of the 66 affected companies, 32 entities fit the definition of a small entity as defined by the RFA. Table XI-1 presents the estimated annualized incremental compliance costs borne by the 32 small businesses in the petroleum refining industry. The annual incremental cost of the rule for the 32 facilities ranged from \$4,566 to \$11.8

³⁵ According to "EPA Guidelines for Implementing the Regulatory Flexibility Act" (February, 1997) and the Small Business Size Regulations (13 CFR 121), any refinery that produces petroleum products (SIC 2911) of less than or equal to 75,000 barrels of crude per day and has no more than 1,500 employees, constitutes a "small entity." The Agency believes that none of the entities which would incur incremental compliance costs as a result of this rulemaking produce more than 75,000 barrels and have less than 1,500 employees.

million (1992 dollars). For each of the 32 facilities impacted, these annual costs constitute less than 0.96 percent of total annual sales. EPA believes that these costs do not represent a significant impact. Hence, pursuant to section 605(b) of the RFA, 5 U.S.C. 605(b), the Administrator certifies that this rule will not have a significant economic impact on a substantial number of small entities.

XII. Submission to Congress and the General Accounting Office

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. This action is not a "major rule" as defined by 5 U.S.C. § 804(2). This rule will be effective six months from the date of publication.

TABLE XI-1.—RESULTS OF THE REGULATORY FLEXIBILITY ANALYSIS ^(a)

| Summary of economic impacts on small entities | | | |
|--|------------------------------|--------------------------|--------------------------|
| | Listing scenarios | LDR scenario lower bound | LDR scenario upper-bound |
| Range of Annualized Compliance Costs | \$4,566–\$305,379 | \$4,556–\$7,561,781 | \$4,556–\$11,765,904 |
| Range of Annual Company Refinery Sales | \$19,377,340–\$1,218,936,710 | | |
| Range of Annualized Compliance Costs as a Percentage of Company Refinery Sales | 0.001%–0.236% | 0.001%–0.620% | 0.001%–0.965% |

^(a) The analysis was conducted using 1992 cost and price data. Costs and prices were not inflated to 1997 dollars and the analysis was not revised because the anticipated impacts would still be insignificant.

XIII. Unfunded Mandates

Under section 202 of the Unfunded Mandates Reform Act of 1995 (“UMRA”) signed into law on March 22, 1995, The EPA must prepare a statement to accompany any rule where the estimated costs to State, local, or tribal governments, or to the private sector, will be \$100 million or more in any one year. Section 203 requires the EPA to establish a plan for informing and advising any small governments that may be significantly or uniquely impacted by the rule.

Under section 205, agencies also must develop a process to permit elected State, local, and tribal government officials to provide “meaningful and timely input” into the development of regulatory proposals “containing significant intergovernmental mandates.” In addition, agencies must consider a “reasonable number of regulatory alternatives” and select the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule, unless the provisions of the alternative are inconsistent with the law or an explanation is provided by the head of the affected agency.

EPA has determined that this rule does not include a Federal mandate that may result in estimated costs of \$100 million or more to either State, local, or tribal governments in the aggregate or to the private sector. The rule would not impose any Federal intergovernmental mandate because it imposes no enforceable duty upon State, tribal, or local governments. States, tribes, and local governments would have no compliance costs under this rule, which applies only to facilities managing the listed petroleum production wastes. It is expected that States will adopt similar rules and submit those rules for inclusion in their authorized RCRA programs, but they have no legally enforceable duty to do so. For the same reasons, EPA also has determined that this rule contains no regulatory requirements that might significantly or uniquely affect small governments.

In addition, as discussed above, the private sector is not expected to incur costs exceeding \$100 million in any one year. The upper-bound of the range of potential average annual costs is estimated to be \$60 million (\$1997) with the granting of an oil-bearing exclusion, considerably below the \$100 million annual threshold. The Agency believes that this average annual cost represents the typical cost for any given year and that this rulemaking will not result in a spike in annual cost that might rise above \$100 million in any given year above for the following reasons. First, compliance with these new requirements does not involve significant capital costs which could generate such a spike. Treatment and disposal capacity for these wastes already exist and the typical costs incurred come from treatment and disposal on a routine basis. Second, waste generation rates for these wastes are expected to be relatively constant over time. No significant surge in generation of the wastes listed in this rule involving a concomitant increase in costs are anticipated.

XIV. Paperwork Reduction Act

This rule does not contain any new information collection requirements subject to OMB review under the Paperwork Reduction Act of 1995, 44 U.S.C. 3501 *et seq.* Facilities will have to comply with the existing Subtitle C recordkeeping and reporting requirements for the newly listed waste streams.

To the extent that this rule imposes any information collection requirements under existing RCRA regulations promulgated in previous rulemakings, those requirements have been approved by the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and have been assigned OMB control numbers 2050–0009 (ICR no. 1573, Part B Permit Application, Permit Modifications, and Special Permits); 2050–0120 (ICR 1571, General Facility Hazardous Waste Standards); 2050–0028 (ICR 261, Notification of

Hazardous Waste Activity); 2050–0034 (ICR 262, RCRA Hazardous Waste Permit Application and Modification, Part A); 2050–0039 (ICR 801, Requirements for Generators, Transporters, and Waste Management Facilities under the Hazardous Waste Manifest System); 2050–0035 (ICR 820, Hazardous Waste Generator Standards); and 2050–0024 (ICR 976, 1997 Hazardous Waste Report.

Release reporting required as a result of listing wastes as hazardous substances under CERCLA and adjusting the RQs has been approved under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and has been assigned OMB control number 2050–0046 (ICR 1049, Notification of Episodic Release of Oil and Hazardous Substances).

XV. National Technology Transfer and Advancement Act

Under Section 12(d) of the National Technology Transfer and Advancement Act, the Agency is directed to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, business practices, etc.) that are developed or adopted by voluntary consensus standard bodies. Where available and potentially applicable voluntary consensus standards are not used by EPA, the Act requires the Agency to provide Congress, through the OMB, an explanation of the reasons for not using such standards.

This rule does not establish any new technical standards and thus, the Agency has no need to consider the use of voluntary consensus standards in developing this final rule.

XVI. Executive Order 13045—Protection of Children From Environmental Health Risks and Safety Risks

The Executive Order 13045 is entitled “Protection of Children from

Environmental Health Risks and safety Risks (62 FR 19885, April 23, 1997). This Order applies to any rule that EPA determines (1) is "economically significant" as defined under Executive Order 12866, and (2) the environmental health or safety risk addressed by the rule has a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency. This final rule is not subject to E.O. 13045 because this is not an economically significant regulatory action as defined by E.O. 12866.

List of Subjects

40 CFR Part 148

Administrative practice and procedure, Hazardous waste, Reporting and recordkeeping requirements, Water supply.

40 CFR Part 261

Environmental protection, Hazardous waste, Recycling, Reporting and recordkeeping requirements.

40 CFR Part 266

Environmental protection, Boilers and industrial furnaces, Energy, Hazardous waste, Recycling, Reporting and recordkeeping requirements.

40 CFR Part 268

Environmental protection, Hazardous waste, Reporting and recordkeeping requirements.

40 CFR Part 271

Environmental protection, Administrative practice and procedure, Confidential business information, Hazardous materials transportation, Hazardous waste, Indians-lands, Intergovernmental relations, Penalties, Reporting and recordkeeping requirements, Water pollution control, Water supply.

40 CFR Part 302

Environmental protection, Air pollution control, Chemicals, Hazardous substances, Hazardous waste, Intergovernmental relations, Natural resources, Reporting and recordkeeping requirements, Superfund, Water pollution control, Water supply.

Dated: June 29, 1998.

Carol M. Browner,
Administrator.

For the reasons set out in the preamble, title 40, chapter I, of the Code

of Federal Regulations is amended as follows:

PART 148—HAZARDOUS WASTE INJECTION RESTRICTIONS

1. The authority citation for part 148 continues to read as follows:

Authority: Secs. 3004, Resource Conservation and Recovery Act, 42 U.S.C. 6901 *et seq.*

2. Section 148.18 is amended by adding paragraph (i) to read as follows:

§ 148.18 Waste specific prohibitions—newly listed and identified Wastes.

(i) Effective February 8, 1999, the wastes specified in 40 CFR 261.32 as EPA Hazardous Waste Numbers K169, K170, K171, and K172 are prohibited from underground injection.

PART 261—IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

3. The authority citation for part 261 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, 6922, 6924(y), and 6938.

4. Section 261.3 is amended by revising paragraphs (a)(2)(iv)(C) and (c)(2)(ii)(B); and by adding paragraph (c)(2)(ii)(E) to read as follows.

§ 261.3 Definition of hazardous waste.

(a) * * *
(2) * * *
(iv) * * *
(C) One of the following wastes listed in § 261.32, provided that the wastes are discharged to the refinery oil recovery sewer before primary oil/water/solids separation—heat exchanger bundle cleaning sludge from the petroleum refining industry (EPA Hazardous Waste No. K050), crude oil storage tank sediment from petroleum refining operations (EPA Hazardous Waste No. K169), clarified slurry oil tank sediment and/or in-line filter/separation solids from petroleum refining operations (EPA Hazardous Waste No. K170), spent hydrotreating catalyst (EPA Hazardous Waste No. K171), and spent hydrorefining catalyst (EPA Hazardous Waste No. K172); or

(c) * * *
(2) * * *
(ii) * * *

(B) Waste from burning any of the materials exempted from regulation by § 261.6(a)(3)(iii) and (iv).

(E) Catalyst inert support media separated from one of the following wastes listed in § 261.32—Spent hydrotreating catalyst (EPA Hazardous

Waste No. K171), and Spent hydrorefining catalyst (EPA Hazardous Waste No. K172).

5. In § 261.4, new paragraphs (a)(18) and (a)(19) are added, and paragraph (a)(12) is revised to read as follows:

§ 261.4 Exclusions.

(a) * * *
(12) (i) Oil-bearing hazardous secondary materials (i.e., sludges, byproducts, or spent materials) that are generated at a petroleum refinery (SIC code 2911) and are inserted into the petroleum refining process (SIC code 2911—including, but not limited to, distillation, catalytic cracking, fractionation, or thermal cracking units (i.e., cokers)) unless the material is placed on the land, or speculatively accumulated before being so recycled. Materials inserted into thermal cracking units are excluded under this paragraph, provided that the coke product also does not exhibit a characteristic of hazardous waste. Oil-bearing hazardous secondary materials may be inserted into the same petroleum refinery where they are generated, or sent directly to another petroleum refinery, and still be excluded under this provision. Except as provided in paragraph (a)(12)(ii) of this section, oil-bearing hazardous secondary materials generated elsewhere in the petroleum industry (i.e., from sources other than petroleum refineries) are not excluded under this section. Residuals generated from processing or recycling materials excluded under this paragraph (a)(12)(i), where such materials as generated would have otherwise met a listing under subpart D of this part, are designated as F037 listed wastes when disposed of or intended for disposal.

(ii) Recovered oil that is recycled in the same manner and with the same conditions as described in paragraph (a)(12)(i) of this section. Recovered oil is oil that has been reclaimed from secondary materials (including wastewater) generated from normal petroleum industry practices, including refining, exploration and production, bulk storage, and transportation incident thereto (SIC codes 1311, 1321, 1381, 1382, 1389, 2911, 4612, 4613, 4922, 4923, 4789, 5171, and 5172.) Recovered oil does not include oil-bearing hazardous wastes listed in subpart D of this part; however, oil recovered from such wastes may be considered recovered oil. Recovered oil does not include used oil as defined in 40 CFR 279.1.

* * * * *

(18) Petrochemical recovered oil from an associated organic chemical manufacturing facility, where the oil is to be inserted into the petroleum refining process (SIC code 2911) along with normal petroleum refinery process streams, provided:

(i) The oil is hazardous only because it exhibits the characteristic of ignitability (as defined in § 261.21) and/or toxicity for benzene (§ 261.24, waste code D018); and

(ii) The oil generated by the organic chemical manufacturing facility is not placed on the land, or speculatively accumulated before being recycled into the petroleum refining process. An "associated organic chemical manufacturing facility" is a facility where the primary SIC code is 2869, but

where operations may also include SIC codes 2821, 2822, and 2865; and is physically co-located with a petroleum refinery; and where the petroleum refinery to which the oil being recycled is returned also provides hydrocarbon feedstocks to the organic chemical manufacturing facility. "Petrochemical recovered oil" is oil that has been reclaimed from secondary materials (i.e., sludges, byproducts, or spent materials, including wastewater) from normal organic chemical manufacturing operations, as well as oil recovered from organic chemical manufacturing processes.

(19) Spent caustic solutions from petroleum refining liquid treating processes used as a feedstock to produce cresylic or naphthenic acid unless the

material is placed on the land, or accumulated speculatively as defined in § 261.1(c).

* * * * *

§ 261.6 [Amended]

6. In § 261.6, paragraph (a)(3)(iv)(C) is amended by removing ";" and" at the end of the paragraph and adding a period in its place; and paragraph (a)(3)(v) is removed.

7. In § 261.31(a), the table is amended by revising the entry for F037, to read as follows:

§ 261.31 Hazardous wastes from non-specific sources.

(a) * * *

| Industry and EPA hazardous waste No. | Hazardous waste | Hazard code |
|--------------------------------------|--|-------------|
| * * * * * | | |
| F037 | Petroleum refinery primary oil/water/solids separation sludge-Any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather flow, sludge generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges generated in aggressive biological treatment units as defined in § 261.31(b)(2) (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and K051 wastes are not included in this listing. This listing does include residuals generated from processing or recycling oil-bearing hazardous secondary materials excluded under § 261.4(a)(12)(i), if those residuals are to be disposed of. | (T) |
| * * * * * | | |

8. In § 261.32, the table is amended by adding in alphanumeric order (by the first column) the following waste streams to the subgroup "Petroleum refining" to read as follows:

§ 261.32 Hazardous wastes from specific sources.

| Industry and EPA hazardous waste No. | Hazardous waste | Hazard code |
|--------------------------------------|--|-------------|
| * * * * * | | |
| Petroleum refining: | | |
| * * * * * | | |
| K169 | Crude oil storage tank sediment from petroleum refining operations | (T) |
| K170 | Clarified slurry oil tank sediment and/or in-line filter/separation solids from petroleum refining operations | (T) |
| K171 | Spent Hydrotreating catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic reactors (this listing does not include inert support media). | (I,T) |
| K172 | Spent Hydrorefining catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic reactors (this listing does not include inert support media). | (I,T) |
| * * * * * | | |

9. Appendix VII to Part 261 is amended by adding the following waste streams in alphanumeric order (by the first column) to read as follows.

APPENDIX VII TO PART 261—BASIS FOR LISTING HAZARDOUS WASTE

| EPA hazard-ous waste No. | Hazardous constituents for which listed |
|--------------------------|--|
| K169 | Benzene. |
| K170 | Benzo(a)pyrene, dibenz(a,h)anthracene, benzo (a) anthracene, benzo (b)fluoranthene, benzo(k)fluoranthene, 3-methylcholanthrene, 7, 12-dimethylbenz(a)anthracene. |
| K171 | Benzene, arsenic. |
| K172 | Benzene, arsenic. |

PART 266—STANDARDS FOR THE MANAGEMENT OF SPECIFIC HAZARDOUS WASTES AND SPECIFIC TYPES OF HAZARDOUS WASTE MANAGEMENT FACILITIES

The authority citation for part 266 is revised to read as follows:

Authority: 42 U.S.C. 1006, 2002(a), 3004, and 3014, 6905, 6906, 6912, 6922, 6924, 6925, and 6937.

11. Section 266.100(b)(3) is revised to read as follows:

§ 266.100 Applicability.

(b) * * *

(3) Hazardous wastes that are exempt from regulation under §§ 261.4 and 261.6(a)(3) (iii) and (iv) of this chapter, and hazardous wastes that are subject to the special requirements for conditionally exempt small quantity generators under § 261.5 of this chapter; and

PART 268—LAND DISPOSAL RESTRICTIONS

12. The authority citation for part 268 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, and 6924.

Subpart C—Prohibitions on Land Disposal

13. Section 268.35 is added to subpart C to read as follows:

§ 268.35 Waste specific prohibitions-petroleum refining wastes.

(a) Effective February 8, 1999, the wastes specified in 40 CFR part 261 as EPA Hazardous Wastes Numbers K169, K170, K171, and K172, soils and debris contaminated with these wastes, radioactive wastes mixed with these hazardous wastes, and soils and debris contaminated with these radioactive mixed wastes, are prohibited from land disposal.

(b) The requirements of paragraph (a) of this section do not apply if:

(1) The wastes meet the applicable treatment standards specified in Subpart D of this part;

(2) Persons have been granted an exemption from a prohibition pursuant to a petition under § 268.6, with respect to those wastes and units covered by the petition;

(3) The wastes meet the applicable treatment standards established pursuant to a petition granted under § 268.44;

(4) Hazardous debris that have met treatment standards in § 268.40 or in the alternative treatment standards in § 268.45; or

(5) Persons have been granted an extension to the effective date of a prohibition pursuant to § 268.5, with respect to these wastes covered by the extension.

(c) To determine whether a hazardous waste identified in this section exceeds the applicable treatment standards specified in § 268.40, the initial generator must test a sample of the waste extract or the entire waste, depending on whether the treatment standards are expressed as concentrations in the waste extract or the waste, or the generator may use knowledge of the waste. If the waste contains constituents in excess of the applicable Universal Treatment

Standard levels of § 268.48, the waste is prohibited from land disposal, and all requirements of this part are applicable, except as otherwise specified.

Subpart D—Treatment Standards

14. In § 268.40, the Table of Treatment Standards is amended by adding in alphanumeric order new entries for K169, K170, K171, and K172 to read as follows. The appropriate footnotes to the Table of Treatment Standards are republished without change.

§ 268.40 Applicability of treatment standards.

* * * * *

TREATMENT STANDARDS FOR HAZARDOUS WASTES

[Note: NA means not applicable]

| Waste code | Waste description and treatment/ regulatory subcategory ¹ | Regulated hazardous constituent | | Wastewaters | Nonwastewaters |
|------------|--|---------------------------------|----------------------|--|--|
| | | Common Name | CAS ² No. | Concentration in mg/L ³ ; or tech- nology code ⁴ | Concentration in mg/kg ⁵ unless noted as "mg/L TCLP"; or tech- nology code ⁴ |
| K169 | Crude oil tank sediment from petroleum refining operations. | Benz(a)anthracene | 56-55-3 | 0.059 | 3.4 |
| | | Benzene | 71-43-2 | 0.14 | 10 |
| | | Benzo(g,h,i)perylene | 191-24-2 | 0.0055 | 1.8 |
| | | Chrysene | 218-01-9 | 0.059 | 3.4 |
| | | Ethyl benzene | 100-41-4 | 0.057 | 10 |
| | | Fluorene | 86-73-7 | 0.059 | 3.4 |
| | | Naphthalene | 91-20-3 | 0.059 | 5.6 |
| | | Phenanthrene | 81-05-8 | 0.059 | 5.6 |
| | | Pyrene | 129-00-0 | 0.067 | 8.2 |
| | | Toluene (Methyl Benzene) | 108-88-3 | 0.080 | 10 |
| | | Xylene(s) (Total) | 1330-20-7 | 0.32 | 30 |
| K170 | Clarified slurry oil sediment from petroleum refining operations. | Benz(a)anthracene | 56-55-3 | 0.059 | 3.4 |
| | | Benzene | 71-43-2 | 0.14 | 10 |
| | | Benzo(g,h,i)perylene | 191-24-2 | 0.0055 | 1.8 |
| | | Chrysene | 218-01-9 | 0.059 | 3.4 |
| | | Dibenz(a,h)anthracene | 53-70-3 | 0.055 8.2. | |
| | | Ethyl benzene | 100-41-4 | 0.057 | 10 |
| | | Fluorene | 86-73-7 | 0.059 | 3.4 |
| | | Indeno(1,2,3-cd)pyrene | 193-39-5 | 0.0055 | 3.4 |
| | | Naphthalene | 91-20-3 | 0.059 | 5.6 |
| | | Phenanthrene | 81-05-8 | 0.059 | 5.6 |
| | | Pyrene | 129-00-0 | 0.067 | 8.2 |
| | | Toluene (Methyl Benzene) | 108-88-3 | 0.080 | 10 |
| | | Xylene(s) (Total) | 1330-20-7 | 0.32 | 30 |
| K171 | Spent hydrotreating catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic reactors (this listing does not include inert support media). | Benz(a)anthracene | 56-55-3 | 0.059 | 3.4 |
| | | Benzene | 71-43-2 | 0.14 | 10 |
| | | Chrysene | 218-01-9 | 0.059 | 3.4 |
| | | Ethyl benzene | 100-41-4 | 0.057 | 10 |
| | | Naphthalene | 91-20-3 | 0.059 | 5.6 |
| | | Phenanthrene | 81-05-8 | 0.059 | 5.6 |
| | | Pyrene | 129-00-0 | 0.067 | 8.2 |
| | | Toluene (Methyl Benzene) | 108-88-3 | 0.080 | 10 |
| | | Xylene(s) (Total) | 1330-20-7 | 0.32 | 30 |
| | | Arsenic | 7740-38-2 | 1.4 | 5 mg/L TCLP |
| | | Nickel | 7440-02-0 | 3.98 | 11.0 mg/L TCLP |
| | | Vanadium | 7440-62-2 | 4.3 | 1.6 mg/L TCLP |
| | | Reactive sulfides | NA | DEACT | DEACT |
| K172 | Spent hydrorefining catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic reactors (this listing does not include inert support media). | Benzene | 71-43-2 | 0.14 | 10 |
| | | Ethyl benzene | 100-41-4 | 0.057 | 10 |
| | | Toluene (Methyl Benzene) | 108-88-3 | 0.080 | 10 |
| | | Xylene(s) (Total) | 1330-20-7 | 0.32 | 30 |
| | | Antimony | 7740-36-0 | 1.9 | 1.15 mg/L TCLP |
| | | Arsenic | 7740-38-2 | 1.4 | 5 mg/L TCLP |
| | | Nickel | 7440-02-0 | 3.98 | 11.0 mg/L TCLP |
| | | Vanadium | 7440-62-2 | 4.3 | 1.6 mg/L TCLP |
| | | Reactive Sulfides | NA | DEACT | DEACT |

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

[Note: NA means not applicable]

| Waste code | Waste description and treatment/regulatory subcategory ¹ | Regulated hazardous constituent | | Wastewaters | Nonwastewaters |
|------------|---|---------------------------------|----------------------|--|--|
| | | Common Name | CAS ² No. | Concentration in mg/L ³ ; or technology code ⁴ | Concentration in mg/kg ⁵ unless noted as "mg/L TCLP"; or technology code ⁴ |
| * | * | * | * | * | * |

¹ The waste descriptions provided in this table do not replace waste descriptions in 40 CFR part 261. Descriptions of Treatment/Regulatory Subcategories are provided, as needed, to distinguish between applicability of different standards.

² CAS means Chemical Abstract Services. When the waste code and/or regulated constituents are described as a combination of a chemical with its salts and/or esters, the CAS number is given for the parent compound only.

³ Concentration standards for wastewaters are expressed in mg/L and are based on analysis of composite samples.

⁴ All treatment standards expressed as a Technology Code or combination of Technology Codes are explained in detail in 40 CFR 268.42 Table 1—Technology Codes and Descriptions of Technology-Based Standards.

⁵ Except for Metals (EP or TCLP) and Cyanides (Total and Amenable) the nonwastewater treatment standards expressed as a concentration were established, in part, based upon incineration in units operated in accordance with the technical requirements of 40 CFR part 264, Subpart O or part 265 Subpart O, or based upon combustion in fuel substitution units operating in accordance with applicable technical requirements. A facility may comply with these treatment standards according to provisions in 40 CFR 268.40(d). All concentration standards for nonwastewaters are based on analysis of grab samples.

PART 271—REQUIREMENTS FOR AUTHORIZATION OF STATE HAZARDOUS WASTE PROGRAMS

15. The authority citation for part 271 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), and 6926.

Subpart A—Requirements for Final Authorization

16. Section 271.1(j) is amended by adding the following entries to Table 1 in chronological order by date of publication in the **Federal Register**, and

by adding the following entries to Table 2 in chronological order by effective date in the **Federal Register**, to read as follows:

§ 271.1 Purpose and scope.

(j) * * *

TABLE 1.—REGULATIONS IMPLEMENTING THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

| Promulgation date | Title of regulation | Federal Register reference | Effective date |
|-------------------|-----------------------------------|----------------------------|-------------------|
| August 6, 1998 | Petroleum Refining Process Wastes | [Insert FR page numbers] | February 8, 1999. |

TABLE 2.—SELF-IMPLEMENTING PROVISIONS OF THE SOLID WASTE AMENDMENTS OF 1984

| Effective date | Self-implementing provision | RCRA citation | Federal Register reference |
|------------------|--|-----------------------------|---|
| February 8, 1999 | Prohibition on land disposal of newly listed and identified wastes; and prohibition on land disposal of radioactive waste mixed with the newly listed or identified wastes, including soil and debris. | 3004(g)(4) (C) and 3004 (m) | August 6, 1998. 63 FR [Insert page numbers] |

PART 302—DESIGNATION, REPORTABLE QUANTITIES, AND NOTIFICATION

17. The authority citation for part 302 continues to read as follows:

Authority: 42 U.S.C. 9602, 9603, and 9604; 33 U.S.C. 1321 and 1361.

18. In § 302.4, table 302.4 is amended by adding footnote f and the following new entries in alphanumerical order at the end of the table to read as follows:

§ 302.4 Designation of hazardous substances.

* * * * *

TABLE 302.4—LIST OF HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES

[NOTE: All Comments/Notes Are Located at the End of This Table]

| Hazardous substance | CASRN | Regulatory synonyms | Statutory | Code† | RCRA waste No. | Final RQ | |
|--|-------|---------------------|-----------|-------|----------------|----------|-------------|
| | | | RQ | | | Category | Pounds (Kg) |
| K169 [‡] Crude oil storage tank sediment from petroleum refining operations. | | | 1* | 4 | K169 | A | 10(4.54) |
| K170 [‡] Clarified slurry oil tank sediment and/or in-line filter/separation solids from petroleum refining operations. | | | 1* | 4 | K170 | X | 1 (0.454) |
| K171 [‡] Spent hydrotreating catalyst from petroleum refining operations. (This listing does not include inert support media.) | | | 1* | 4 | K171 | X | 1 (0.454) |
| K172 [‡] Spent hydrorefining catalyst from petroleum refining operations. (This listing does not include inert support media.) | | | 1* | 4 | K172 | X | 1 (0.454) |

† Indicates the statutory sources as defined by 1, 2, 3, and 4 below.

1*—Indicates that the 1-pound RQ is a CERCLA statutory RQ.

‡ See 40 CFR 302.6(b)(1) for application of the mixture rule to this hazardous waste.

19. Section 302.6 is amended by revising paragraphs (b)(1)(i) and (b)(1)(ii) and by adding paragraph (b)(1)(iii) to read as follows:

§ 302.6 Notification requirements.

* * * * *

(b) * * *

(1) * * *

(i) If the quantity of all of the hazardous constituent(s) of the mixture or solution is known, notification is required where an RQ or more of any hazardous constituent is released;

(ii) If the quantity of one or more of the hazardous constituent(s) of the mixture or solution is unknown, notification is required where the total amount of the mixture or solution

released equals or exceeds the RQ for the hazardous constituent with the lowest RQ; or

(iii) For waste streams K169, K170, K171, and K172, knowledge of the quantity of all of the hazardous constituent(s) may be assumed, based on the following maximum observed constituent concentrations identified by EPA:

| Waste | Constituent | Max ppm |
|------------|--|---------|
| K169 | Benzene | 220.0 |
| | Benzene | 1.2 |
| K170 | Benzo (a) pyrene | 230.0 |
| | Dibenz (a,h) anthracene | 49.0 |
| | Benzo (a) anthracene | 390.0 |
| | Benzo (b) fluoranthene | 110.0 |
| | Benzo (k) fluoranthene | 110.0 |
| | 3-Methylcholanthrene | 27.0 |
| | 7,12-Dimethylbenz (a) anthracene | 1,200.0 |
| | Benzene | 500.0 |
| K171 | Arsenic | 1,600.0 |
| | Benzene | 100.0 |
| K172 | Benzene | 100.0 |
| | Arsenic | 730.0 |

* * * * *