DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

49 CFR Parts 171, 172, 173, 174, 175, 176, 177 and 178

[Docket No. RSPA–99–6283 (HM–230)]

RIN 2137–AD40

Hazardous Materials Regulations; Compatibility With the Regulations of the International Atomic Energy Agency

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Final rule.

SUMMARY: In this final rule RSPA is amending requirements in the Hazardous Materials Regulations (HMR) pertaining to the transportation of radioactive materials based on changes contained in the International Atomic Energy Agency (IAEA) publication, entitled ''IAEA Safety Standards Series: Regulations for the Safe Transport of Radioactive Material,'' 1996 Edition, No. TS–R–1. The purpose of this rulemaking initiative is to harmonize requirements of the HMR with international standards for radioactive materials as well as to promulgate other DOT-initiated requirements.

DATES: *Effective Date:* The effective date of these amendments is October 1, 2004.

Voluntary Compliance Date: RSPA is authorizing voluntary compliance with the amendments adopted in this final rule beginning February 25, 2004. However, RSPA may further revise this rule as a result of appeals it may receive for this rule.

Incorporation by Reference Date: The incorporation by reference of publications listed in this final rule has been approved by the Director of the Federal Register as of October 1, 2004.

FOR FURTHER INFORMATION CONTACT: Dr. Fred D. Ferate II, Office of Hazardous Materials Technology, (202) 366–4545, or Charles E. Betts, Office of Hazardous Materials Standards, (202) 366–8553; RSPA, U.S. Department of Transportation, 400 Seventh Street SW., Washington, DC 20590–0001.

SUPPLEMENTARY INFORMATION:

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I. Background

In 1958, at the request of the Economic and Social Council of the United Nations, the IAEA undertook the development of international regulations for the safe transportation of radioactive materials. The initial regulations published by the IAEA in 1961 were recommended to member states as the basis for national regulations and for application to international transportation. Most nations have since adopted the IAEA regulations as a basis for regulations governing the transportation of radioactive materials.

In 1967, after extensive revisions, the IAEA published its regulations entitled ''Regulations for the Safe Transport of Radioactive Material, Safety Series No. 6.'' In October 1968, DOT published amendments to the Hazardous Materials Regulations (HMR; 49 CFR Parts 171–180) for radioactive materials which were in substantial conformance with the 1967 IAEA regulations (Docket HM–2, 33 FR 14918).

Based on work done by participants from member states, including the U.S., the IAEA issued two major updates of Safety Series No. 6 in 1973 and 1985. On March 10, 1983, the Research and Special Programs Administration (RSPA, we) published a final rule (Docket HM–169, 48 FR 10218), bringing the HMR requirements relating to the transportation of radioactive materials into alignment with the 1973 IAEA regulations. On September 28, 1995, we published a final rule (Docket HM–169A, 60 FR 50291) that revised the radioactive materials requirements in the HMR to align them with the 1985 revision of Safety Series No. 6. In each case, we coordinated the HMR revisions with the Nuclear Regulatory Commission (NRC), which concurrently revised 10 CFR part 71, and in each case these revisions made the United States radioactive material transport regulations compatible with those of most other industrialized nations.

In 1996, the IAEA revised and issued IAEA Safety Standards Series No. ST–1, (''ST–1''). IAEA subsequently revised ST–1 in June 2000 to include minor editorial changes and renamed it ''TS–R–1.'' In this final rule, we use the nomenclature ''TS–R–1'' to refer to the 1996 IAEA ''Regulations for the Safe Transport of Radioactive Material.'' Copies of TS–R–1 may be obtained from the U.S. distributor, Bernan Associates, 4611–F Assembly Drive, Lanham, MD 20706–4391, telephone (301) 459–7666.

As in past rulemakings to incorporate updates of the international regulations into the HMR, we are working in close cooperation with NRC in the development of this rulemaking. Currently, DOT and NRC jointly regulate the transportation of radioactive material in the United States in accordance with a July 2, 1979, Memorandum of Understanding (MOU; 44 FR 38690). In accordance with this MOU (a copy of which has been placed in the docket of this rulemaking):

1. DOT regulates both shippers and carriers and has issued:

- Packaging requirements;
- Communication requirements for:
  —Shipping paper contents,
  —Package labeling and marking requirements, and
  —Vehicle placarding requirements;
- Training and emergency response requirements; and
- Highway routing requirements.

2. NRC requires its licensees to satisfy requirements to protect public health and safety and to assure the common defense and security, and:

- Certifies Type B and fissile material package designs and approves package quality assurance programs for its licensees;
- Provides technical support to DOT and works with DOT to ensure consistency with respect to the transportation of radioactive materials; and
- Conducts inspections of licensees in accordance with DOT requirements.

This rulemaking is being coordinated by RSPA with NRC to ensure that consistent regulatory standards are maintained for radioactive material transportation regulations, and to ensure coordinated publication of rules by both agencies. This final rule addresses only the areas over which DOT has jurisdiction as defined in the MOU. Comments received on non-DOT issues or on DOT issues not in the scope of this rulemaking will not be addressed in this rule.

On December 28, 1999 (64 FR 72633), we published an advance notice of proposed rulemaking (ANPRM) requesting comments from interested persons concerning the extent to which differences between the HMR and the IAEA publication TS–R–1 should be considered in proposing changes to the HMR. We identified a partial list of TS–R–1 requirements being considered for incorporation in the HMR. We invited interested persons to review and comment on any or all of the requirements in TS–R–1 that differ from current HMR requirements and identify related issues we should address in the NPRM. In response to the ANPRM, we received approximately 80 written comments from trade associations, hazardous materials consulting firms, chemical manufacturers, radiopharmaceutical manufacturers, shippers and carriers of hazardous materials, and private citizens.

In addition, we compared TS–R–1 to the previous version of Safety Series No. 6 to identify changes made in TS–R–1, and then identified affected sections of the HMR. Based on this comparison and comments received from the ANPRM, we identified ten issues where increased compatibility between the HMR and TS–R–1 appears to be desirable.

On February 1, 2000, we published a final rule under Docket HM–215D (66 FR 8644), in which we adopted the International Maritime Dangerous Goods (IMDG) Code, 2000 edition, including Amendment 30–00 and the UN Recommendations on the Transport of Dangerous Goods, Eleventh Revised Edition (1999), both of which authorize the use of TS–R–1. We published a final rule on June 21, 2001 (66 FR 33315), which provided that TS–R–1 could be used, as an alternative to the HMR, for international shipments of radioactive materials. Additionally, we retained Safety Series No. 6 with the same restrictions.

This final rule will address the adoption of TS–R–1 (instead of Safety Series No. 6) requirements into the HMR for domestic use. On April 30, 2002, we published a notice of proposed rulemaking (NPRM) under Docket HM–230 (67 FR 21328). The major changes to the HMR proposed in the NPRM included the following:

(1) Adopt the nuclide-specific exemption activity concentrations and the nuclide-specific exemption consignment activities listed in TS–R–1 to assure continued consistency between domestic and international regulations for the basic definition of radioactive material;

(2) Adopt the new proper shipping names and UN identification numbers, except for those referring to Type C packages, to fissile low specific activity (LSA) materials or to fissile surface contaminated objects (SCO);

(3) Require, if customary units are to be used, that the appropriate quantity and customary units be placed within parentheses positioned after the original quantity expressed in the International System of Units (SI units);

(4) Incorporate the TS–R–1 changes for packagings containing more than 0.1 kg of UF_6;

(5) Authorize the use of the 1993 edition of International Organization for Standardization (ISO) 7195 as an alternative to American National Standards Institute (ANSI) N14.1, to require UF_6 packagings to meet the pressure, drop and thermal test requirements, to prohibit the use of pressure relief devices, and to certify the packagings in accordance with TS–R–1 requirements;

(6) Accept the IAEA transitional requirements and begin the phase-out of packages satisfying the 1967 IAEA requirements, including DOT specification packages; and

(7) Require that manufacture of all Type B specification packages conforming to Safety Series No. 6 (1967) be prohibited as of the date of implementation of this rule and that use of these packages be prohibited two years after implementation of this rule.

Those proposed changes were intended to harmonize requirements of the HMR with international standards for the transport of radioactive materials as well as to promulgate other DOT initiated requirements.

More than 150 commenters submitted over 200 comments in response to the NPRM, including representatives of Federal and state agencies, manufacturers, shippers, carriers, consultants, electric utilities, special interest groups, private citizens and trade associations.

II. Overview of Changes in This Final Rule

A. Summary of Amendments

In this final rule, we are amending the HMR to:

- Adopt the nuclide-specific exemption activity concentrations and the nuclide-specific exemption consignment activities listed in TS–R–1 to assure continued consistency between domestic and international regulations for the basic definition of radioactive material;
- Provide an exception in the HMR that certain naturally occurring radioactive materials would not be subject to the requirements of the HMR so long as their specific activities do not exceed 10 times the activity concentration exemption values;
- Incorporate the TS–R–1 changes in the A_1 and A_2 values into the HMR;
- Adopt the new proper shipping names and UN identification numbers, except for those referring to Type C packages, to fissile LSA material and to fissile SCOs;
- Require, if customary units are used, that the appropriate quantity and customary units be placed within parentheses positioned after the original quantity expressed in the International System of Units (SI units);
- Adopt the use of the Criticality Safety Index (CSI) to refer to what was formerly the criticality control transport index, and to restrict the use of the concept of transport index (TI) to a number derived purely from the maximum radiation level at one meter from the package;
- Require the new fissile label be placed on each fissile material package, and that the CSI for that package be noted on the fissile label;
- Adopt the requirement that excepted packages be marked with the UN identification number, that industrial packagings be marked with the package type, and that Type IP–2 and IP–3 industrial packages and Type A packages be marked with the international vehicle registration code of the country of origin of packaging design;
- Remove some former requirements which would become redundant upon adoption of the new proper shipping names, such as the requirement that the shipping description contain the words ''Radioactive Material'' unless those words are included in the proper shipping name;
- Remove plutonium-238 from the definition of fissile material. Remove the reference to Pu-238 in the list of fissile radionuclides for which the weight in grams or kilograms may be listed instead of or in addition to the activity, in the shipping paper or radioactive label description of the radioactive contents of a package;
- Adopt a definition of contamination, and include an authority to transport unpackaged LSA material and SCO, and an authority to use qualified tank containers, freight containers and metal intermediate bulk containers as industrial packagings, types 2 and 3 (IP–2 and IP–3);
- Adopt the new class of LSA–I material, consisting of radioactive

material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the activity concentration exemption level, and to remove the present category referring to mill tailings, contaminated earth, concrete, rubble, other debris, and activated material that is essentially uniformly distributed, with specific activity not exceeding 10^{-6} A_2/g.

- Incorporate the TS–R–1 changes for packagings containing more than 0.1 kg of uranium hexafluoride (UF_6);
- Require UF_6 packagings to meet the pressure, drop and thermal test requirements, to prohibit the use of pressure relief devices, and to certify the packagings in accordance with TS–R–1 requirements;
- Revise § 173.453 to reflect the NRC ''fissile material exemption provisions,'' to remove the definition of ''fissile material, controlled shipment,'' and to revise §§ 173.457 and 173.459 to remove the references to ''fissile material, controlled shipment'' and to base requirements for non-exclusive use and exclusive use shipments of fissile material packages on TS–R–1 package and conveyance CSI limits;
- Accept the IAEA transitional requirements and begin the phase out of packages satisfying the 1967 IAEA requirements, including DOT specification packages;
- Prohibit the manufacture of all Type B specification packages conforming to Safety Series No. 6 (1967) as of the effective date of this rule. The use of these packages would be allowed for three years after the effective date of this rule; and
- Add a requirement that the active material in an instrument or article intended to be transported in an excepted package be completely enclosed by the non-active components.

B. Issue Discussion

Issue 1: Nuclide-Specific Exemption Values

Background. In the April 30, 2002 NPRM, we proposed to adopt the nuclide-specific exemption activity concentrations and the nuclide-specific exemption consignment activities listed in TS–R–1. The objective of the proposal was to assure continued consistency between domestic and international regulations for the basic definition of Class 7 radioactive material, *i.e.*, of radioactive material which is deemed hazardous enough to be subject to the HMR.

The new exemption activity values would replace the previous activity concentration threshold of 70 becquerels per gram (2000 picocuries per gram)(70 Bq/g (2000 pCi/g)) that has long been used to decide whether a particular radioactive material is regulated by the HMR (*i.e.*, to decide whether it is ''radioactive for the purposes of transport'') the proposed exemption values include. This is in contrast to the previous use of a single threshold defined in terms of an activity concentration. In addition to nuclide-specific activity concentration thresholds proposed, nuclide-specific consignment activity thresholds such that consignments with activities below the latter thresholds would also not be considered ''radioactive for the purposes of transport.''

The considerations which led to the establishment of the exemption values, and the sources from which that information was obtained, are described in the NPRM. They included calculations carried out during the development of TS–R–1, involving 20 radionuclides, which represent radionuclides actually transported, to calculate the activity concentrations and the consignment activities that would not give an annual dose to transport workers of more than 0.01 millisievert (1.0 millirem), or 0.01 mSv (1.0 mrem) during a variety of transportation scenarios. This was done for each of the 20 radionuclides by determining for each of the approximately 24 scenarios (the number of scenarios varied somewhat, depending on the physical form of the radionuclide) the activity concentration and total activity that would yield an annual dose of 0.01 mSv (1.0 mrem), and then selecting the lowest of those activity concentrations and the lowest of those activities as the exemption values for that radionuclide. These activity concentrations and consignment activities were then compared with threshold activity concentrations and threshold activities that had previously been adopted for fixed facilities as a key element in the ''International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources,'' Safety Series No. 115, International Atomic Energy Agency, Vienna, 1996.

The IAEA's Standing Advisory Group on the Safe Transport of Radioactive Materials (SAGSTRAM, made up of representatives of a subset of IAEA member countries) had previously agreed that exemption values for transport different from those for fixed facilities would be adopted only if they were different by more than two orders of magnitude, so that to the extent possible, entities dealing with radioactive materials would not have to deal with two different sets of exemption (threshold) values.

The IAEA working groups decided to adopt the exemption values previously adopted in Safety Series No. 115 for fixed facilities because the exemption values calculated for the 20 radionuclides using the transport scenarios did not differ by more than two orders of magnitude. This finding was true for all radionuclides (except Kr-85, a noble gas, for which it was argued that because Kr-85 is not transported in such large containers as used in the scenarios, the scenarios used were overly conservative). For those radionuclides in the transport regulations not listed in Safety Series No. 115, transport exemption values were calculated using the Safety Series No. 115 methodology.

Using the Safety Series No. 115 exemption activity concentrations and the same transport scenarios, those performing the study calculated the annual worker dose averaged over the 20 previously examined radionuclides to be about 0.23 mSv (23 mrem). This compares with an average annual worker dose of about 0.50 mSv (50 mrem) if the same 20 radionuclides had been transported with an activity concentration of 70 becquerels/gram using the same transport scenarios.

In this final rule we are incorporating in the HMR the TS–R–1 nuclide-specific exemption values to specify when radioactive material is regulated as Class 7. According to this new definition, a radioactive material offered for transport is regulated as a Class 7 hazardous material only if both the activity concentration and the consignment activity are greater than the exemption values determined for that material.

Discussion. One commenter noted that the nuclide-specific exemption values, which are more closely dose related than a strictly activity-based system, are more defensible.

To assist the regulated community in correctly performing these calculations and for consistency another commenter requested that RSPA provide example calculations of the use of the various mixture formulas within the NPRM. To resolve doubts on how to apply the formulas for a specific scenario, any person may obtain help through one of the mechanisms described in § 105.20.

One commenter felt that the proposed changes in the exemption activity concentrations, and particularly the proposed default exemption values, do not appear to represent risk- or performance-based approaches and could negatively impact the overall safety of DOE activities. We believe that the proposed changes in the exemption activity concentrations do result in a risk-based approach since the dose equivalent received by a person is much more directly related to the risk than is the activity. Adherence to the criterion of limiting annual worker doses to 0.01 mSv (1.0 mrem) was balanced against the cost and safety implications of having to deal with two sets of exemption values, one for fixed facilities and another for transport. As a result of deciding to use the single set of exemption values derived for fixed facilities, the calculated dose and therefore the risk, was reduced by approximately a factor of two.

It is true that the exemption activity concentrations for most of the more commonly occurring alpha emitters have gone down from 70 Bq/g to 10 Bq/g or 1 Bq/g. In several of these cases, such as U(nat), Th(nat), or Ra-226, the number refers to the maximum activity concentration of the parent nuclide in the decay chain (assumed to be in secular equilibrium). Taking into account the activity concentrations of the progeny, the actual activity concentration thresholds for materials with these radionuclides will be higher.

With respect to the proposed default exemption values, paragraph 406.1 of IAEA Safety Guide TS–G–1.1 (ST–2), Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, IAEA, Vienna, 2002, indicates that the default values are the lowest possible values within the alpha or beta/gamma subgroups. In the case of the default activity concentration threshold of 1×10^{-1} Bq/g for alpha emitters and for the case when no relevant data are available, the only nuclide in TS–R–1 Table I which has an exemption activity concentration this low is Ac-227. If any person has reason to believe through process knowledge or other means that Ac-227 is not present, or if an upper bound can be placed on the fraction of total activity concentration which may be due to Ac-227, the next lowest alpha emitter exemption activity concentration of 1×10^0 Bq/g be used as the default value.

Several commenters recommended that we retain the threshold activity concentration of 70 Bq/g for domestic shipments. One of these commenters argued that the proposed change in the activity concentration exemption values would add significant delays and costs for Department of Energy waste site remediation efforts. The commenter cited past shipments of 98 railcars of soil from the DOE Savannah River Site that were shipped as non-radioactive for purposes of transport because the specific activity of the soil was less than 70 Bq/g, as determined by periodic gross alpha and gross beta measurements. The commenter stated that ''under the proposed regulations, the gross measurements would not provide sufficient confidence in the classification and some isotopic analyses [which would then be required] would require significant time to complete. Performing similar removal actions under the proposed regulations will result in delays and costs for isotopic analysis/confirmation as well as additional costs associated with shipping the material as Class 7. This additional time and expense will be incurred with no significant change in the risk presented by such shipments made in compliance with the current regulations.''

Just as gross alpha and beta measurements may not be sufficient with the new exemption values to determine whether the hazardous materials transport regulations apply, this has also been true in the past when determining whether the activity concentration was below 70 Bq/g. Gross counting measurements cannot yield the activity present until the isotopes and types of radiation, as well as the fractions of the counts caused by each isotope, are known. In cases where one or a few radionuclides are present, this information may be known through ''process knowledge'' or previous measurements, or both. If there are multiple isotopes present it is often not possible to determine this information without doing more lengthy and costly isotopic analyses.

In borderline cases, where some batches of a radioactive material have specific activities that exceed the exemption values and others do not, it may be simpler to determine whether any of the material exceeds the LSA–I limits. If not, the material could be treated conservatively and shipped as LSA–I. Although the material would now be transported under the HMR, the existing regulations for domestic shipments of LSA–I contain relatively modest communication and packaging requirements.

One commenter supported the proposal to adopt the radionuclide-specific exemption values. The commenter noted that of 2400 intermodal containers of decommissioning soil and debris shipped over a 38 month period, all would have had to be shipped as LSA rather than 10% of them, but that the additional cost would have been minimal.

One commenter objected to the nuclide-specific exemption activity concentrations because some of them are higher than the previous 70 Bq/g value. As pointed out in the NPRM, the hazards associated with radioactive materials are not directly related to their activity or activity concentration, but rather to the dose that a person in the vicinity or in contact with them would receive. The new system would, under the reasonable transport scenarios considered, raise the calculated dose due to some radionuclides from a small value to a somewhat larger, but still small value, while lowering the calculated dose from higher values for other radionuclides. For the 20 representative radionuclides for which detailed calculations were performed, the average calculated annual dose to workers transporting these materials at the proposed exemption activity concentration levels would be reduced from about 0.5 mSv (50 mrem) to about 0.23 mSv (23 mrem), *i.e.,* a reduction in dose of about 50%. Members of the public who were not actually involved in transporting these materials would presumably receive much lower doses, if any.

The commenter stated that although the proposed revision cuts the average modeled dose in half, the dose is still much too high. As pointed out above, the decision to use the Safety Series No. 115 exemption values instead of ones calculated specifically for transport, avoided the requirement to use two different sets of exemption values, one for fixed facilities (at least in the countries where these are used, for example most of the European countries) and one for transport. This in itself would likely lead to confusion and more errors, reducing safety.

We note that present NRC limits for occupational dose and dose to members of the public due to licensed activities are 50 mSv (5000 mrem) and 1.0 mSv (100 mrem), respectively. This is in addition to background radiation to which we are all exposed. The average background dose to a person living in the United States, according to information in NCRP Report No. 93, ''Ionizing Radiation Exposure of the Population of the United States,'' published by the U. S. National Council on Radiation Protection and Measurements in 1987, is approximately 3.6 mSv (360 mrem), of which about 1.0 mSv (100 mrem) is due to cosmic, terrestrial, and internal sources of naturally occurring radiation; about 2.0 mSv (200 mrem) is due to radon; and the remaining 0.6 mSv (60 mrem) is due mostly to medical procedures, with a small contribution from consumer products and miscellaneous sources. Thus the average modeled dose of 0.23 mSv (23 mrem) for dose to workers due to transport of the 20 radionuclides considered, although not negligible, is small compared to accepted limits and compared to background doses that we all receive. In addition, it is expected that doses from these transport activities to persons not involved in the transport will in almost all cases be much smaller.

A commenter suggested that doses from accidents have not been adequately analyzed. The fact that the average dose for the 20 radionuclides considered diminished by a factor of two indicates that on the average, the proposed exemption values should reduce doses due to accidents involving radioactive materials transported at the exemption levels and using the scenarios chosen.

This commenter noted that the proposed revision of exemption values would create an inconsistency with the present EPA practice of setting an upper limit of 70 Bq/g on the radioactivity content of waste that can be accepted at a Resource Conservation and Recovery Act (RCRA)-regulated waste disposal site. EPA has indicated that it has no national requirement of this type for RCRA Subtitle C facilities, but that such a requirement is frequently dictated by state regulations for the acceptance of mixed waste, or included in the site permit restrictions. The commenter is correct in implying that the proposed replacement of the 70 Bq/g threshold with the new exemption values, for the purpose of regulating the transport of radioactive materials, may result in some waste being sent to the RCRA site in a radioactive material placarded vehicle. However, where this limit is in use, it was obviously based on DOT's definition of radioactive material. If the intent of using this limit is to avoid having the site receive radioactive waste considered radioactive for purposes of transport, either the state regulations or the permit requirements would have to be changed to accommodate the new exemption values.

One commenter supports adoption of the new definition for Class 7 materials. However, the commenter states that the new definition will pose an unreasonable burden to those industries involved in environmental restoration, because classifying low activities in environmental media will be costly and burdensome without benefit. The commenter hopes that RSPA will weigh the effect of each proposed change in light of all affected and adopt domestic exceptions as warranted.

As we indicated above, in this final rule we are adopting the TS–R–1 exemption values to replace the 70 Bq/g criterion for determining when radioactive material will be regulated as a Class 7 hazardous material (with one exception: as discussed under Issue 2, we are also adopting in the HMR the TS–R–1 exception that the Class 7 thresholds will be 10 times the exemption values for ores and other natural materials not intended to be used for their radioactive properties).

With respect to this issue and to the others discussed below, we note that we have reviewed the present regulations, the proposed changes, and the various comments we have received, with the objective of achieving a balance between the competing tasks of ensuring safety and of avoiding imposing unjustified economic burdens on shippers and carriers of radioactive materials. In some cases we believe that domestic exceptions are justified, and have, for example, retained the U.S. practice of only requiring that vehicles carrying category Yellow III packages, highway route controlled quantities or exclusive use shipments of LSA/SCO be placarded, as well as the domestic A_2 value of 0.74 TBq (20 Ci) for Mo-99 and A_1 value of 0.1 TBq (2.7 Ci) for Cf-252.

Issue 2: Naturally Occurring Radioactive Materials

Background. The radioactive material transport regulations are intended to apply to natural materials or ores that form part of the nuclear fuel cycle, or that will be processed in order to utilize their radioactive properties. They do not apply to other natural materials or ores that may contain small amounts of naturally occurring radionuclides, when those materials or ores are to be used because of some other physical or chemical characteristics, provided that their activity concentration does not exceed 10 times the activity concentration in the table in § 173.436. The regulations also do not apply to natural materials and ores containing naturally occurring radionuclides when these have been subjected to physical or chemical processing, when the processing was not for the purpose of extracting radionuclides, again provided that their activity concentration does not exceed 10 times the activity concentration in the table in § 173.436. Examples of such materials are cement, coal, fertilizers, non-radioactive metals, gypsum, residues from mining and smelting processes, etc. In general these materials present a very low radiological hazard. On the other hand there are ores in nature where the activity concentration is much higher than the exemption values. The factor of 10 times the regulatory exemption activity concentration values was chosen as providing an appropriate balance between radiological protection concerns and the practical inconvenience of regulating large quantities of material with low activity concentrations of naturally occurring radionuclides.

In conjunction with the adoption of the nuclide-specific exemption values, in this final rule we are also incorporating in the HMR an exception for natural materials and ores containing radioactive material, in that natural materials and ores will be regulated as Class 7 hazardous material only if both their activity concentrations and consignment activities are greater than 10 times the corresponding exemption values.

Discussion. One commenter supports the higher threshold of 10 times the exemption values for natural materials and ores that contain naturally occurring radioactive material but are mined for their non-radioactive components or properties, and states that without an exemption for low levels of naturally occurring radioactive materials, application of the § 173.436 exemption values to these materials would result in unnecessarily regulating enormous amounts of material not currently regulated, and that regulating these materials would provide no benefit and increase their costs to the general public. However, this commenter also states that the intent of using these materials for their radioactive components should not be a determining factor in the risk analysis when they are transported in their natural state, and adds that for whatever purpose the materials are being transported, they pose the same negligible risk. The commenter states that it is only when the materials have been processed and the radioactive components are removed from their natural state that the radioactive components should be considered, and adds that the tailings from the removal of naturally occurring radioactive materials should be included in this group, as well as naturally occurring radioactive materials that accumulate from the extraction of non-radioactive minerals.

Another commenter suggests that DOT and NRC determine if the exemption below 10 times the activity concentration values in the table in § 173.436 would apply to mill tailings and residual radioactivity in soils and debris.

Another commenter indicated that the intended use of a material should not be a factor in how the material should be regulated, and that regulations for the transport of radioactive material should be based only on the radiological properties of the material being shipped.

Still another commenter urges RSPA to clarify in the preamble to the final rule that the ''10 times'' (''10×'') exemption for ''natural materials and ores'' includes tailings, secondary materials and solid wastes resulting from non-nuclear processing of such ores. This commenter notes that the need for the shipper to determine the intended end-use of ores creates an artificial and difficult to enforce barrier to the transportation of useful materials, particularly since the eventual end-use is not always known at the time of shipment. In addition, the commenter is not aware of any other instance where DOT applies an ''intent'' based test when determining whether a material is hazardous.

One commenter recommends that the 10x exemption apply to the domestic transport of unimportant quantities of source material subject to the 10 CFR 40.13 (licensing) exemption provided that the material and ores not be processed for recovery of source material content.

Our intention is that use of the exemption between 1 and 10 times the activity concentration values in the table in § 173.436 be allowed for ores containing small amounts of activity when these ores are not intended to be used for their radioactive properties.

Although in most cases it will be obvious why a certain ore is being mined, we agree that there may be instances where the ''intended use'' test can be difficult to apply, and that it would be preferable to minimize this burden on the shipper and carrier. We also agree that the intended use of an ore containing low levels of naturally occurring radionuclides does not change the low degree of risk it would present in transport.

In determining if an ore or other material satisfies the 10× exemption criterion, one should avoid using an average activity concentration which masks volumes with much higher specific activities. We suggest that a reasonable criterion for applying the 10× exemption is to determine the ''estimated average activity'' of the ore or material as described in section 4.2.3 of NUREG–1608/RSPA Advisory Guidance 97–005 for ''distributed throughout.'' For example, if the material can be divided into 10 or more equal volumes, each no greater than 0.1 m^3, and the specific activity differences between all pairs of volumes do not vary by more than a factor of 10, then one may average over the specific activities of all the volumes to obtain the estimated average activity, which may then be compared with 10 times the exemption activity concentration obtained from the table in § 173.436. If there are individual differences in the volume specific activities greater than a factor of 10, start with the volume with the maximum specific activity and average that specific activity with the next nine values in order of decreasing magnitude. If this average is no greater than 10 times the activity concentration from the table, the material qualifies for the 10× exemption.

Issue 3: Changes in A_1 and A_2 Values

Background. A_1 and A_2 values are used in the international and domestic transportation regulations to specify the amount of radioactive material that is permitted to be transported in a particular packaging, and for other purposes. A_1 and A_2 values for the most commonly transported radionuclides are listed in § 173.435 of the HMR, and in Appendix A to 10 CFR 71.

A_1 and A_2 values for most of the commonly transported radionuclides were provided in the 1973 IAEA Safety Series No. 6, and were based on certain dosimetric models and the assumption of certain exposure scenarios and pathways. These models and scenarios were extended and improved in the 1985 Safety Series No. 6, where the calculation procedure was called the ''Q system.'' This resulted in changes in the A_1 and A_2 values listed there. More recent biokinetic data and dosimetric models have been used to update the Q system and the resulting A_1 and A_2 values in the 1996 TS–R–1. A description of the Q system as applied in deriving the values adopted in TS–R–1 may be found in Appendix I of the IAEA publication TS–G–1.1, ''Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material,'' IAEA, Vienna, 2002.

Based on the results from the updated Q system, IAEA has adopted new A_1 and A_2 values for radionuclides listed in TS–R–1 (see paragraph 201 and Table 1 of TS–R–1). IAEA adopted these new values based on calculations that were performed using the latest dosimetric models recommended by the International Commission on Radiological Protection (ICRP) in Publication 60, ''1990 Recommendations of the ICRP.'' A thorough review of the Q system also included incorporation of data from updated metabolic uptake studies. In addition, several refinements were introduced in the calculation of contributions to the effective dose from each of the pathways considered. The pathways themselves are the same ones considered in the 1985 version of the Q system (*i.e.*, external photon dose; external beta dose; inhalation dose; skin and ingestion dose from contamination; and dose from submersion in gaseous radionuclides). The impact of these analyses is that for each radionuclide a thorough up-to-date radiological assessment has been performed of potential exposures to an individual should a Type A transport package of radioactive material be involved in an accident during transport. The new A_1 and A_2 values reflect that assessment.

The revised dosimetric models are accepted internationally as more accurate ways of calculating the doses from individual nuclides, and this improvement in accuracy and the additional refinements in the pathways calculations result in various changes to the A_1 and A_2 values.

Discussion. Several commenters to the ANPRM requested retention of the present A_2 value of 20 Ci for domestic shipments of Mo-99, citing an increase in the needed number of shipments with consequent greater radiation exposure to workers and greater costs as probable consequences of eliminating the present 20 Ci domestic exception.

Two commenters to the ANPRM objected to the TS–R–1 reduction of the A_1 value for californium-252 (Cf-252) from its present value of 0.1 TBq (2.7 Ci) to 0.05 TBq (1.35 Ci), on the basis of very high costs for disposal of present Type A packages for transporting 0.1 TBq of special form Cf-252 and possible development of replacement Type B packages, or of greater radiation exposure to workers because of the need to double the number of shipments if smaller quantities had to be shipped to be able to continue to use existing Type A packagings. However, during analysis of comments to the ANPRM, RSPA and NRC staff members also learned that the IAEA is proposing, for the 2003 revision of TS–R–1, to change the A_1 and A_2 values in TS–R–1 for Cf-252 back to the values currently in the HMR.

Therefore, as proposed in the NPRM, we are adopting the revised A_1 and A_2 values, with two exceptions. We are retaining the A_2 value of 0.74 TBq (20 Ci) for domestic shipments of molybdenum-99 and the A_1 value of 0.1 TBq (2.7 Ci) and A_2 value of 0.001 TBq (0.027 Ci) for domestic shipments of californium-252. Transportation of these isotopes in accordance with international requirements would be subject to the TS–R–1 A_1 and A_2 values.

Some radionuclides for which A_1 and A_2 values are presently listed in § 173.435 and Appendix A of 10 CFR 71 do not appear in Table I of TS–R–1. These are Ar-42, Au-96, Es-253, Es-254, Es-254m, Es-255, Fm-255, Fm-257, Ho-163, Ir-193m, Nb-92m, Po-208, Po-209, Re-183, Te-118, and Tm-168. All except the Einsteinium (Es) and Fermium (Fm) isotopes appear in Safety Series No. 6, 1985 Edition; the latter (Es and Fm) isotopes were appended to the tables in DOT's and NRC's domestic regulations when these incorporated the 1985 IAEA regulations. Through an oversight, numerical A_1 and A_2 values were never entered for Es-255. The above nuclides were not included in TS–R–1 Table I because of uncertainties in their decay schemes and/or the biological models used to determine doses from internal exposures (Dr. K. Eckerman, Oak Ridge National Laboratory). For this reason, we are removing them from § 173.435. To determine A_1 and A_2 values for these radionuclides we refer the shipper to § 173.433.

Discussion. Several commenters to the NPRM support the new A_1 and A_2 values.

One commenter noted that the proposed wording for § 173.433(b) did not accurately reflect the TS–R–1 requirements, in that the proposed text did not make it clear that the use of an A_2 value related to the solubility class of the radionuclide, when that A_2 value is not in the table, still requires the approval of the Associate Administrator for Hazardous Materials Safety and, for international shipments, multilateral approval. We agree, and have changed the text of § 173.433(b) to reflect this.

The same commenter noted that the word ''Only'' for alpha emitting nuclides in Tables 10A and 10B is unnecessarily restrictive, and should be removed (even though it appears in TS–R–1). We agree, and have removed it. This commenter also felt that reference to Tables 10A and 10B should be made in §§ 173.433(e) and 173.433(f) in the case that the identity of each nuclide is known, but not all of the individual activities are known. We disagree because when one applies the directions given in these two sections, any of the prescribed ways of determining the appropriate basic radionuclide values—from the tables in § 173.435 or § 173.436, from Tables 10A or 10B, or by approval of the AAHMS—is acceptable.

This commenter also asks whether the activity of progeny in radioactive decay chains should be included in the total activity required on shipping papers and Radioactive Yellow II and Yellow III labels. The answer is: The same reasoning that led to the inclusion of footnote (a) of the table in § 173.435 of the NPRM should govern the activities to be included on shipping papers and labels. When A_1 or A_2 values include contributions from daughter nuclides with half lives less than 10 days, and no daughter has a half life greater than that of the parent, as referenced in footnote (a) to the table in § 173.435, the parent and those daughters are to be treated as a single radionuclide both for the purpose of using the table to determine the appropriate packaging type, and for the contribution of that chain to the ''total activity'' required by § 172.203(d) to be included on the shipping paper and by § 172.403(g) to be included on the Radioactive Yellow II and Yellow III labels. The reason is that the A_1 and A_2 values assigned to the parents of those chains have been adjusted to appropriately represent the hazard of all the nuclides in that chain. This will occasionally lead to a situation where the true activity contents of the package can be somewhat greater than the ''total'' activity listed on the shipping paper and labels. However, the hazard of that decay chain will have been correctly taken into account for the selection of packaging type. The above considerations also imply that in applying the rules for determining which radionuclides should be listed on the shipping paper or labels, the stated daughters in these short half life chains need not be listed, or included in the application of the 95% formula in § 173.433(f).

This commenter also noted that footnote (a) appears in both tables in the NPRM, in §§ 173.435 and 173.436, even though it only refers to A_1 and A_2 values. This was an error, and we have removed that footnote from the table of exemption values in § 173.436, and reordered the remaining footnotes for that table. This commenter also requested the inclusion of an MFP (multiple fission products) entry and an entry for uranium enriched to more than 20% in the A_1/A_2 table in § 173.435. Multiple fission products should be dealt with by the methods described in § 173.433. A request for approval of A_1/A_2 values for nuclides not in the table should be addressed to the Associate Administrator, as indicated in § 173.433, with appropriate justification. In general, it is expected that this determination will be made following the guidelines of the Q system, as described in Appendix I to TS–G–1.1.

Issue 4: Communication Changes

Background. In this final rule we are adopting several changes in the regulations governing hazard communication associated with the transport of Class 7 (radioactive) materials, as well as revising and adding to the definitions in subpart I of 49 CFR 173.

Revisions in hazard communication include the following:

1. We are eliminating entries in the Hazardous Materials Table at § 172.101 presently accompanied by the symbol ''D'' in column (1) of the Table, and removal of the ''I'' in column (1) for the remaining Class 7 (radioactive) materials entries.

The ''D'' symbols, as well as the new proper shipping names and UN identification numbers from TS–R–1 accompanied by the ''I'' symbols, were introduced for radioactive material entries in the Hazardous Materials Table in the Final Rule for docket HM–215D (66 FR 33316; June 21, 2001). This was done to permit import and export shipments of radioactive materials in accordance with the new international air and sea modal requirements, and to allow shippers to reuse domestically previous imported packagings marked with the new proper shipping names and UN numbers.

As a result of the above action, as of the effective date of this final rule, we will only allow the use of proper shipping names and UN identification numbers established in TS–R–1 and in the international modal regulations. Since we are not adopting domestic use of Type C packages (see Issue 7), we are not incorporating in the HMR proper shipping names and UN identification numbers found in TS–R–1 for Type C packages, or for fissile LSA or SCO materials. In addition, we are not allowing fissile material (above the level considered fissile-excepted) to be transported domestically as LSA material or SCO.

2. We are adopting a requirement to mark UN identification numbers on excepted packages, and to mark package type, international vehicle registration code (the letters USA in the case of the U.S.) on all industrial and Type A packages, and mark the packaging manufacturer on Type A packages.

3. We are specifying that customary activity units (curies, or fractions thereof), if used in shipping paper descriptions or on radioactive labels, must be enclosed in parentheses following the required SI units.

4. We are introducing a criticality safety index (CSI) to express the former criticality control transport index (criticality TI) for fissile material, and the restriction of the term transport index (TI) to the former radiation TI, derived exclusively from the maximum radiation dose rate at one meter from the package. We are also introducing a fissile label for a package of fissile material, on which the CSI for that package must be displayed.

The fissile label will make it obvious that the package is carrying fissile material, and the use of the fissile label in conjunction with the designation of the CSI will reduce the complexity of the system presently in use. These changes will also simplify decisions as to how many packages can be grouped together, since under the new system the description of radiation and criticality hazards is uncoupled, and during transport each hazard can be considered separately.

5. We are introducing a requirement to mark industrial packagings with the markings TYPE IP–1, TYPE IP–2 or TYPE IP–3.

6. We are removing some former requirements that have become redundant upon adoption of the new proper shipping names, such as the requirement that the shipping description contain the words ''Radioactive Material'' unless those words are included in the proper shipping name.

7. In accordance with the corresponding change in TS–R–1 (see the discussion for Issue 8), we have removed the isotope plutonium-238 from our definition of fissile material in § 173.403, as well as the reference to it in the list of fissile radionuclides for which the weight in grams or kilograms may be listed instead of or in addition to the activity, in the shipping paper or radioactive label description of the radioactive contents of a package.

8. To improve readability and clarity of the HMR we have moved the labeling requirements for overpacks from § 173.448 to subpart E of part 172.

Discussion. Three commenters did not support the requirement to mark excepted packages and ''empty'' packages with the UN number preceded by the letters ''UN,'' stating this change will not assist first responders in communicating a package's hazard and will more likely than not simply confuse such personnel. The commenters added they were not aware of any situation where a responder was needlessly or excessively exposed to a hazard because, despite its limited quantity, its radioactive nature was not communicated. The commenters did not think that the extra effort to mark Limited Quantity and Empty packages will result in enhanced safety since the quantity of material in these packages has already been determined to be low-risk, and the extra effort to mark these packages is not rewarded with increased safety. We agree that the risk associated with the transport of excepted packages is small; however, in addition to the small benefit for emergency response involving these packages, the benefits of following the same practice for domestic and international regulations in this regard are sufficient to warrant harmonization with TS–R–1.

Two commenters stated that the proposal to modify § 178.350(b) by removing the wording ''and Radioactive Material'' from the marking requirement is commendable since this wording is already included in the proper shipping name that is also provided as a marking on the package.

One commenter referenced the proposed § 173.427(a)(6)(vi) and stated the existing § 173.427(a)(6)(vi) requires only the stenciling of non-bulk packages with the words ''Radioactive-LSA'' or ''Radioactive-SCO'' and ''RQ'' as appropriate. Typically only non-bulk packages are marked for reportable quantities as per § 172.324. The proposed paragraph no longer states that only non-bulk packages must be stenciled. The commenter recommended ensuring that the intention was to stencil both bulk and non-bulk packages with the words ''Radioactive-LSA'' or ''Radioactive-SCO'' and ''RQ'' as appropriate. We intend that the ''Radioactive-LSA'' or ''Radioactive-SCO'', and ''RQ'' markings when appropriate, be placed on all Class 7 (radioactive) material packages containing LSA material or SCO, independent of their weight or capacity.

One commenter addressed concerns regarding the proposed change to § 173.424 and the burden that will be imposed upon manufacturers, importers and distributors of consumer products, such as lamps that contain small quantities of radioactive material, if it is adopted as contained in the above referenced docket. The proposed change would modify § 173.424(e) to require the marking ''radioactive'' on each instrument or article shipped in an excepted package, except for radio-luminescent timepieces. The commenter stated that as is the case with radioactive luminescent timepieces, lighting products, such as lamps, glow-switches or glow bottles that contain small quantities of radioactive material necessary for their operation, are manufactured or imported under either an NRC or Agreement State radioactive materials possession license and distributed (sold) to the general public under an NRC exempt distribution ''E'' license.

In order for a product to be licensed for exempt distribution, the manufacturer, importer or distributor must satisfy the NRC that it has been manufactured and prototype-tested according to specified standards and that the product meets specified radiation limits, where applicable. In addition, the manufacturer must develop routine quality control testing and production lot sampling procedures to the satisfaction of the agency. According to NRC regulations, a product licensed for exempt distribution may be used and in most cases disposed of by the consumer without regard to its radioactive content. The commenter cited certain other consumer products that will also be affected by this rule change, such as high intensity discharge (HID) lamps and other products which contain thorium.

The commenter argued that to require an NRC-exempt lighting product to be marked as radioactive would be burdensome because ''E'' licensed lighting products have already been evaluated and licensed for distribution with any marking approved by the NRC. He stated that, in most instances the individual item package, rather than the item itself, is marked with information about the radioactive content; that the new requirement of § 173.424(e) would either supersede or be in addition to the NRC approved product marking; and that the new marking requirement of § 173.424(e) would impose product marking on a large and decade old segment of HID market even though the NRC has found such labeling to be unnecessary. The proposed change to § 173.424(e) would require the product itself to be marked, regardless of size or design, which in some cases could make a readable ''radioactive'' marking virtually impossible, (*e.g.,* glow switches are sealed glass tubes that measure approximately 20mm long by 9mm in diameter). Individual product marking would entail modifications to production line equipment and possibly even the redesign of certain equipment to accommodate the marking of small components. Marking a lighting product as radioactive would send a mixed message to the consumer, as would be the same marking of a radioactive luminescent timepiece. The NRC has determined that such a product is safe to use without regard to its contained radioactivity and yet § 173.424(e), if enacted as currently written, would require the product to be marked, in the manner of a warning, that it is ''radioactive''—a marking the NRC has not deemed necessary.

The commenter also argued that both fluorescent and HID lamps are typically three to four times more energy efficient than incandescent lamps. The Environmental Protection Agency and the Department of Energy actively promote the conversion to more energy efficient lighting, which reduces the amount of coal, oil and gas burned in power plants, as well as the amount of air pollutants including greenhouse gasses released from power plants. A requirement to label these products as radioactive is likely to discourage the use of these environmentally preferable products. The commenter proposed to change the wording of the instrument or article marking exception to: ''* * * (except any device either distributed under a NRC Exempt Distribution License, pursuant to 10 CFR 32.14 or exempt from NRC regulation pursuant to 10 CFR 40.13) * * *''

We agree that in some cases the physical size of the instrument or article that qualifies to be shipped in an excepted package may make it difficult to comply with the requirement to mark ''RADIOACTIVE'' on such instrument or article. We also agree that the degree of additional safety that this measure would provide is small, while the costs to manufacturers, particularly in the case of items of such small size that they do not easily accommodate the marking, may be unreasonably large, without a commensurate increase in safety. Therefore we are not adopting this proposal. We note, however, that excepted packages of instruments and articles containing small quantities of radioactive material must still have the ''RADIOACTIVE'' marking if they are to be transported under the IAEA Regulations in TS–R–1, the ICAO Technical Instructions, or the IMDG Code.

A commenter opposed the proposed revision of the requirements pertaining to the labeling of overpacks in § 172.403. Section 172.403(h)(4) in the NPRM, as did its predecessor § 173.448(g)(iv), allows the transport index (TI) of a rigid overpack to be determined by adding the individual indices of the packages inside or by direct measurement of the radiation level at one meter from the outside surface. However, § 172.403(h)(5) in the NPRM states that the label category for an overpack is to be determined by the TI, as determined according to § 172.403(h)(4), and the highest surface radiation level on an individual package inside the overpack, ''unless the overpack has been demonstrated to satisfy the packaging requirements for the package type appropriate for the totality of its contents.''

The commenter stated that while the purpose of this change is described by RSPA as a clarification, this will lead to confusion. The proposed requirements could lead to a situation where an overpack may require a Yellow-III category label (because of using the highest surface dose rate on an interior package) yet the measured TI to be entered on the label for the overpack (*e.g.* less than 1.0) could correspond to a Yellow-II or White-I label. Thus this proposed change could result in the need to use a Yellow III label on the overpack when a Yellow II label would be sufficient under present requirements, thereby subjecting the carrier to placarding requirements and additional carrier requirements.

According to the commenter this would place a hardship on shippers who would now have to use placarded vehicles and carriers with Commercial Driver's Licenses (CDLs), yet the Type A packages inside would not be better protected or safer in any way. Any Type A package inside an overpack would still be expected to meet the design and performance requirements on its own, regardless of the type of overpack used. Therefore, if the shipper chooses not to or cannot use the sturdier overpack, which would allow him to use the dose rate on the surface of the overpack to determine the overpack category, more packages, with potentially higher radiation levels than that of the overpack, would then be handled by the shipper, carrier and recipient, resulting in additional radiation exposure to shippers, carriers and recipients of these packages. The commenter stated that this proposal should be abandoned.

Another commenter representing a large maritime construction firm stated that its primary concern is regulations related to transportation of Class 7 (radioactive) materials associated with industrial radiography. Radioactive isotopes, primarily iridium-192 and cobalt-60, are used for soundness inspection of welds and critical components in the submarine construction industry. The proposed requirement, to determine the category of Class 7 label on the overpack based in part on the maximum radiation level on the interior package or packages, would seriously impact his firm and many other industry users that normally transport radioactive materials in order to conduct inspections required by government specifications. Users and small businesses would be adversely impacted through costs associated with compliance with the proposed rules, since in many cases both the overpack and the interior package or packages would now be labeled Yellow-III, and whether or not the overpack is used, the vehicle would require a placard. Since DOT regulations require the driver of any vehicle requiring a placard to possess a CDL and to be a ''Registered Shipper of Hazardous Materials,'' this would entail additional costs for the businesses involved, with no additional benefit, or even increased radiation exposure if the company decided not to use the overpack. The commenter stated that the proposed requirement would increase the radiation exposure received by workers incident to the transportation of radioactive materials required for industrial radiography as well as other industries, such as those using moisture density gauges, well logging equipment, alloy identification equipment, and other radioactive devices, since if the labels on the packages and also on the overpack are determined by this proposed requirement to be Radioactive Yellow-III, transporters would now have less incentive to use an overpack. The proposed requirements would reduce the use of overpacks and packages would be transported at radiation levels closer to the maximum limits allowed.

Another commenter expressed concern that radiographers and some density gauge users, who under present regulations can use an overpack to reduce the category of label and therefore avoid having to placard their vehicle, would under the proposed change for determining the category of an overpack be forced to placard their trucks, and that the radiographer and gauge users and the general public could be at risk from terrorist or thieves who would be keenly aware of the presence of radioactive devices that have been invisible to them in the past by stalking the hundredfold increase in radioactive placarded vehicles on the roads. He added that even without the events of 9/11, there have been many gauge thefts out of the back of vehicles, and that placing a placard on the back of a vehicle may appear to increase the safety of the public, but it could increase the risk to the radiographers, gauge users and the public since the devices are relatively easy to steal.

We have reviewed the consequences of the wording proposed for § 172.403(h)(5) in the NPRM, and we agree with the above commenters. The requirement to use a sturdier overpack, which could often imply the need for a Type B packaging, in order to be able to use the overpack surface dose rate to determine its category for labeling purposes, is unreasonably restrictive and in many cases impossible to realize. Therefore, we are removing that restriction in § 172.403(h)(5), and simply requiring that, by the procedure described in § 172.403(b) for packages, the category of the overpack be determined using the maximum dose rate on the surface of the overpack, and the TI for the overpack determined by one of the methods prescribed in § 172.403(h)(3) for a non-rigid overpack, or in § 172.403(h)(4) for a rigid overpack.

One commenter agreed with the proposal in § 178.350(b) to remove the wording ''Radioactive Material'' from the marking requirement on a DOT

Specification 7A Type A package, as this wording is already included in the proper shipping name that must also be marked on the package. This commenter also agreed with the proposal to retain the ability in §§ 172.203(d) and 172.403(g) to use the customary units of activity as long as they are placed within parentheses after the original quantity in SI units. According to this commenter this will facilitate the ongoing understanding of carriers, end users and potential emergency responders who are accustomed to seeing the customary units to describe the contents of radioactive materials packages.

Two commenters stated that customary units should be required if the SI system is used. One commenter stated that customary units should be required and the SI units be optional, but put in parenthesis, if used. Three commenters supported the proposed changes for §§ 172.203(d) and 172.403(g) that would allow continued use of customary activity units as long as they are placed within parentheses after the original quantity in SI units. As noted elsewhere, we are requiring that customary units, if used, be placed after the required SI units, and be enclosed in parentheses. The present regulations allow the shipper to use customary units after the required SI units. In this final rule, we are adding the requirement that these be enclosed in parentheses.

A commenter stated that some place in the proposed regulations the format of the criticality safety index should be specified for appropriate guidance to both shippers and carriers. The following modification was suggested: The CSI for packages containing fissile material is determined in accordance with the instructions provided in 10 CFR 71.22, 71.23 and 71.59, and is a number rounded up to the nearest tenth. It is recognized that the above information is provided in 10 CFR, but the added phrase specifying the numerical format should be included in DOT's regulations. We agree, and have inserted that clarification in our definition of CSI in § 173.403.

One commenter noted that in § 175.702(b)(2), which deals with the requirements for carriage of packages containing Class 7 (radioactive materials) in a non-exclusive use cargo aircraft only, when the total transport index for all the packages is greater than 50.0 but does not exceed 200.0, and the criticality safety index for all of the packages does not exceed 50.0, the proposed section remains incompatible with IAEA TS–R–1, and in fact it is also incompatible with IAEA Safety Series No. 6, (1985 Edition as Amended 1990). The proposal in the NPRM is that the radioactive material packages be in groups not exceeding 50.0 TI and that each group of 50 TI or less is separated from all other groups of 50 TI or less by at least 6 meters and from humans by at least 9 meters.

The commenter noted that the IAEA TS–R–1 Table IX provides for 200 TI on a cargo aircraft. Paragraph 562 of TS–R–1 states that segregation between the radioactive materials and human occupied space shall be governed by paragraph 306, which prescribes annual dose limits for the purpose of calculating segregation distances. Table 7–6 in the 2001–2002 edition of the ICAO Technical Instructions is calculated on such a basis for TI's between 50.0 and 200.0. He stated that the fifty TI grouping should be abolished and the ICAO segregation table should be adopted. Grouping of packages into 50.0 TI or less involves additional handling and therefore represents a dosage increase. The 50.0 to 200.0 TI segregation table has been in ICAO and IATA for many years, ever since the adoption of IAEA Safety Series No. 6 (1985 Edition as Amended 1990), and it is unlikely that most foreign air carriers entering U.S. airspace are adhering to or are aware of the § 175.702(b)(2) operational requirement. This comment is not within the scope of this rulemaking.

The only substantive changes introduced in § 175.702 in the NPRM were the inclusion of reference to a FISSILE label in § 175.702(b), a restriction to a total CSI of 50 in § 175.702(b), and the introduction of an upper limit of 200 TI for cargo aircraft only. The remaining changes were the rearrangement and renumbering of the previous requirements.

Because we did not propose to adopt the segregation scheme of the ICAO Technical Instructions in our NPRM, we are unable to introduce these changes in this final rule. Consideration of the discrepancy between § 175.702 and the ICAO regulations may be considered in a future rulemaking.

A commenter stated packages should be labeled ''Danger—Radioactive Material'' rather than ''fissile.'' Another commenter stated that the CSI should be included in the shipping description for fissile material packages and that the fissile label is inadequate and should have more information because 99.9% of the population doesn't know what that means. The commenter suggested adding the radiation symbol and the words ''Very Dangerous, Radioactive. Keep far away from public and animals. Guard at all times.'' A commenter stated that it is not evident that there is a benefit in substituting the CSI for the TI and that, to minimize damages, the maximum amount of information should be given. The same commenter stated that all packages should be labeled Dangerous—Radioactive Material and a radiation warning symbol should be attached to every package. Another commenter supported the proposal to use the new ''Fissile'' label and the Criticality Safety Index (CSI), stating that the use of the CSI value will remove a source of confusion in the old TI values and the resulting enhancement of the safety of shipments makes the extra efforts necessary to implement this proposal worthwhile.

We agree that it is important that communications be as clear as possible, that their impact correspond to the hazard, and at the same time that the shipper, carrier or first responder not be so overwhelmed by information that the probability of errors is increased rather than diminished. For this reason we feel that the uncoupling of the concepts of TI, which refers to the external radiation hazard, and CSI, which refers to the criticality hazard, is an important improvement over the historical TI, which could have resulted from either of these hazards.

Because the two hazards are quite different, the use of one of various phrases involving the words ''radioactive material'' on a fissile material package without a Fissile label would actually convey less information than the presence of the Fissile label on the package. In addition, it should be noted that all radioactive material packages, aside from excepted packages and certain LSA and SCO shipments (for which the markings ''RADIOACTIVE–LSA'' or ''RADIOACTIVE–SCO'' are substituted), are required to have the proper shipping name marked on the package, and with the adoption of the TS–R–1 proper shipping names, all radioactive material proper shipping names start with the words ''Radioactive material.''

A commenter questioned why Type C packages and fissile LSA and SCO are exempt from proper shipping names and UN ID numbers. We have not adopted proper shipping names and UN identification numbers for Type C packages, or for fissile LSA material and SCO, because we have decided not to recognize these categories in HMR.

A commenter stated that plutonium weight should not replace the activity but may be added to it in the shipping documents and package labels. We note that this is in fact what appears in the proposed language for §§ 172.203(d)(3) and 172.403(g)(2), and has been the case previously. The change in these two paragraphs was the removal of reference to plutonium-238 as a fissile nuclide.

Issue 5: Low Specific Activity (LSA) materials and Surface Contaminated Objects (SCO)

Background. On September 28, 1995, in a final rule published under Docket HM–169A (60 FR 50292), we refined the existing Low Specific Activity (LSA) and Surface Contaminated Object (SCO) regulations by adopting complementary, but not additional, features of the LSA and SCO provisions of the IAEA regulations. This approach was considered best because it offered minimal changes to existing requirements while facilitating international transport consistent with IAEA regulations. Shortly after implementing this new regulatory program, we recognized the shortcomings of not adopting the Safety Series No. 6 definition of contamination. We are now bringing the HMR into closer harmony with TS–R–1 by adopting the IAEA definition of contamination.

In accordance with TS–R–1, we have included the phrase ''and other ores containing radioactive materials intended to be processed for the use of these radionuclides'' in the category of LSA–I referring to uranium and thorium ores and concentrates of such ores.

TS–R–1 (paragraph 226) contains a new category of LSA–I material, consisting of radioactive material, excluding non-excepted fissile material, in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the activity concentration exemption values. The purpose of this category is to allow shipment as LSA–I of very low specific activity materials containing one or more of a variety of radionuclides. We are adopting this new category in the definition of LSA–I. A previous LSA–I category, which specifically included mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which the Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed 10^{-1} A_2/g, has been eliminated. The specific materials, *e.g.*, earth, concrete, and rubble, previously listed in the definition may still be classified as LSA–I, as long as they meet the requirements of the new definition.

We are also providing an authorization to transport unpackaged LSA–I and SCO-I by means of qualified tank containers, freight containers and metal intermediate bulk containers as industrial packagings, types 2 and 3 (IP–2 and IP–3). The authorization to use qualified tank containers, freight containers and metal intermediate bulk containers as industrial packagings and the other packaging changes made for LSA and SCO will greatly simplify the HMR with no increase in risk.

We have eliminated the previous paragraph § 173.427(d), which excepted LSA material and SCO that conform to the provisions of 10 CFR 20.2005 from all requirements of the HMR for Class 7 (radioactive) materials, when offered for transportation for disposal or recovery by means other than aircraft. Such material is 1.85 kBq (0.05 μCi) or less of H-3 or C-14 per gram of liquid scintillation counting medium or of animal tissue. These exceptions are no longer needed since the TS–R–1 exemption activity concentrations for these materials adopted in this final rule are 1×106 Bq/g (27 μCi/g) for H-3 and 1×10^4 Bq/g (0.27 μCi/g) for C-14; *i.e.,* they are greater than the concentrations previously excepted. Note, however, that this does not mean that these materials would be exempt from the provisions of the HMR relating to other hazard classes.

Incorporating these changes into the HMR greatly simplifies the LSA and SCO regulations by bringing them into closer harmony with the TS–R–1. Specifically, the addition of a contamination definition and the authority to transport unpackaged LSA and SCO better focuses the regulations on radioactive material that truly poses a hazard to persons, property, and the environment.

Discussion. Several commenters were concerned that the definitions and use of the terms LSA and SCO by DOT and NRC are not totally consistent and encouraged the review of the use of these terms to ensure compatibility with TS–R–1. We agree. This inconsistency has been resolved in this and the NRC's final rules.

Two commenters disagreed with the decision to remove the LSA–I definition of mill tailings, contaminated earth, concrete, rubble or other debris with average specific activity less than 10^{-6}/g, since much of the LSA shipped today is from this category. The commenter stated that eliminating these categories from the regulation will cause confusion and shipping delays. The specific materials mentioned, *e.g.,* earth, concrete, and rubble in the previous definition may still be classified as LSA–I as long as they meet the requirements of the new definition. Furthermore, it is believed the revised activity limits will ultimately reduce confusion and shipping delays by standardizing with the international community and the content of TS–R–1. Training on the new requirements should eliminate any confusion or shipping delays due to the revised definition.

One commenter stated that the actual meaning of ''unpackaged'' as discussed on 67 FR 21336–21337 and 21358 was unclear. The commenter noted that we had proposed to allow transport of unpackaged LSA–I and SCO–I in § 173.427. The commenter correctly interpreted the proposal to mean that LSA–I and SCO–I material may be shipped unpackaged in accordance with the proposed modification of § 173.427(c) which requires for the unpackaged material, other than for ores containing only naturally occurring radionuclides, that there be no escape of the contents from the conveyance nor a loss of shielding (Shipment of unpackaged LSA–I or SCO–I must also be by exclusive use; note however that unpackaged SCO–I is allowed to be transported non-exclusive use if the conditions of the modified § 173.427(c)(2) are met.) The commenter also correctly concluded that an LSA–I or SCO–I shipment no longer is required to be in a DOT Specification 7A, an industrial packaging, or a strong tight packaging, as is currently required by regulation, if the requirements of the modified § 173.427(c) are met.

One commenter incorrectly assumed that SCO–I material, such as pipes, can serve as their own packaging. The commenter cited TS–R–1 paragraphs 241 (a)(iii) and 523(c) and supplemental TS–G–1.1 (ST–2) information. Specifically, it was stated that SCO–I is allowed to have non-fixed contamination on inaccessible surfaces in excess of the values specified for accessible surfaces. Therefore, items such as pipes resulting from the decommissioning of a facility can be prepared for unpackaged transport in a way to ensure that there is no release of non-fixed contamination from inaccessible surfaces (for which allowable contamination levels may exceed the accessible surface non-fixed contamination limits) into the conveyance by, for example, applying end caps or plugs at both ends of the pipes. The commenter went on to state that the same principle applies equally to valves, compressors, tanks, or other surface contaminated articles which, because the contamination that renders the article SCO is limited to internal surfaces, may effectively serve as their own packagings. While the effective end result is virtually the same, the commenter is mistaken in saying these items serve as their own packaging. Rather, if they meet the definition of

SCO–I material, or suspected non-fixed contamination levels exceed the accessible surface non-fixed contamination limit, but measures are taken to ensure radioactive material is not released into the conveyance by making these surfaces inaccessible, thereby rendering the material fully compatible with the definition for SCO–I, then the material may be transported unpackaged in accordance with § 173.427(c).

The commenter also indicated that the LSA–I and SCO–I provisions addressed in paragraph 540 of TS–R–1 state that, when these materials are transported according to the provisions of paragraph 523, the marking ''RADIOACTIVE LSA–I'' or ''RADIOACTIVE SCO–I'' described in paragraph 540 is optional, and is not mandated by (the IAEA) regulation. The commenter encouraged DOT to permit similar flexibility in marking SCO and LSA materials. We interpret this to mean that the commenter would like to have the freedom to make exclusive use shipments of LSA–I or SCO–I without such markings.

We believe that, in accordance with past requirements for similar marking of domestic shipments of LSA or SCO that are required to be transported exclusive use, such markings serve the useful purpose of alerting emergency response personnel, Class 7 (radioactive) material is present in relatively low concentrations. We have therefore decided to retain this requirement. However, the comment focuses our attention on the lack of detail in § 173.427 in our proposed rulemaking concerning transport requirements for unpackaged LSA–I materials and unpackaged SCO–I. Therefore, in this final rule we have included wording in § 173.427(a)(4), (a)(6)(iii), and (a)(6)(vi) to indicate that unpackaged LSA–I and SCO–I are subject to the same transport controls as packaged LSA material and SCO.

Two commenters stated that the new definition for contamination and LSA–I will allow radioactive material to enter industrial and consumer goods. Another commenter stated that the LSA–I definition allowing exemption of materials having an estimated specific activity up to 30 times the exempt activity concentration should be eliminated because it fits the definition of volumetrically contaminated material and neither the NRC nor DOE currently allows for release or recycle of volumetrically contaminated radioactive materials.

We believe the commenters misinterpreted the proposed § 173.403 definition of LSA–I. No section of the proposed LSA–I definition provides an exemption, rather the sections provide bounding criteria of what may be considered LSA–I material.

A commenter stated that all ores, even if not intended to be processed, should be regulated because in the past certain companies have contaminated large areas from ores. As stated previously in Issue 2, we will continue to regulate natural materials and ores that are not intended to be processes for their radioactive content, when their specific activities are greater than ten times the activity concentration exemption values in § 173.436. One commenter stated that external dose rates for LSA and SCO should be required to be less than 1 mrem/year at 3 meters. We believe this comment is outside the scope of the rulemaking.

This commenter also stated there should be no exemptions for H–3 or C–14 in animal tissues. These exceptions have been removed in the final rule since the TS–R–1 exemption activity concentrations for these materials adopted in this final rule are 1×10^6 Bq/g (27 μCi/g) for H–3 and 1×10^4 Bq/g (0.27 μCi/g) for C–14 (*i.e.,* they are greater than the concentrations previously excepted). Note, however, that this does not mean that these materials would be exempt from the provisions of the HMR relating to other hazard classes.

Several commenters disagreed with the new rules that would allow LSA–I and SCO–I to be transported unpackaged, citing the conveyance could become contaminated. We agree that given the amounts of radioactive material contained in LSA–I and SCO–I materials there is a likelihood that cross-contamination of the interior of a conveyance used for unpackaged transport of these materials, in accordance with the proposed § 173.427(c), could occur. However, in order to prevent the spread of contamination to subsequent non-radioactive material shipments in the same conveyance, it is incumbent upon the carrier of an exclusive use shipment to ensure that the conveyance is surveyed and decontaminated, if necessary, in accordance with § 173.443(c), prior to unrestricted release of the conveyance. The carrier may perform such measurements, or these may be made by the consignee or other persons, through appropriate arrangements among the interested parties.

One commenter stated that it is not clear in the definition for ''contamination'' what is meant by the statement ''Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in § 173.443.'' We point out that our definition of contamination is similar to our definition of radioactive material, in that the definition designates a threshold value below which the material in question is not subject to the Class 7 hazardous materials transport regulations. In that context we agree that the statement referred to by the commenter is ambiguous and, if ''Non-fixed (removable) radioactive contamination'' were interpreted as referring to the physical (non-regulatory) definition of contamination, is redundant. Hence, we have removed this phrase from the definition of contamination.

The commenter also requested that the meaning of the terms ''distributed throughout'' and ''estimated average specific activity'' be clarified in the definition for LSA–I, and asked whether these terms are intended to be applied as discussed in NUREG–1608/RSPA Advisory Guidance 97–005 for LSA materials. The guidance concerning ''distributed throughout'' and ''essentially uniformly distributed'' would be appropriate as provided in NUREG–1608, ''Categorizing and Transporting Low Specific Activity Materials and Surface Contaminated Objects.'' For packages containing at least 0.2 m^3 of LSA material, ten or more equal volumes no greater than 0.1 m^3 each, of objects or materials that are ''distributed throughout,'' should not vary by more than a factor of ten. The specific activity among similarly defined volumes for materials that are ''essentially uniformly distributed'' should not vary by more than a factor of three. It should be noted that, where the LSA materials contain radionuclides in quantities less than 1 A_2, this determination may be made either quantitatively or qualitatively. The ''estimated average specific activity'' for radioactive material ''distributed throughout'' would be an arithmetic average specific activity of material where the range of specific activities does not vary by more than a factor of ten.

Issue 6: Uranium Hexafluoride (UF_6)

Background. Uranium hexafluoride (UF_6) packaging and transportation is regulated under both NRC and DOT requirements. The HMR contain provisions that govern many aspects of UF_6 packaging and shipment preparation. The NRC regulates fissile materials and Type B packaging designs for all materials. Since UF_6 may be a fissile material, it may also be regulated by the NRC.

TS–R–1 contains detailed requirements for UF_6 packagings designed for more than 0.1 kg UF_6. First, TS–R–1 requires the use of the International Organization for Standardization (ISO) Standard 7195, ''Packaging of Uranium Hexafluoride (UF_6) for Transport,'' instead of the ANSI N14.1 standard, previously referenced in DOT's regulations, with the condition that approval by all countries involved in the shipment is obtained (*i.e.*, multilateral approval (Paragraph 629)). Second, TS–R–1 requires that all packages containing more than 0.1 kg UF_6 meet the ''normal conditions of transport'' drop test, a minimum internal pressure test and the hypothetical accident condition thermal test (Paragraph 630). However, TS–R–1 does allow a national competent authority to waive certain design requirements, including the thermal test for packages designed to contain greater than 9,000 kg UF_6, provided that multilateral approval is obtained. Third, TS–R–1 prohibits use of packages utilizing pressure relief devices (Paragraph 631). Fourth, TS–R–1 includes a new exception for UF_6 packages, regarding the evaluation of a single package.

This new exception (Paragraph 677(b)) allows UF_6 packages to be evaluated without considering the in-leakage of water into the containment system if the packages satisfy certain specified conditions. Under these conditions, a single fissile UF_6 package does not have to be shown to be subcritical under the assumption that there is water inside the containment system. This provision only applies when there is no contact between the valve and any other component of the cylinder under hypothetical accident tests and the valve remains leak-tight following the thermal test, and when there is a high degree of quality control in the manufacture, maintenance, and repair of packagings coupled with tests to demonstrate closure of each package before each shipment. In addition, competent authority package design certificates are also required for international shipments of uranium hexafluoride (paragraph 828).

Commenters to the December 28, 1999 ANPRM asked for the following information to be included in the HMR: (1) Clarification of the requirements for new cylinders, cleaned cylinders, and cylinders containing residual amounts of UF_6 (heel cylinders); (2) additional details regarding approval provisions; and (3) transitional or grandfathering provisions. We agreed with the need for additional information and included the requested guidance in the proposed and final rule. Furthermore, we recommend that shippers and carriers of UF_6 consult with IAEA Safety Guide TS–G–1.1, ''Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material,'' for further clarification.

In this final rule we have incorporated the TS–R–1 changes for packagings containing more than 0.1 kg of UF_6. We have required that the packagings meet the pressure, drop and thermal test requirements found in paragraph 630. We have prohibited the use of pressure relief devices and provided designated packaging certification identification marks in accordance with IAEA TS–R–1 paragraph 828. We have not incorporated our proposal from the NPRM to allow uranium hexafluoride to be packaged and transported in accordance with ISO 7195. The reason is that the 1993 revision of ISO 7195 referenced in TS–R–1 is inconsistent with the ANSI N14.1 requirements, and there has been a delay in publishing a new revision which harmonizes the two standards.

Discussion. Two commenters supported RSPA's position to make only minimal changes to the regulation of uranium hexafluoride. While the commenters did not support the inclusion of industry consensus standards in regulations, they did support RSPA's recognition of the compatibility of ISO 7195 with ANSI N14.1.

One commenter disagreed that the thermal test should be required for domestic shipments of cylinders containing natural or depleted UF_6 given how extremely unlikely it would be for these cylinders to encounter thermal conditions similar to those of the hypothetical accident conditions and the safety basis for imposing such a requirement is questionable. The commenter referenced USEC's study ''Probabilistic Safety Evaluation of 48-inch Loaded Depleted and Natural UF_6 Cylinders Involved in the ST–1 Regulatory Fire.'' The commenter noted the study of North American shipments of the 48-inch cylinders showed the expected frequency of occurrence of the regulatory fire resulting in cylinder rupture was extremely low, ranging from 1,800 to 29,000 years, depending on the mode of shipment.

Another commenter stated that large quantities of depleted UF_6 (about 60,000 Type 48G packages filled with UF_6 tails) are presently in storage. Furthermore, the DOE issued the ''Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride'' on April 23, 1999. The document considered the environmental impacts, benefits, costs, and institutional and programmatic needs associated with the management and use of approximately 700,000 metric tons of depleted uranium hexafluoride. In the Record of Decision for the Long-Term Management and Use of Depleted Uranium Hexafluoride, a decision has been made to convert the depleted UF_6 inventory to depleted uranium oxide for use, storage and disposal, as necessary. Approximately 4,700 cylinders of depleted UF_6 at one facility will need to be transported to a conversion facility. The commenter noted that if the proposed requirements for thermal protection are incorporated into the HMR for the depleted uranium hexafluoride cylinders, costs for overpacking and transporting these cylinders will increase substantially without any demonstrated additional safety benefit. The commenter recommended that the current HMR requirements for cylinders of depleted UF_6 be retained for domestic transportation for a period of five years.

Although the predicted frequency of occurrence of a fire resulting in a cylinder rupture is arguably low, when considering the potential increase in societal risks resulting from transport accidents involving fire and the long-term benefits ensuing from international radioactive material transport harmonization resulting from requiring thermal tests for packages designed to contain UF_6, we believe requirements for the thermal tests for domestic shipments are necessary.

One commenter stated the proposed revisions to modify the packaging requirements for uranium hexafluoride would relax the current requirement that a fissile material package must be designed, or the contents limited, so that a single package would be critically safe if water were to leak into the containment vessel. The commenter suggests the proposed regulations would provide an exception whereby a single fissile UF_6 package does not have to be shown to be subcritical under the assumption that there is water inside the containment system as long as certain conditions are met. The commenter concluded that given the potential serious consequences of a criticality accident, this proposed revision should not be considered or adopted in the absence of better justification and analysis. We disagree. Although this new section of the IAEA regulations (Paragraph 677(b)) allows UF_6 packages to be evaluated without considering the in-leakage of water into the containment system if the packages satisfy certain specified conditions described above in the Discussion section, this is not a relaxation of previous regulatory requirements, rather, it is an enumeration of existing regulatory agency practices.

Issue 7: Air Transport Requirements

Background. TS–R–1 has introduced two new concepts for the air transport of radioactive material: the Type C package (paragraphs 230, 667–670, 730, 734–737) and Low Dispersible Material (LDM). Type C packages are designed to withstand severe accident conditions associated with air transport without loss of containment or significant increase in external radiation levels. The LDM is a material exception to these new air transport standards that is granted based on a material's limited radiation hazard and low dispersibility.

If qualified as LDM, material in quantities that would otherwise require a Type C package could continue to be transported by aircraft in a Type B package. U.S. regulations do not contain a Type C package or LDM category, but do have specific requirements for the air transport of plutonium (10 CFR 71.64 and 71.74). These specific NRC requirements for air transport of plutonium will continue to apply.

The Type C requirements apply to all radionuclides packaged for air transport that contain a total activity value above 3,000 A_1 or 100,000 A_2, whichever is less, for special form material, or above 3,000 A_2 for all other radioactive material. Below these thresholds, Type B packages may be used in air transport. The Type C package performance requirements are significantly more stringent than those for Type B packages. For example, a 90-meter per second (m/s) impact test is required instead of the 9-meter drop test. A 60-minute fire test is required instead of the 30-minute for Type B packages. These stringent tests are expected to result in package designs that will survive more severe aircraft accidents than Type B package designs.

The LDM specification was added in TS–R–1 to account for radioactive materials (package contents) that have inherently limited dispersibility, solubility, and radiation levels. The test requirements for LDM to demonstrate limited dispersibility, and leachability are a subset of the Type C package requirements (90-m/s impact and 60-minute thermal test) with an added solubility test, and must be performed on the material without packaging. The LDM must also have an external radiation level below 10 mSv/h (1 rem/hr) at 3 meters. Specific acceptance criteria are established for evaluating the performance of the material during and after the tests (less than 100 A_2 in gaseous or particulate form of less than 100 micrometer aerodynamic equivalent diameter and less than 100 A_2 in solution). These stringent performance and acceptance requirements are intended to ensure that these materials can continue to be transported safely in Type B packages aboard aircraft. LDM must be certified as such by the Competent Authority (Paragraphs 803, 804, 828, 830).

In 1996, the NRC communicated to the IAEA that the NRC did not oppose the IAEA adoption of the newly created Type C packaging standards (letter dated May 31, 1996, from James M. Taylor, EDO, NRC, to A. Bishop, President, Atomic Energy Control Board, Ottawa, Canada). However, Mr. Taylor stated in the letter that, to be consistent with United States law, any plutonium air transport to, within or over the United States will be subject to the more rigorous U.S. packaging standards.

A commenter to our 1999 ANPRM asserted that the testing criteria for Type C packages are inadequate. For example, the commenter questioned the rigorousness of the testing described in TS–R–1, indicating that the minimum acceptable impact speed should be increased to at least 129 m/s, as was mandated by Congress. Several commenters stated that it is unclear what the differences are between a Type B and Type C package and that the definitions should be clarified. Several commenters supported the addition of the term LDM and recommended its incorporation into the HMR. Finally, one commenter suggested that the new concept of LDM was introduced to offset the problems encountered in developing a Type C package. The commenter further asserted that the nuclear industry would attempt to certify reprocessed fuel known as MOX as LDM. The commenter believed there are significant safety implications regarding the movement of these substances via transportation by air and very strongly opposed any adoption of requirements in this area.

According to the DOT and NRC MOU, the NRC has responsibility for matters concerning packagings for fissile and greater-than-Type-A quantities of radioactive material. The NRC is not adopting the concepts of Type C packages or LDM at this time. In accordance with the NRC position, RSPA is not adopting the IAEA standards for Type C packaging or LDM in this final rule.

Discussion. All commenters supported the proposal not to adopt the IAEA standards for Type C packaging or Low Dispersible Material. Therefore, as proposed in the NPRM, we are not adopting the IAEA standard for Type C packaging or LDM.

Issue 8: Fissile Material Package and Transport Requirements

Background. Under the MOU between DOT and NRC, the NRC establishes the packaging requirements for the transport of fissile radioactive material, including excepted fissile material (*i.e.*, fissile material which may be transported as if it were non-fissile Class 7 (radioactive) material). In February 1997, the NRC published an emergency final rule (62 FR 5913, February 10, 1997) to amend 10 CFR 71 with respect to the regulations for shipping small quantities of fissile material. This rule was issued in response to a regulatory defect in the fissile material exemption regulations in § 71.53 of 10 CFR identified by an NRC licensee.

Based on the public comments on the emergency final rule, the NRC contracted with Oak Ridge National Laboratory (ORNL) to perform a thorough analysis of the possible hazards involved and to provide recommendations. In July 1998, the NRC published ORNL's conclusions as NUREG/CR–5342, entitled ''Assessment and Recommendations for Fissile-Material Packaging Exemptions and General Licenses Within 10 CFR Part 71.'' Based on the research and recommendations of this report, the NRC in its NPRM to harmonize 10 CFR 71 with TS–R–1, proposed several changes to its requirements for fissile exemptions, which were reiterated in § 173.453 of our NPRM. As a result of comments received by the NRC to the proposed wording in its NPRM, it has made several modifications in its final rule, and we have adopted those changes in this final rule. For further information the reader is directed to the NRC's discussion of Issue 16 in its final rule.

In its NPRM, the NRC also proposed the introduction of a Type B(DP) package, to be certified for use and used both to transport and to store spent nuclear fuel. Such a package would be issued an NRC Certificate of Compliance approving the design of a spent fuel (fissile material) transportation package, in accordance with the requirements of subpart I of 10 CFR 71, and an NRC Certificate of Compliance approving the design of a spent fuel storage cask, in accordance with the requirements of subpart L of 10 CFR 72. To maintain consistency between the NRC and DOT's regulations, we proposed wording in subpart I of 49 CFR 173, in our NPRM in which the concept of a

Type B(DP) was introduced. As a result of comments received by the NRC to the proposed wording in its NPRM, it has decided to withdraw reference to a Type B(DP) package in its final rule. Consequently, we have revised the text in this final rule to remove references to a Type B(DP) package.

As a result of the publication of our ANPRM, several commenters asserted that the TS–R–1 requirements for conducting criticality analyses for fissile materials being shipped by air required clarification. The commenters stated that a guidance note should be issued and included in TS–R–2 (now referred to as TS–G–1.1) when published and the HMR should reflect this clarification. Although we have no authority to make unilateral changes in IAEA documents, we stated we would analyze problems in performing criticality analyses for the shipment of fissile materials by air as they arise, in coordination with the NRC, and the possibility of issuing a guidance document would be considered if it appeared to be an appropriate means to address any problems encountered.

Other commenters stated DOT should provide clear guidance regarding the requirements for obtaining U.S. Competent Authority Certificates for air transport of fissile materials prior to formal harmonization of TS–R–1 and the HMR. However, the NRC and DOT did not propose to adopt TS–R–1 provisions for Type C packages or Low Dispersible Radioactive Material (LDRM). The practical consequence of this is that RSPA's Office of Hazardous Materials Safety, as U.S. Competent Authority, does not intend to issue Certificates of Competent Authority for Type C packages or LDRM. Other Certificates of Competent Authority for the international transport of fissile materials by air will be issued in accordance with §§ 173.471 and 173.473.

Accordingly, in this rulemaking we are: (1) Adopting the NRC fissile material exemption provisions in § 173.453; (2) removing the definition for ''fissile material, controlled shipment,''; (3) revising §§ 173.457 and 173.459 to remove the references to ''fissile material, controlled shipment''; and (4) establishing requirements for non-exclusive use and exclusive use shipments of fissile material packages based on TS–R–1 package and conveyance CSI limits, since we feel that this will considerably simplify the transport of fissile material packages, while maintaining appropriate criticality safeguards.

Discussion. We received four comments concerning fissile material package and transport requirements regarding the fissile material exceptions in the proposed § 173.453. In accordance with the MOU, we ensured that the comments had been addressed by the NRC review and we have incorportated the revised NRC language for fissile material exceptions into § 173.543 in this final rule. It should be noted that the final rule concerning fissile material exceptions applies to domestic situations only. International transport concerning fissile material exceptions will also need to comply with the requirements of the International Civil Aviation Organization's Technical Instructions (ICAO), the International Maritime Dangerous Goods Code (IMDG Code) or Canadian regulations, as applicable.

A commenter stated that the wording of proposed § 173.417(c) is confusing as it is presently written since the 1A2 steel drum/Type A combination packaging is not a Type B packaging and then suggested that ''Type B packaging'' be changed to ''packaging for fissile material.'' We agree and the change has been incorporated into this final rule.

Issue 9: Transitional Requirements

Background. Transitional requirements typically authorize: (1) Continued use of existing package designs and packagings already fabricated, although some additional requirements may be imposed; (2) completion of packagings that are in the process of being fabricated or that may be fabricated within a given time period after the regulatory change; and (3) limited modifications to package designs and packagings without the need to demonstrate full compliance with the revised regulations, provided that the modifications do not significantly affect the safety of the package.

Each transition from one edition of the IAEA regulations to another (and the corresponding revisions of the NRC and DOT regulations) included transitional provisions. The transitional provisions in TS–R–1, the latest version, are found in paragraphs 815–818 of that document. Although provisions for continued use of packages and special form sources previously approved in accordance with the 1973 and 1985 editions of the IAEA regulations remain virtually unchanged, TS–R–1 does not provide transitional provisions for packages approved under the 1967 edition of the IAEA regulations.

The TS–R–1 transitional provisions will have several impacts. The primary impact is that under TS–R–1 provisions, Safety Series No. 6 (1967) approved packagings will no longer be authorized. The second impact is that fabrication of packagings designed and approved under Safety Series No. 6 1985 (As Amended 1990) must be completed by a specified date.

In TS–R–1, packages approved for use based on Safety Series No. 6 (1973/1973A revisions) will continue to be authorized for use and can continue to be used through their design life, provided they meet the following conditions: (1) Multilateral approval is obtained, as applicable; (2) TS–R–1 quality assurance requirements are adhered to; (3) TS–R–1 A_1 and A_2 activity values are used; and, (4) if applicable, approval for air transport of fissile radioactive material is obtained. While existing packagings are still authorized, no new packagings may be fabricated to this design standard. Should a safety issue associated with the package be identified, this packaging will need to meet all of the applicable requirements of TS–R–1. In summary, a packaging designed to Safety Series No. 6 (1973/1973A) may continue to be used.

In similar fashion, TS–R–1 states that those packages approved for use based on Safety Series No. 6 (1985/1985A revisions) may continue to be used, provided the packaging meets the following conditions: (1) TS–R–1 quality assurance requirements, (2) TS–R–1 A_1 and A_2 activity values, and, (3) if applicable, approval for air transport of fissile radioactive material. After December 31, 2003, use of these packages may continue under multilateral approval if applicable. Should a safety issue associated with the package be identified, the packaging will need to meet all of the applicable requirements of TS–R–1. Additionally, use of this packaging will end on December 31, 2006. Beginning January 1, 2007, all packages shipped internationally will be required to meet TS–R–1 packaging approval requirements.

The NRC has stated in its final rule that it believes that packages approved under the 1967 edition of Safety Series No. 6 lack the enhanced safety features that have been incorporated in the packages approved under later revisions of the regulations. NRC cites the fact that more recent packages are required to be more leakage resistant, and that all packages presently approved by the NRC must satisfy the pertinent quality assurance requirements described in subpart H of 10 CFR 71. A more complete list of enhancements to package safety requirements since the 1967 IAEA regulations is found in the NRC NPRM (67 FR 21406), and includes: (1) The introduction of the

A1/A2 system; (2) standards for defining acceptable containment system performance; (3) the immersion test for Type A fissile material packages; (4) maximum normal operating pressure; (5) the definition of appropriate test parameters for evaluation of the package under normal and accident condition tests; and (6) quality assurance requirements for the design, fabrication, and use of Type B packages. NRC has also noted that the elimination of packages approved against the 1967 IAEA regulations first became public knowledge in 1996, with the IAEA's publication of ST–1 (later renamed TS–R–1). The NRC is therefore phasing out all of its package design certificates based on the 1967 IAEA Regulations.

In its analysis, NRC considered that designs for 1967-based packages would fall into one of five categories: (1) Package designs that may meet current safety standards with no modifications but have until now not been submitted to the NRC for review against these standards; (2) package designs that can be shown to meet current safety standards after relatively minor design changes; (3) spent fuel casks certified to the 1967 standards, for which stringent quality assurance requirements for design and fabrication did apply; (4) package designs that cannot be shown to meet current safety standards; and (5) packages for which the safety performance of the package design under the current safety standards is not known. NRC believes that it is appropriate to phase out use of designs that fall into the last two categories.

DOT Specification 6L, 6M, 20WC and 21WC packages are packages that have not been shown to satisfy packaging requirements of the 1973, 1985, or 1996 IAEA radioactive material transport regulations. In accordance with the decision by the NRC to phase out packages approved against the 1967 IAEA Regulations, and recognizing that under the MOU between the two agencies that NRC has cognizance over domestic use of Type B and fissile material packages, we proposed in our NPRM that as of the effective date of this final rule no new manufacture of packages of these types be allowed, and that all use of these packages cease as of two years following the effective date of this final rule.

In this final rule, to provide more time for affected parties to adjust to the new requirements and in consultation with the NRC, we have doubled the transition period to four years from the effective date of the rule, and have set the effective date to be nine months after publication of this final rule in the **Federal Register**. Thus, from the date of publication of this final rule, affected parties will have approximately five years to establish appropriate packaging alternatives.

It has been known since the publication of IAEA's ST–1 in 1996 that packages designed in accordance with the 1967 IAEA regulations would no longer be allowed for international transport. Moreover, NRC made clear that it was considering adopting this restriction for domestic transport. Thus, by the end of the five year period affected parties will have had approximately 12 years to adapt to the domestic elimination of these packages.

Discussion. Commenters to the NPRM generally stated that some type of transitional arrangements should be provided in the HMR to clarify how packages manufactured under earlier versions of Safety Series 6 will be phased out, and how and if these packages may be re-validated. One commenter suggested that we should provide a transition period prior to the full adoption of TS–R–1 that would provide shippers and carriers the flexibility to make shipments of radioactive materials under the current HMR requirements (equivalent to Safety Series 6) or under TS–R–1. Several commenters stated that for domestic shipments, we should provide a one-year transition period for complete implementation of the TS–R–1 regulations. Other commenters suggested that we incorporate the following statement into the HMR: ''Packages that have been prepared for transport prior to (five-year effective date) may be offered for transport provided that the labeling, marking, and placarding provisions of the regulations in effect at time of shipment are complied with.''

We agree that shippers and carriers will need time to adjust to the changes in the regulations introduced in this final rule, and that there should be a sufficiently long transition period for affected shippers to adapt to the removal of the DOT Specification packages. Accordingly, as we mentioned earlier, for most of the new requirements we are delaying the effective date of this rule to one year after its publication in the **Federal Register**. In addition, for reasons discussed below and in Section D, ''Regulatory Flexibility Act, Executive Order 13272, and DOT Regulatory Policies and Procedures,'' we are substantially lengthening the transition period before use of the DOT Specification packages is prohibited, from the two years originally proposed to four years after the effective date of this final rule. Thus, the regulated community will essentially have five years from the date of publication of this final rule before all use of the DOT Specification packages must cease, unless they have been shown to satisfy current performance requirements and are certified by the NRC.

A commenter supported the overall intent of the proposed modifications. As the number of international shipments increases, a common set of regulations will enhance the safety of these shipments. However, the commenter stated that DOT and NRC regulations should also provide allowance for domestic shipments that are unique to the United States. One example is the grandfathering of shipping packages. The commenter suggests that packages manufactured to the 1967 safety standard should be allowed to continue in domestic service, unless a safety problem is identified. The commenter stated that it is a small business and has estimated that replacing the two-year old DOT Specification 6L packages currently in use with newly-designed packages will cost about $500,000.

Two commenters reiterated how important the grandfathering issue pertaining to previously approved packages is to the future success of their organization as well as other small businesses that routinely transport Type B quantities of radioactive materials domestically. The commenters questioned why some packages with proven safety records would be phased out for domestic shipments in as little as two years after the final rule is issued. They noted that significant resources have been invested in transportation packages designed specifically for certain applications, and these packages will no longer be authorized for use should the regulations change as proposed. The commenters did not support the IAEA grandfathering provision for packages designed in accordance with the 1967 standard when such package(s) are limited to domestic-only shipments.

A primary concern of the commenter was with regard to transporting iridium-192, which is used for industrial radiography, and which is an integral part of the oil and gas pipeline industry, commercial and military aircraft safety maintenance programs, and ship construction and repair. The commenter stated that his company is the only domestic commercial source of this radioisotope for industry. The commenter cited extensive shipping experience using the GE–8500 transport container, without incident, for the past 23 years and stated that if the proposed regulations are adopted, none of these containers will be available for use and there are no other containers available in the world that meet the proposed new requirements for domestic use within the United States.

The commenter estimated that the cost of replacing these transport containers with ones meeting the proposed regulations, and having these packages reviewed and accepted by the NRC, would be at over a million dollars; and disregarding cost, it is unlikely the NRC would approve any new containers before the implementation date. Therefore, adoption of the new regulations would eliminate the company's ability to provide a domestic supply of critical radioisotope for both commercial and military applications and would dictate that only foreign companies could import this material.

A second concern expressed by the commenter was that the proposed rules would essentially remove from service any and all containers that could be used to transport isotopes from the Department of Energy's Advanced Test Reactor for medical or industrial use, and that in order to use this rare domestic reactor source for isotope production a new transportation package would have to be constructed that would meet the Safety Series 6, 1985 criteria. The commenter further stated that the time and cost associated with the design, manufacture, testing, and approval of such a container would likely exceed the financial ability of the commenter's company.

The commenter recommended currently approved DOT specification packages (such as welded special form sources inside a Type A package, within a 20WC overpack) should continue to be approved for domestic shipments. The commenter stated that the cost associated with phasing out transportation packages that have been in use safely for decades cannot be justified solely on the basis of harmonizing the regulations with the IAEA Transportation Safety Standards (TS–R–1). The commenter further recommended that DOT accept Competent Authority Certificates for foreign made Type B packages without requiring revalidation by a U.S. Competent Authority. The commenter stated that the basis for this suggestion is that revalidation by the U.S. of foreign made (Type B(U)) packages for which another country has already issued a Competent Authority Certificate in accordance with TS–R–1 is a redundancy that provides no additional benefit.

We disagree. For safety reasons it has long been NRC and DOT policy that revalidations of foreign package design approvals should be made for import and export, or for domestic use of such packages, only after we have assured ourselves that the packages do in fact meet our safety standards.

Another commenter focused on the proposal to eliminate the manufacture and use of all packages manufactured to IAEA 1967 Safety Series No. 6 requirements used for shipment of Type B quantities of special form radioactive material, two years after the effective date of the regulation. Specifically, the commenter referenced DOT Type 7A packages fitted with a metal jacket and contained in a DOT Specification 20WC overpack, and overpacks manufactured pursuant to NRC Certificate of Compliance (CoC) 6280. The commenter stated that after these packages are prohibited the only means of certifying new transportation packages (either new designs or recertifications of 1967 designs) would be via new Certificates of Compliance issued by the NRC, and there are reasons why the proposal should not be incorporated into regulation. The supporting rationale for the commenter's position can be described under five broad headings; these are discussed in detail below: (1) Increased costs; (2) safeguard/security issues; (3) safety record of 1967 Specification packages; (4) unnecessary harmonization; (5) transition period.

(1) *Increased costs:* The commenter stated that if the proposal is applied to domestic shipments, it is likely to have far different effects than those intended including unacceptably high costs for many small but important business entities, thus either substantially weakening firms or literally driving them out of business with no ready successors. The commenter suggested that there is also a potential for substantial delay in approving new designs or recertifying existing designs. The commenter's organization typically makes approximately 200 shipments per year for its operations and does not own any other overpacks suitable for its shipments. The commenter stated that there are between 100 and 200 20WC Specification containers in use in the United States today, in addition to the 15 owned and used by the commenter, and there are probably between 25 and 50 active NRC-approved 1967 containers in service, in addition to the two owned by the commenter's organization. If these estimates are accurate, the commenter asserts that the overall effect of implementation of the proposal to eliminate use of packages designed to the 1967 IAEA standards would be on the order of 10 to 15 times that projected by the commenter's organization alone.

The commenter stated that it manufactures some 1000 devices and ships them in either NRC CoC or DOT Specification containers built to the 1967 standards in current use throughout the United States, and it is certain that under the proposed regulations at least two CoCs would have to be obtained, either to requalify existing containers or to construct new ones meeting the TS–R–1 requirements. The commenter asserts that it is also possible that as many as a dozen or more CoCs would have to be obtained, depending on the NRC's licensing flexibility.

The commenter estimated that for each required CoC, it will cost at least $500,000 and take upwards of two years to design, test and obtain regulatory approval from the NRC for the corresponding new or requalified package. Thus, the commenter provided the following cost estimates: (1) Redesign/reapproval would range between $1 million and $6 million for the commenter's organization; (2) new overpack construction would cost about $50,000 each, with anticipated total costs of between $600,000 and $750,000; (3) the value of existing overpacks, with a per-unit depreciated value of about $30,000 apiece, would be lost, for a total of approximately $500,000. Therefore, the commenter estimated its overall cost of compliance to be $2–8 million. The commenter concluded that given this cost estimate compared to the commenter's organization's annual revenues and net worth, to proceed would be a sufficiently questionable economic decision that the company would, instead, probably close its doors and go out of business.

Upon consulting with the NRC, we believe that the estimated costs for certifying existing packagings or new designs against current requirements will be far less than the commenter estimated, on the order of $40,000 to $390,000 for each package design, or an estimated $120,000 to $1.17 million total (if complete redesigns consolidate content requirements to three designs). Individual packaging rework or full construction costs are further estimated at $200 to $50,000 each.

The commenter also stated that if the devices they service cannot be legally shipped, the value of these devices will be largely or totally lost from the time they need to be re-sourced or refurbished. At an average cost of approximately $50,000 per unit, this would mean an aggregate cost on the order of $50 million, distributed among several hundred customers. Since we believe a cost-effective solution will be readily achievable, the value of the devices will not be lost, so we feel that this cost estimate is moot.

The commenter also stated that the organization's devices, which were built to be shipped in DOT Specification packages, contained source shielding and housing containers that were built under Quality Assurance standards that were not governed by the NRC's QA program in 10 CFR Part 71, §§ 71.101–71.135. As a result, the documentation or ''QA Paper'' for these devices may not conform to NRC QA requirements even though actual design, procurement and construction standards may have been identical or equivalent to NRC standards. Therefore, the commenter stated, it would not be possible to document the ''pedigree'' of such components as the shielding and the housing of these devices, which are integral to the device but technically part of the ''packaging'' as defined in NRC and DOT regulations (10 CFR 71.4 and § 173.403). Therefore, unless the NRC either amends or relaxes its interpretation of its QA requirements, the commenter suggests it likely that NRC will not accept packages initially designed and manufactured to DOT specifications. In that event, according to the commenter, the cost of compliance would rise dramatically, as one of three scenarios would follow:

a. Transportation containers weighing upwards of 60,000 pounds would have to be designed that could transport existing devices without taking any credit for the radioactive shielding or structural housing surrounding the source, which would require special highway authorizations and increase costs. The commenter estimated that designing, licensing and constructing such a container, with dedicated tractor and specially designed trailer, would cost upwards of $2,250,000. The cost of succeeding containers, each with its own trailer, would approach $1,000,000 apiece. Shipping costs for these containers would also be an order of magnitude higher than those for current devices ($35,000–$40,000 vs. $3000 per trip now). Even then, the transportation rig would be unable to access numerous locations that can now be reached, thus running the risk that some sources would be stranded. Therefore, this alternative, while technically feasible, is physically cumbersome and sufficiently more costly than current shipping modes that many existing customers would be tempted to buy and ship new devices rather than have existing ones re-sourced or hauled away for decommissioning.

b. Sources could be transferred at the customer's site from the existing device to a specially designed ''transportation container,'' using a portable hot cell transported to the customer's site. This option has not been fully cost estimated because it appears to have almost insuperable obstacles. First, most of the devices are fabricated with welded end-caps, in order to prevent tampering by unauthorized persons. As a result, removing the source is a difficult, potentially high-exposure process when conducted in the field. Second, setting up a hot cell is an unavoidably expensive business—on the order of $300,000 per installation. Even if devices were designed with screw-on end caps (and some are) and special shipping containers were designed to operate with them—thus substantially lessening the labor and radioactive exposure associated with a transfer—it would still be necessary to set up a portable hot cell. This alternative is prohibitively expensive except in extreme conditions. It is also inconsistent with the as low as reasonable achievable (ALARA) goal of minimizing occupational exposures to radiation.

c. Existing sources in existing devices manufactured to DOT specifications would become unshippable in existing packages, and their value would be lost as of the time their sources next need to be removed. There are nearly 1,000 of these devices in service throughout the U.S., so the cost to customers, at an average value of $50,000, would be $50 million. The commenter regarded this scenario as the most likely, since the cost of the other two scenarios is likely to deter market entrants.

As a result, the commenter stated that the actual total numbers of 20WC overpacks and the devices shipped in them are on the order of 10 to 15 times its own. In that event, the commenter stated that the industry-wide economic costs projected can be extrapolated as follows:

Cost of design, testing and licensing of new designs: $10,000,000 to $90,000,000
Costs of construction of new overpacks: $6,250,000 to $12,500,000
Loss of value of existing overpacks: $5,000,000 to $10,000,000
Loss of value of existing devices: $500,000,000 to $1,000,000,000.

Finally, the commenter stated that numerous participants in this market sector are small entities within the meaning of the Regulatory Flexibility Act, 5 U.S.C. 9 601 *et seq.*, and the draft Regulatory Analysis does not account for this fact. The commenter stated that both the NRC and DOT have mis-assessed the impact of their proposals on small entities protected by the Regulatory Flexibility Act. In any event, the commenter suggests that the NRC's characterization of nuclear power plant operators as the typical type of entity affected by the proposal under discussion is incomplete. In addition, the commenter states that affected entities include hospitals, research facilities, blood banks, colleges and the like, numerous of which fall within the size or income categories of small entities.

We do not agree. We find it implausible, given activity levels that are currently routinely transported in legal weight vehicles, that these devices will require overweight vehicle transport. Therefore, we discount this cost estimate. We agree that the option of setting up satellite hot cells to perform refurbishment may not be a cost-effective viable option; however we do not rule out the possibility free market initiatives could make this a desired alternative. We do not believe there will be a loss of value to devices currently in use, since packages that conform to current safety standards will be found to replace those being phased out.

We note that the fact that a packaging may lack complete QA documentation, although ''the actual design, procurement and construction standards may have been identical or equivalent to NRC standards,'' is an important reason for upgrading the packaging, or for replacing it with a packaging that can be shown to satisfy current safety requirements. Only when and if it can be shown that the design, procurement and construction standards were in fact equivalent to current requirements can we have confidence that such is the case.

Assuming conservatively that on the order of 10 to 20 new package designs for the 20WC would need to be approved by the NRC, that from 50 to 100 replacements for the 20WC packagings would need to be manufactured, using typical cost estimates from the NRC of $300,000 to $390,000 for design, testing, and licensing, manufacturing costs of $50,000 per manufactured package, and the commenter's estimate of $30,000 per package for depreciation costs, we believe that a conservative estimate of the industry-wide cost can be projected as follows:

Cost of design, testing and licensing of new designs: $3,000,000 to $7,800,000
Costs of construction of new overpacks: $2,500,000 to $5,000,000
Loss of value of existing overpacks: $1,500,000 to $3,000,000

Estimated total cost to industry:
$7,000,000 to 15,800,000.

Therefore, we conclude that the realistic costs are relatively modest and we believe the commenter has overestimated total industry-wide costs resulting from the proposal by almost two orders of magnitude.

With respect to the assertion by the commenter that numerous participants in this market sector are small entities, we received only three comments regarding the economic cost of removing the 1967 Specification Packages from service. In addition, NRC staff found that only 15 of 127 NRC licensed quality assurance programs belong to small entities, and that of these, only 2 or 3 would be appreciably affected by the elimination of the 1967 based packages. They concluded from these data that this requirement would not cause a significant economic impact for a substantial number of small entities.

(2) *Safeguard/security issues:* The commenter stated that at some point in time every device containing a radioactive source needs either a fresh source, refurbishment, or retirement. The commenter also stated the proposal would make devices and sources now shipped in currently approved packages not legally transportable in any currently licensed container, thus creating hundreds of sites with thousands of orphan sources that could no longer be used, could not be shipped for orderly disposition, and would have to be maintained and safeguarded indefinitely. For instance, one obsolete type of device distributed under the aegis of the former AEC is known to be located in at least five high schools and 28 colleges or universities around the country, awaiting shipment for decommissioning. According to the commenter, under the proposed regulations these would then be orphaned. Therefore, the commenter asserts that facility managements, in coordination with state governments (in Agreement States) or the NRC, must then store them safely, indefinitely, keeping them physically secure, protecting personnel against radiological hazards, and guarding against security hazards, such as theft by terrorists.

To make matters worse, the commenter suggests that as long as these devices are unable to be shipped, no entity possessing them can conduct a final radiation survey and terminate its license. Every such licensee must remain indefinitely on NRC or Agreement State rolls. In the meantime, the commenter asserts that any closure of any facility containing such a device, or any sale or other transfer or conversion, becomes virtually impossible since the current licensee must either remain on the license for the device or transfer it to another qualified potential licensee. This not only greatly complicates normal real estate transactions but basically freezes any facility in its current use and ownership indefinitely. The commenter raised the possibility that one collateral effect of the pending proposal may be that it constitutes a major federal action significantly affecting the human environment, thereby requiring a full-blown Environmental Impact Statement under the National Environmental Policy Act, 42 U.S.C. 4331 *et seq.*

We do not agree, especially given an effective five-year transition period from publication of the final rule, that the loss of authorization to use 1967 Specification packages could result in thousands of sources becoming orphaned. For example, a situation exists where non-licensees find themselves to be in possession of radioactive sources that they did not seek to possess, at hundreds of sites. Even with no transition time, the sources will not immediately become orphaned.

Additionally, we believe that five years will provide a sufficient transition period, in the near future, as an interim transport methodology for those devices that require refurbishment, repair, relocation etc., or if the licensee is undergoing a license termination evolution, while the concurrent process of designing, constructing, and approving packages, in accordance with current safety standards will allow sufficient time for an orderly phase out of the 1967 Specification packages.

(3) *Safety record of 1967 Specification packages:* The commenter stated that the packages designed and built to 1967 specifications and properly maintained have an excellent safety record, and that neither agency alleges any safety problem with their design, which was subjected to 30-foot drop, fire and immersion tests by Sandia Laboratory in 1968. The commenter added that both the NRC and DOT concede in their rulemaking notices that their proposal to eliminate 1967 Specification containers from domestic use does not rest on a health-and-safety foundation and that current container regulations provide adequate safety.

The commenter is correct in stating the packages were subjected to drop, fire, and immersion tests. However, concerning the 1967 Specification packages, since there is often no quality assurance program element, inadequate testing to international contemporary consensus standards, and no stand-alone safety analyses report, the packages, unless recertified to current standards, need to be recognized as being outdated and obsolete.

We also agree there is no current safety issue that would require the immediate elimination of the 1967 Specification packages. However we believe there will be an increase in the level of safety resulting from adopting the proposed regulations, and this increased level of safety is provided at a reasonable cost. Therefore, we are adopting the proposed elimination of the DOT Specification packagings, with a modified implementation time of four years from the effective date of this rule, after a one year period between publication of the final rule in the **Federal Register** and the effective date.

(4) *Unnecessary harmonization:* The commenter stated that neither the NRC nor DOT has advanced a substantial argument, other than consistency with IAEA requirements (which are not binding under U.S. law), for compelling the elimination of these containers from continued use in U.S. domestic commerce. The commenter added it is useful to incorporate technical advances in equipment into regulations, but not sensible to require costly change with respect to adequate existing equipment absent significant offsetting safety or other statutory-policy justifications. The commenter also stated that IAEA requirements, or regulations, are not self-implementing inasmuch as they do not bind the United States, or any member State, unless ratified or accepted by that State's government. Indeed, IAEA recognizes in TS–R–1 that national-level departures from its provisions may be "necessary for solely domestic purposes" and DOT is only obligated to ensure only that U.S. domestic regulations are "consistent with" international standards, and then only "to the extent practicable." Finally, the commenter stated there is neither a tangible safety benefit to be achieved nor a definable risk to be avoided from the proposed elimination of 1967 Specification packages as applied to domestic shipment of Type B quantities of special form radioactive materials.

We agree that the IAEA regulations are not binding in the U.S., unless adopted, and have implemented exceptions when deemed necessary. Since the old packages will be replaced by packages that will have shown to conform to current safety standards, we believe elimination of the 1967 specification packages will increase the level of transportation safety.

(5) *Transition period:* The commenter urged the rulemaking be modified so as to permit the indefinite continued use of

properly maintained existing packages built to 1967 IAEA Safety Series No. 6 Specifications for the shipment of Type B quantities of special form radioactive material within the United States. However, the commenter stated any ''sunset'' deadline on use of any package design being phased out under this proposal should permit its continued use pending ultimate decision by the NRC on either re-certification of the existing design or approval of a new design.

The commenter suggests that if a specific ''sunset'' date is chosen, it should be significantly longer than the ones proposed by either the NRC or DOT, which should agree on a common ''sunset'' date. Due to the time necessary to design, fabricate, test and gain NRC review of a new CoC design, the commenter asserts that the two-year transition period proposed by DOT would cause a shipping hiatus even if costs were not an issue.

We agree. Due to the reasons cited earlier, and after consultation with the NRC, we are providing a nine month window from publication of this final rule in the **Federal Register** to the effective date when it becomes obligatory, and a four year transition period from the effective date before use of the DOT specification packages is no longer allowed. The total transition period from the publication of the final rule to the date when these packages may no longer be used will be approximately five years. This will increase the level of transportation safety at an acceptable cost, provide a reasonable, low-impact solution taking all concerns into consideration, and allow a sufficiently long transition period for introduction of replacement packages.

This five-year transition period is in addition to the time that it can reasonably be assumed that it became general industry knowledge that the use of these packagings would be eliminated domestically. The IAEA ''Regulations for the Safe Transport of Radioactive Material'' have provided a basis for U.S. radioactive material transport regulations for decades. Paragraph 713 of the 1985 Edition (As Amended 1990) of Safety Series No. 6 stated ''Packagings manufactured to a design approved by the competent authority under the provisions of the 1967 Edition of these Regulations may continue to be used, subject to multilateral approval.''

The 1996 Edition of the IAEA regulations (TS–R–1) completely eliminated any transitional arrangements for the use of packagings manufactured to a design meeting the requirements of the 1967 Edition of the IAEA regulations. As a consequence of this change, DOT notified all registered users of the Certificate of Competent Authority USA/5800/B for the use of the DOT Specification 20WC packaging for import and export, including this commenter, that the 1996 IAEA regulations had removed the transitional approval provisions for Type B packages constructed in accordance with the 1967 Edition of the IAEA regulations, and that therefore, users of DOT Specification 20WC packaging would be required to show that their package meets the performance criteria of the 1996 regulations or it would have to be transported under a Special Arrangement when used for import or export.

This notification was made via written memoranda sent on each of four different occasions, in 1997, 1998, 1999, and 2000. These memoranda further stated that no Special Arrangements were envisioned after January 1, 2001, since the advent of this requirement would by that time have already been public knowledge for several years. Consequently, for those users who also used this packaging for international shipments, these notifications, along with an effective five-year transition period from the publication of this final rule, will have provided an effective transition period of more than a decade for elimination of the 20WC packaging.

Another commenter stated that DOT and NRC must recognize that while IAEA standards generally have good technical bases, they are consensus standards that do not necessarily consider the risk-informed, performance-based aspects of regulations that we have developed in the United States. Therefore, this commenter suggests that while most of the IAEA standards should be incorporated into U.S. regulations, the unique aspects of the U.S. regulations need to be considered. The commenter agrees that the IAEA standards are appropriate for international shipments, but believes that DOT and NRC regulations should also provide allowance for domestic-only applications. This would include for example, a grandfathering provision.

We believe that this rulemaking process is the appropriate forum that takes into consideration the risk-informed, performance-based aspects the commenter referenced, and that balances individual concerns with the overall lack of clarity in the ability of these packages to meet current safety standards. Therefore as discussed earlier, we have decided to allow a transition period of four years from the effective date of the rule, which is in turn set to nine months after publication of the final rule in the **Federal Register**. This will result in an effective five-year transition period from the date of the final rule publication in the **Federal Register**.

Two commenters stated that the discontinuation of DOT specification packages two years after the effective date of this rule has the potential to impact the timely remediation and closure of U.S. Department of Energy (DOE) sites and the DOE has an excellent safety record using DOT specification packages. Additionally, since significant volumes of material (9,000 packages) are presently prepared in specification packages, the commenter states that repackaging would be time consuming, very costly and would increase the risk to workers whenever it is required. Since it may take two to four years to complete the design, construction, and certification processes to replace these packages, the commenters asserted that the continued use of these packages for five years after the effective date of the rule would allow the DOE to complete many of its shipping campaigns without initiating design, certification and production of new packagings, or to do so in an orderly manner.

We agree. We believe that the two-year time frame was insufficient. We have therefore, changed the transition period to four years from the effective date of the rule, with a nine month effective date from final rule publication in the **Federal Register**. This will allow an effective five-year transition period from the date the rule is published in the **Federal Register**, which would only require a slight acceleration of remediation campaign activities.

Three commenters were concerned the separate DOT and NRC rulemaking proposals had different effective implementation dates and they encouraged DOT to work with the NRC to ensure a common effective date. We agree. We have reached consensus with the NRC to implement a four-year transition time, beginning at the effective date of the rulemakings, with a nine month effective date from final rule publication in the **Federal Register**. This change has been included throughout this final rule as appropriate.

Two commenters supported the proposal to accept the IAEA transitional requirements including the phase out of Type B specification packages and the termination of authorization of Safety Series 6 (1967) packages. The commenters stated that Specification packages and Safety Series 6 (1967) packages have not been designed and constructed according to standards where their continued use would be consistent with the intent of the regulations. We agree, as discussed above.

Two commenters stated that an issue that is overlooked in the transition to a new regulation is the fact that recurrent training is only required once every three years. Therefore, many organizations only send their personnel to be ''DOT Trained'' every three years. It may therefore take three years for the shippers to recognize that there have been major changes in the regulation. The commenters recommended that serious consideration be given to reducing the time for recurrent training to one year or incorporating a three-year transition period into the proposal, consistent with these training requirements.

We do not agree. The HMR (§ 172.702(b)) states * * * ''a hazmat employee who performs any function subject to the requirements of this subchapter may not perform that function unless instructed in the requirements of this subchapter that apply to that function.'' Our position regarding all HMR changes is that if a new regulation is adopted, or an existing regulation is changed, that relates to the function performed by a hazmat employee, that hazmat employee must be instructed in those new or revised function specific requirements without regard to the timing of the three year training cycle (Docket HM–222B, 61 FR 27169).

A commenter stated that during the transition phase when DOT Specification packagings would still be authorized for use, the proposed rule does not appear to specify the proper shipping name that would apply for fissile material shipped in a DOT specification packaging and the final rule should make clear what name should be used during transition phase.

We agree. We consider that during the transition period, when a non-fissile or fissile-excepted Type B quantity is transported domestically in a 1967 DOT Specification package or in an NRC-approved B( ) package, the proper shipping name and UN number ''Radioactive material, Type B(U) package'' and ''UN2916'' may be used. Similarly, during the transition period when a fissile Type B quantity is transported in a 1967 DOT Specification package or in an NRC-approved B( )F package, ''Radioactive material, Type B(U) package, fissile'' and ''UN3328'' may be used.

Issue 10: Other Changes

Background. We are requiring in § 173.424 that the active material in an instrument or article intended to be transported in an excepted package be completely enclosed by the non-active components. This is a requirement which appears in paragraph 517(c) of TS–R–1, and is a change from the wording in Safety Series No. 6. It is intended to enhance the safety of shipments of instruments or articles in excepted packages by making it explicit that the radioactive contents in such an instrument or article must be completely enclosed by the non-radioactive material of which the instrument or article is constructed in order to prevent release of the active contents under normal conditions of transport.

Discussion. A commenter noted that the term ''completely enclosed'' is not defined in the NPRM. The commenter asked for clarification regarding the exception provided in § 173.424 regarding items that are ''completely enclosed'' by non-radioactive components. The commenter specifically asked whether items like smoke detectors, which by necessity must have openings for smoke to enter the active volume, would qualify for this exception. The commenter went on to explain that smoke alarms contain a small amount of radioactive material, Americium-241, which is embedded in a gold foil matrix within an ionization chamber, and that the thin gold-americium foil is sandwiched between a thicker silver backing and a palladium laminate. The laminate is thick enough to completely retain the radioactive material, but thin enough to allow the alpha particles to pass.

The commenter requested that RSPA clarify in the final rule that an instrument is not required to provide an air-tight enclosure for the radiation source in order to be considered ''completely enclosed.'' Rather, where the radioactive material is enclosed in or forms a component part of an instrument or other manufactured article where an added degree of protection is provided against escape of material in the event of an accident, such instrument or article should qualify for the exception in § 173.424.

We agree that the intent of the requirement in § 173.424 is not to exclude items such as Americium-241 smoke detectors, and the requirement that the active material be completely enclosed by non-active components is met, in the case of a smoke detector or a similar device, by the combination of the thin laminate and the positioning of the active element within the outer case, even though that case is not air-tight.

In addition to the above comment, we received numerous comments that did not lend themselves to categorization in one of the other nine issues. Therefore, we have elected to discuss these comments here.

One commenter provided a petition signed by several thousand people that called for the United States President, Vice President, Congress and all Federal, state and international regulators and legislative bodies to recapture, stop and prevent release/clearance recycling of radioactive wastes and materials into consumer products and the environment. The petition further supported regulation and isolation of radioactive wastes from nuclear power and weapons and also opposed the use of radioactive materials and wastes in consumer products and building materials including, but not limited to metals, concrete, plastics, glass, paper, wood, soil, and equipment.

The commenter's petition called on the NRC to reverse its efforts and expenditures to release radioactive wastes, to initiate a policy requiring regulatory control and isolation of all radioactive wastes, and demanded the recall of radioactive material and wastes that have been released into the marketplace. The petition also called on DOE to halt all releases of radioactive wastes and materials into the marketplace, to recapture that which has been released, and revocation of the Radioactive Recycle 2000 policy immediately. We acknowledge receipt of the comment; however the comment is not within the scope of this rulemaking.

A commenter stated the proposed rule is too confusing and complicated. We disagree. Although the regulating of radioactive materials involves a degree of technical complexity, particularly because of the need to determine quantities in terms of activity limits and potential exposures, we believe the requirements adopted in this final rule are capable of being understood and complied with. One reason we are allowing an implementation time of one year from publication of the final rule in the **Federal Register** is to allow adequate time for preparation and training for persons responsible for complying with these requirements.

Several commenters stated that over-reliance is placed on unchallenged information of the International Commission on Radiation Protection (ICRP), outdated and incomplete models, lack of information on 350 radionuclides, and a biased scientific opinion on radiation health effects. We disagree. We believe the ICRP offers a quality and reasonably comprehensive perspective on radiation protection standards. However, during the rulemaking process we do evaluate alternative information and opinions, when submitted to us, which provide reasoned arguments.

Two commenters stated that all the proposals should be withdrawn and that we should adopt public recommendations that improve safety and security and take into account the growth of future radioactive shipments. We disagree. We believe that the proposed rulemaking will improve public safety and is based on projected levels of transportation activities, and that to restart the rulemaking issue would be a public disservice.

Several commenters were opposed to harmonization promulgated by the United Nations and the IAEA. They stated that the international standards-setting process is not democratic, the documents are not freely available, and the deliberations and negotiations are not accessible. The commenters questioned if this process meets the Federal Advisory Committee Act, the Sunshine Act, the Administrative Procedure Act, and the Open Meetings Act. One commenter requested we put interested parties on notice of impending IAEA rulemaking, and receive comments for its consideration as a participant in IAEA's rulemaking process, because neglecting the interests of U.S. stakeholders in the IAEA rulemaking process leaves DOT open to criticism for ill-informed rulemaking that is more in the nature of a legislative fiat from IAEA than a product of the democratic process.

Another commenter stated that although IAEA standards generally have good technical bases, they are consensus standards that do not necessarily consider the risk-informed, performance-based aspects of domestic regulations. Therefore, while most of the IAEA standards should be incorporated into U.S. regulations, the unique aspects of the U.S. regulations need to be considered; the IAEA standards are appropriate for international shipments, but DOT and NRC regulations should also provide allowance for domestic-only applications.

We disagree. We believe that although international agencies, such as the IAEA are not subject to the aforementioned acts, conducting the rulemaking process in accordance with 49 CFR 106, to consider incorporation of their recommendations into U.S. regulations, provides the necessary forum to comply with the Administrative Procedure Act (5 U.S.C. 553). Furthermore, the rulemaking process provides a methodology to deviate from IAEA regulations domestically, where appropriate.

Several commenters generally supported the overall intent of the proposed modifications since a uniform set of requirements for the movement of nuclear materials worldwide is in the public interest for the safe transport of these materials. However, the commenters expressed a concern regarding the slowness of the governmental rulemaking actions. Global businesses are required to comply with the regulations of many countries and many international organizations as well as those of the U.S. during these transitional times, and are therefore forced to operate to two regulatory systems, one for domestic and one for international shipments. This situation places complex demands on management systems, procedures, personnel and training, and for this reason, the commenters stated that the transition to international standards needs to be streamlined so that this impact is minimized more so than is currently the case.

One commenter noted the IAEA two-year cycle is needlessly frequent, resulting in demands on the resources of both the competent authorities and the regulated community to adapt to changes that are unwarranted as they provide little value to a segment of transportation that, based on its track record, requires no improvement. We disagree. We believe the application of the IAEA two-year revision cycle will actually result in a more timely revision process due to the fact that revisions will typically focus on far fewer issues than has been the case with the ten-year revision cycle; the historically lengthy IAEA revision process can cause several significant issues to accumulate, which can compound problems due to simultaneous implementation of new regulations covering several topics.

A commenter recommended that there be a three-year phase-in for implementation of the changes in this final rule, because of costs involved in ordering supplies in quantity, and to allow time for IP containers to be modified to meet the communication changes. We are aware that changes in the regulations may require the investment of time, money and effort. We believe that a three year transition time is too long for the implementation of most of the changes. However, in order to allow more time to make these changes we are including in this final rule a transition time of nine months from the date of publication before mandatory compliance will be required.

Several commenters stated that the term ''consignment'' should be clarified because in transportation in commerce the term is often considered to mean a package or group of packages offered by a consignor for transport to a single consignee and multiple consignments may be offered to a carrier simultaneously. One commenter questioned if the RSPA usage of ''consignment'' meant all the packages listed on a single manifest/bill of lading, offered by a single consignor at one time (even if the packages are destined for multiple consignees), or loaded onto a conveyance at a single location. Another commenter suggested the definition of ''consignment'' presented in ICAO 2001–2002 Section 3.1 and in IATA 2002 Appendix A is a much more workable definition, where consignment means one or more packages of dangerous goods accepted by an operator from one shipper at one time and at one address, receipted for in one lot and moving to one consignee at one destination address.

Another commenter stated that ''consignment'' bears the connotation of all packages in a shipment. The commenter also stated that the inclusion of ''load of radioactive material'' needs to be better defined, because operations often require the shipment of bulk quantities of radioactive materials (*e.g.*, soil with residual radioactivity). The commenter questioned if the purpose of this statement is to limit the definition of a consignment to one bulk railcar (*e.g.*, gondola), each railcar being one consignment, as opposed to eight or more bulk railcars comprising one consignment. The commenter suggested the proposed rule is also not clear as to whether a rail car with several bulk containers (*e.g.*, 4–6 rail cars) would be defined as a single consignment or if each bulk container would be a ''load.'' The commenter recommended that the definition of ''consignment'' be clarified to address shipments of bulk containers (*e.g.*, gondolas, intermodals) by rail and other transport vehicles. The definition should account for the difference in hazards from shipping a group of radioactive material packages in an aircraft to shipping several bulk containers on a single railcar and a number of gondolas of radioactive material in a single train. We agree. The definition can be clarified and we have provided a modified definition in the final rule.

A commenter disagreed with the proposed definition of ''Quality Assurance'' and suggested the wording should specify the use of health physicists, radiation safety officers, nuclear engineers, NRC and DOT personnel, as well as up to date radiation detectors. We disagree. We believe the definition is adequate and should be brief, since it provides a formal meaning to the subject phrase, recognizing the definition alone is not intended to set forth the comprehensive elements of a quality assurance program.

One commenter was concerned that in some instances, the proposed DOT rules do not incorporate some important aspects of the TS–R–1 standard. A specific case is the determination of transport index (TI) in paragraph 526–527 of TS–R–1. By not including the multiplication factor for large dimension loads, the proposed rule maintains an incompatibility with the IAEA standard.

The commenter is correct in noting we have not included the subject IAEA guidance pertaining to transport index multiplication factors for large dimension loads in the U.S. regulations. There are also several other domestic variations from IAEA regulations, such as communications involving Low Specific Activity shipments and the rules for placarding White-I and Yellow-II shipments. These variations from the IAEA regulations generally result from more than one factor, such as cost/benefit analysis, risk-informed rulemaking, and stakeholder comments. We do intend, however, to continue to analyze whether the IAEA multiplication factor for large dimension loads should be made a U. S. requirement.

A commenter stated that, in the NPRM, § 173.415(d) updates the requirements reference to the new IAEA standards. However, § 173.415(d) continues to include as a requirement that, in order for foreign-made Type A packaging to be used for domestic or export shipments, the packaging must have first been ''used for the import of Class 7 * * * materials.'' Given that the purpose of this NPRM is to ''harmonize requirements of the HMR with international standards,'' retaining this import requirement seems to run counter to this purpose in that TS–R–1 does not have a similar requirement. The commenter requested that the requirement that the packaging first be used for the import of radioactive material be deleted, preferably for both domestic and export shipments, but at least for export shipments.

We agree that the wording in § 173.415(d) requiring that a foreign package that meets the IAEA standards for a Type A package be required to have first been used for the importation of radioactive materials before it can subsequently be used for domestic and export shipments of Class 7 (radioactive) materials, is not necessary. Therefore, in this final rule we have eliminated the requirement that the packaging must have first been used for import of radioactive material.

A commenter stated that DOT should take this opportunity to clarify the intent and understanding of the requirements of § 173.443(a)(1) and (2) by defining what is meant by ''wipe efficiency.'' The use of word ''efficiency'' has been the source of confusion and misunderstanding for years in the application of § 173.443 in operations to demonstrate compliance. The proposed wording provides a better explanation of the regulatory requirements but could be improved if ''efficiency,'' taken to be 0.10, is defined as the fraction of removable contamination that is taken up by a wipe and counted as a sample, not as the efficiency of the counting instrument used to measure the amount of activity on the wipe. The commenter stated that making this distinction between wipe efficiency and counting efficiency will eliminate the potential confusion. We agree that clarification of the term ''wipe efficiency'' may be beneficial and we have inserted a parenthetical definition in the subject subparagraph.

We also received numerous other comments that are outside the scope of our proposed rulemaking, and therefore were not considered in this final rule. For example, commenters stated that (1) all radioactive shipments should be on dedicated vehicles or trains; (2) all drivers should be trained on radiation hazards and security measures; (3) there should always be a second person in the cab of the vehicle during radioactive material transport; (4) radioactive material transport should always be escorted, both in front and in back of the transport vehicle; (5) radioactive material placards should read ''Keep Back, Radioactive Material Transport''; (6) a DOT and NRC inspector should check every fissile material package/shipping cask as it comes into each state; (7) no air or water shipment of spent fuel should be allowed; (8) the use of commercial airlines or airports for any radioactive shipments should not be allowed; (9) packages subjected to a crush test should be able to withstand being run over by a freight train or tank; (10) radioactive material should not be on the same conveyance as animals, fish, birds, or members of the public; (11) DOT's segregation distances cause unsatisfactory exposures to crews and passengers; (12) criticized DOT's issuance of an exemption for uranyl nitrate; (13) depleted uranium should be more regulated; (14) all packages should be double packed, not just strong, tight; (15) most radioactive material shippers, handlers and emergency responders need more training, personnel, and equipment; (16) excepted packages should not be allowed if they are designed only to prevent release of active contents under normal conditions of transport, due to the possibility of surprise terrorist attacks, which are not a normal condition of transport; (17) DOT allows casks to reach staggering contamination levels by the time it reaches its destination, therefore en route decontaminations should be performed during transport; (18) fissile material packages should not be mixed with other packages; (19) transport vehicles should be equipped with side rails which cause detonation of any terrorist launched explosive prior to coming in contact with radioactive material packages; (20) women of childbearing age should not be allowed to work around any radiation source.

III. Section-by-Section Review

Part 171

Section 171.7

In the table of material incorporated by reference, we are removing the references to the DOE Uranium Hexafluoride Good Practices manual, the 1985 IAEA Regulations for the Safe Transport of Radioactive Material, Safety Series No. 6 and two ISO standard entries. We are revising the reference to the IAEA Regulations for the Safe Transport of Radioactive Material, No. TS–R–1, 1996 Edition and we are adding three new entries consisting of references to two ISO standards and a United States Enrichment Corporation Good Handling Practices for Uranium Hexafluoride.

Section 171.11

On June 21, 2001, in a final rule, published under Docket HM–215D [66 FR 33336], we added paragraphs to §§ 171.11 and 171.12 to clarify that only the current definition of radioactive material applies (*i.e.*, 70 Bq/g (0.002 microcurie/g)) when transporting a Class 7 (radioactive) material domestically. In addition, we maintained the current provisions in §§ 171.11 and 171.12, including the values for Type A packaging contents. Therefore, in § 171.11, we are removing paragraph (d)(6)(vi) that limits the Class 7 (radioactive) material to the current definition in § 173.403. As a result, offerors of radioactive material shipments by air will no longer have to satisfy either of two different definitions of Class 7 (radioactive) material, since now both the HMR and the ICAO Technical Instructions will both use the TS–R–1 definition. To clarify that the exceptions described in § 173.422 apply to instruments or articles containing natural uranium or thorium, and empty packagings, as well as limited quantities of radioactive material, we are also changing the phrase ''limited quantities'' in § 171.11(d)(6)(iii) and (iv) to ''excepted packages.''

Section 171.12

In § 171.12, we are revising paragraphs (d) introductory text and (d)(4) to remove the reference to Safety Series No. 6, 1985 edition and replace it with TS–R–1, 1996 edition. In addition, we are removing paragraph (d)(7) that limits the Class 7 (radioactive) material definition to the current definition in § 173.403. This again will result in the use of the TS–R–1 definition of Class 7 (radioactive) material for both domestic and international shipments.

Part 172

Section 172.101

In the Hazardous Materials Table, we are revising the radioactive material (Class 7) entries consistent with new entries introduced in the UN Recommendations and IAEA's ''Regulations for the Safe Transport of Radioactive Material, No. TS–R–1.'' In addition, we are removing those radioactive material entries that currently allow for domestic shipment only.

Section 172.203

In paragraph (d) we are removing two requirements that would become redundant upon adoption of the new proper shipping names, the previous requirement that the words ''Radioactive Material'' be entered on the shipping paper unless already contained in the proper shipping name, and the previous requirement that for a shipment of low specific activity material or surface contaminated objects, the appropriate group notation of LSA–I, LSA–II, LSA–II, SCO–I, or SCO–II be entered in the shipping description. In addition, we are requiring that customary units, if used, be enclosed in parentheses. Because the isotope plutonium-238 has been removed from the definition of fissile material, we are removing plutonium-238 from the list of fissile radionuclides for which the weight in grams or kilograms may be listed instead of or in addition to the activity. We are requiring that the criticality safety index be included in the shipping description for fissile material packages, and we are moving to a separate paragraph the requirement that the words ''Highway route controlled quantity'' be included in the shipping description for a package containing a highway route controlled quantity of Class 7 (radioactive) materials.

Section 172.310

We are revising paragraph (b) to require industrial packagings to be marked ''Type IP–1,'' ''Type IP–2,'' or ''Type IP–3,'' as appropriate. In addition, we are revising paragraph (c) to remove the reference to Type B package designs, and to bring the wording into closer correspondence to that in TS–R–1. We are also redesignating paragraphs (c) and (d) as (d) and (e), and adding a new paragraph (c) to require the outside of a Type IP–2, Type IP–3 or Type A packaging to be marked with the international vehicle registration code of the country of origin of design.

Section 172.400

For fissile material packages, TS–R–1 (paragraph 218) introduced the concept of a CSI to replace the ''TI for criticality control purposes,'' and decoupled it from the determination of the TI for such a package. The CSI must be displayed on packages of fissile material (paragraphs 544 and 545) using a new ''FISSILE'' label. The redefined TI is determined in the same way as the ''TI for radiation control purposes'' and continues to be displayed on the traditional ''radioactive material'' label. Therefore, we are revising the table in § 172.400 to add the new ''FISSILE'' label.

Section 172.402

Paragraph (d) is being revised to require each package containing fissile material, other than fissile excepted, to bear the new FISSILE label. (See discussion under § 172.400 above.)

Section 172.403

We are adding a new paragraph (e) to require each FISSILE label to be completed with the CSI. (See discussion under § 172.400 above.) In paragraph (g)(1), for LSA–I material, we are authorizing the entry of ''LSA–I'' on RADIOACTIVE YELLOW II and YELLOW III labels as an alternative to listing the radionuclides contained in the material. Paragraph (g)(2) is revised to require that customary units, if used, be enclosed in parentheses. Because the isotope plutonium-238 has been removed from the definition of fissile material, we are also revising paragraph (g)(2) to remove plutonium-238 from the list of fissile radionuclides for which the weight in grams or kilograms may be listed instead of or in addition to the activity.

For convenience to the reader, we are adding a new paragraph (h) to incorporate the requirements presently in § 173.448(g) pertaining to the labeling of overpacks.

Section 172.441

We are adding a new § 172.441 to identify the specification requirements for the new ''FISSILE'' label. (See discussion under § 172.400 above.)

Part 173

Section 173.401

We are revising paragraph (b)(2) to more accurately and succinctly reflect the present contents of paragraphs (b)(2) and (b)(3). We are adding a new paragraph (b)(3) to except from the HMR such items as thoriated metallic engine parts, depleted uranium counterweights, tritium exit signs, and similar items containing radioactive material which are an integral part of, and are routinely used in the normal operation of a transport vehicle. In addition, we are adding a new paragraph (b)(4) to expand upon those areas when the HMR would not apply by excepting from the HMR, under specific conditions Class 7 (radioactive) material in natural material and ores containing naturally occurring radionuclides, respectively. The new paragraph (b)(4) is intended to except from the HMR the majority of shipments of ores and materials that contain naturally occurring radionuclides, but that are to be used to produce materials whose benefits lie in their non-radiological qualities (such as coal, gypsum, phosphates, non-radioactive metals, *etc.*). The upper limit of 10 times the activity concentration or consignment activity thresholds assures that worker and public doses will remain small from these unregulated materials, while the exemption permits their continued use in commerce without making that use economically unfeasible.

Section 173.403

We are revising this section by removing the definitions for ''Non-fixed radioactive contamination,'' and ''Fissile material, controlled shipment,'' and revising the definitions for ''A_1,'' ''A_2,'' ''Containment system,'' ''Exclusive use,'' ''Fissile material,'' ''Low Specific Activity (LSA) material,'' ''Low toxicity alpha emitters,'' ''Maximum normal operating pressure,'' ''Multilateral approval,'' ''Package,'' ''Radioactive contents,'' ''Radioactive material,'' ''Special form Class 7 (radioactive) material,'' ''Surface Contaminated Object (SCO),'' ''Transport Index (T)(I),'' ''Unilateral approval,'' ''Unirradiated uranium,'' and ''Uranium—natural, depleted, or enriched.'' New definitions for ''Consignment,'' ''Contamination,'' ''Criticality Safety Index (CSI),'' ''Deuterium,'' ''Exemption value,'' ''Fissile material package,'' ''Fixed radioactive contamination,'' ''Graphite,'' and ''Quality assurance'' are added.

The following definitions are removed:

Non-fixed radioactive contamination. We are removing this definition but its essential elements will be added to the definition of ''contamination'' for clarity. (See discussion under the definition for contamination below.)

Fissile material, controlled shipment. We are removing this definition as part of the revision of §§ 173.457 and 173.459 of this subchapter, in order to simplify the requirements for transporting fissile material.

The following definitions are revised:

A_1. We are revising this definition for clarity.

A_2. We are revising this definition for clarity.

Containment system. We are revising this definition to be consistent with the NRC.

Exclusive use. We are revising this definition to clarify that a vehicle survey is required under certain circumstances after use.

Fissile material. We are revising this definition for consistency with TS–R–1 and to include uranium-233, uranium-235, plutonium-239, plutonium-241, or any combination of these radionuclides. We are removing Plutonium-238 from the definition of ''fissile material,'' because plutonium-238 is only fissionable, not fissile. It refers only to the fissile radionuclides themselves and does not include the non-fissile material containing these fissile radionuclides.

Low Specific Activity (LSA) material. We are revising the definition of LSA–I to allow shipments of very low specific activity materials containing one or more of a variety of radionuclides, and to remove the present category which refers to mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed 10^{-6} A_2/g.

Low toxicity alpha emitters. We are revising this definition for consistency with TS–R–1 and primarily includes physical and chemical concentrates in addition to natural uranium, depleted uranium, natural thorium, uranium-235, uranium-238, thorium-228 and thorium-230 when contained in ores; or alpha emitters with a half-life of less than 10 days.

Maximum normal operating pressure. We are revising this definition to align the HMR with the wording in TS–R–1 and 10 CFR 71.4.

Multilateral approval. We are revising this definition for clarity by adding the word ''design.'' The Competent Authority approval for a package is actually for the package design.

Package. We are revising this definition for clarity. The definitions of each package type in § 173.403 include the requirements they must satisfy if their contents are not fissile. Therefore, we are including the caveat that if the contents are fissile, additional requirements must be satisfied. In addition, the definitions of types of packages are rearranged, to put the package types in an order more closely reflecting their increased capability to retain the contents under normal, as well as hypothetical accidental, conditions of transportation.

Radioactive contents. We are revising this definition to be consistent with TS–R–1.

Radioactive material. We are revising this definition to be consistent with TS–R–1. Currently, we use a specific activity threshold of 70 Bq/g (0.002 microcurie/g) for defining a material as radioactive for transportation purposes. The HMR applies to all radioactive materials with specific activities above this value. Therefore, radioactive materials with specific activities equal to or below this value are not regulated. The 70 Bq/g specific activity value is applied collectively for all radionuclides present in a material; *i.e.*, if a chain of radionuclides is present, the sum of the activities of all radionuclides in the chain is to be compared with 70 Bq/g. During the development of TS–R–1, it was recognized that there is no technical justification for the use of a single activity-based exemption (70 Bq/g) value for all radionuclides. As a result, it was concluded that a more rigorous technical approach would be to base radionuclide exemptions on a uniform dose basis, rather than a uniform specific activity (also known as activity concentration) basis. (Please refer to a more detailed discussion of this in Section II of this final rule under Issue No. 1.)

Special form Class 7 (radioactive) material. We are revising this definition to be consistent with TS–R–1.

Surface Contaminated Object (SCO). We are revising this definition for clarity.

Transport Index. We are revising this definition to be consistent with TS–R–1. This is the number which is used to provide control over radiation exposure and is assigned to a package, overpack or freight container, or to unpackaged LSA–I or SCO–I.

Unilateral approval. We are revising this definition by adding the word ''design.'' The Competent Authority approval for a package is actually for the package design.

Unirradiated uranium. We are revising this definition to be consistent with TS–R–1.

Uranium—natural, depleted, or enriched. We are revising this definition for clarity. Minor word and number changes, in addition to clarifying that ''natural uranium'' does not refer to ores, and that all unirradiated uranium contains a small amount of uranium-234.

We are adding the following definitions:

Consignment. We are adding this definition to clarify to what total quantity of radioactive material the consignment activity exemption values are to be applied.

Contamination. We are adding this definition for consistency with TS–R–1. The definition includes the definitions for ''fixed radioactive contamination'' and ''non-fixed radioactive contamination.'' The quantitative definition of contamination is in Safety Series No. 6, 1985 Edition (As Amended 1990) as well as TS–R–1. It was inadvertently omitted in the previous harmonization rulemaking (HM–169A, September 28, 1995). The consequence would be that non-radioactive materials with radioactive substances on the surface in levels below those listed in the definition for contamination would not be considered radioactive for purposes of transportation.

Criticality Safety Index (CSI). This definition is added to be consistent with TS–R–1. The introduction of the CSI is intended to simplify the representation on labels, and on shipping papers of a package's criticality hazard and its radiation hazard by using separate numbers to describe the two. Currently, the TI serves a dual role, in that for fissile packages a TI is determined for the radiation hazard, another for the criticality hazard, and then the final TI assigned to the packages is the greater of the two. The introduction of the CSI permits the use of the TI exclusively for describing the radiation hazard. This reduces the uncertainty inherent in not knowing whether the TI value is because of one hazard or the other, and should aid shippers, carriers, and emergency responders in understanding the hazards associated with a radioactive materials package.

Deuterium. This definition is added due to the occurrence of the term in the revised language for fissile excepted material in § 173.453.

Exemption value. This definition is added to clarify that the phrase refers to the activity concentration or consignment activity thresholds above which a material would be considered sufficiently radioactive to be subject to the HMR, and to distinguish it from a DOT exemption, defined in § 171.8.

Fissile material package. This definition is added to clarify that Type AF package, Type BF package, Type B(U)F package, Type B(M)F package, or fissile material package means a fissile material packaging together with its fissile material contents.

Fixed radioactive contamination. This definition is added to be consistent with TS–R–1. (See discussion under the definition for ''contamination'' above.)

Graphite. This definition is added due to the occurrence of the term in the revised language for fissile excepted material in § 173.453.

Quality assurance (QA). This definition is added to be consistent with TS–R–1. We currently require evidence of a QA program for issuing Certificates of Competent Authority, but do not define it, except to indicate that a NRC approved program is acceptable, or also that adhering to §§ 173.474 and 173.475 is acceptable for export of DOT Specification packages. Therefore, the introduction of the TS–R–1 definition will clarify what we mean by a QA program, and call attention to the fact that this is something we associate with radioactive material transport.

Section 173.411

We are revising paragraph (b)(5)(ii) to correct the reference to the ISO Standard 1496. As described in the 1985 Edition of Safety Series No. 6 and in TS–R–1, the reference should be to Part 1, Cargo Containers, instead of Part 3, Tank Containers.

Section 173.415

We are removing an outdated transition statement in paragraph (a), removing Type B (*i.e.,* any Type B packaging which does not meet 1973 or later NRC or IAEA performance requirements) as an authorized Type A packaging in paragraph (c), and changing the IAEA reference from Safety Series No. 6 to TS–R–1 for Type A packagings of foreign origin in paragraph (d).

Section 173.416

In paragraphs (a) and (b) we are removing Type B (*i.e.,* any Type B packaging which does not meet 1973 or later NRC or IAEA performance requirements) as an authorized Type B packaging. We are deleting paragraphs (d), (e) and (f), and revising paragraph (c) to discontinue the use of DOT Specification 6M, 20WC and 21WC as authorized Type B packagings, and to specify that 4 years after the effective date of the final rule, these DOT Specification packages may no longer be used.

Section 173.417

We are removing paragraphs (a)(1), (a)(2), (a)(6), (b)(1) and (b)(2) to discontinue the use of DOT Specification 6L, 6M and 1A2 as authorized fissile materials packagings. We are also adding a new paragraph (c) to specify that 4 years after the effective date of the final rule, these packages may no longer be used. Tables 2, 4, and 5 are removed. Tables 3 and 6 are redesignated as Tables 2 and 3, respectively. Paragraphs (a)(3), (a)(4), (a)(5), (a)(7) and (a)(8) are redesignated as (a)(1)(i), (a)(1)(ii), (a)(1)(iii), (a)(2) and (a)(3), respectively, and (b)(3), (b)(4), and (b)(5) as (b)(1) through (b)(3). In the new paragraphs (a)(1)(iii) and (b)(2) the references to Safety Series No. 6 have been changed to No. TS–R–1. The new paragraph (a)(2) is revised to include the greater than 0.1 kg of uranium hexafluoride provision. Type B packagings are removed from the new paragraphs (a)(1)(ii), (a)(1)(iii), (b)(1) and (b)(2).

Section 173.420

We are revising § 173.420 to introduce new performance packaging requirements for packagings containing more than 0.1 kg of UF_6.

Section 173.421

We are revising paragraph (a) to indicate that an excepted package of a limited quantity of Class 7 (radioactive) material is not excepted from all marking requirements.

Section 173.422

Consistent with the new marking provisions for excepted packages containing radioactive materials in TS–R–1, we are eliminating the requirement in § 173.422(a) for a certification statement for such packages. In addition, we are adding the requirement that excepted packages be marked with the UN identification number, and removing the reference to § 173.423, since § 173.422 deals with Class 7 (radioactive) material classed as Class 7, while § 173.423 refers only to multiple hazard limited quantity Class 7 (radioactive) materials, which by § 173.2a(a) are classed in terms of the other hazard or hazards.

Section 173.424

We are revising § 173.424 to indicate that an excepted package containing a radioactive instrument or article is not excepted from all marking requirements. In addition, we are requiring that the active material in an instrument or article containing radioactive material be completely enclosed by the non-active components.

Section 173.425

We are revising all references to ''table 7'' to read ''table 4'', this is due to the combining and deleting of several tables in subpart I.

Section 173.426

We are revising § 173.426 to indicate that excepted packages of articles containing natural uranium or thorium are not excepted from all marking requirements.

Section 173.427

We are revising § 173.427 to clarify: (1) LSA/SCO transportation and packaging requirements; (2) that fissile LSA is prohibited; *i.e.*, that material containing fissile radionuclides may be classified as LSA only if it satisfies one of the sets of conditions in § 173.453 to be considered fissile-excepted material; and (3) exclusive use requirements and provisions. In addition, we are also revising this section to authorize the transportation of unpackaged LSA–I and SCO–I material, and removing the present exception for LSA material and SCO conforming to the provisions specified in 10 CFR 20.2005.

Section 173.428

We are revising § 173.428 to include a requirement for marking an empty package with the UN identification number. We are redesignating paragraphs (c), (d) and (e) as (d), (e) and (f). In addition, we are adding a new paragraph (c) to require that the outer surface of any uranium or thorium component of a radioactive materials package intended to be shipped as an empty package be covered by an inactive sheath. This is a safety improvement, and makes this requirement consistent with that in TS–R–1 for the transport of empty radioactive material packages.

Section 173.431

We are revising paragraph (b) to remove the reference to a Type B package.

Section 173.433

We are revising § 173.433 to reference the nuclide-specific exemption values, and clarify how these may be calculated for mixtures. We are also revising the wording to reflect more closely the wording in TS–R–1, and to incorporate the TS–R–1 expression for determining the limits on activities of radionuclides which may be transported in a Type A package when some of the material is in special form and some in normal form.

Section 173.435

We are replacing the present ''Table of A_1 and A_2 values for radionuclides,'' with accompanying footnotes, with the A_1 and A_2 values and accompanying footnotes from Table I of TS–R–1. The exception to allow the domestic transport of up to 20 Ci of Mo-99 in a Type A package is retained. In addition, the Safety Series No. 6 values of A_1 and A_2 is retained for Cf-252.

Section 173.436

In accordance with our adoption of the nuclide-specific exemption values found in TS–R–1, we are adding a new § 173.436 to contain a table entitled ''Exempt material activity concentrations and exempt consignment activity limits for radionuclides.'' This table, along with accompanying footnotes, is taken from Table I of TS–R–1.

Section 173.441

The title is revised to include exclusive use provisions. Paragraph (d) is redesignated paragraph (e). A new paragraph (d) is added in order to assemble in one location the total TI restrictions for non-exclusive use and exclusive use shipments of Class 7 (radioactive) materials.

Section 173.443

We are revising Table 11, in § 173.443 to list the true non-fixed contamination limits for the outer surfaces of packages. In addition, we are revising paragraph (a)(1) to indicate that in calculating the contamination level from the activity measured on the wipe, the true wipe efficiency must be used or a default efficiency of 0.10 may be assumed.

Section 173.447

We are revising § 173.447 to reflect the introduction of additional transportation controls based on the criticality safety index for fissile material packages.

Section 173.448

We are revising § A173.448 to remove the requirements in § 173.448(g)(1) for the labeling of overpacks and relocate them to § 172.403(h). Relocating the requirements for the labeling of overpacks to § 172.403(h) is more logical and should aid the reader.

Section 173.453

We are revising § 173.453 to be consistent with the new fissile material exceptions included in NRC rulemaking.

Section 173.457

We are simplifying the requirements for transporting fissile material packages by incorporating in § 173.457 the TS–R–1 concept of CSI and TS–R–1 CSI limits, and by eliminating the concept of ''fissile material, controlled shipment,'' which was originally developed to control transport of Fissile Class III materials, under a now obsolete scheme for classifying fissile material packages. Because all fissile material transport is now limited by the total CSI which may be carried on a conveyance, this concept is no longer needed.

Section 173.459

We are revising § 173.459(a) to replace the reference to the criticality control transport index with the criticality safety index. With the elimination of the concept of ''fissile material, controlled shipment'' and the inclusion of the total TI limits in § 173.441 and total CSI limits in § 173.457, we are removing § 173.459(b) and (c), that refer to circumstances under which a shipment would become a fissile material, controlled shipment. Because the total CSI conveyance limits provide adequate safeguards against criticality, these paragraphs are no longer needed.

Section 173.645

We are revising all references to ''table 12'' to read ''table 10'', this is due to the combining and deleting of several tables in subpart I.

Section 173.469

We are revising the reference for the alternate leak test methods in paragraph (a)(4)(ii) from ISO/TR 4826–1979(E) to ISO 9978–1992(E). For clarity, we are revising the requirements in paragraph (c) pertaining to the application of leaching assessment methods. To allow for the substitution of the Class 4 impact test from ISO 2919–1980(E) for the basic impact and percussion tests, we are revising paragraph (d)(1) to include the TS–R–1 restriction that the sealed capsule and contents have a mass less than 200g.

Section 173.471

We are revising the introductory text to remove Type B as a sub-class of NRC approved packages, since the NRC no longer issues certificates for this sub-class.

Section 173.473

We are revising the introductory text to clarify the types of foreign-made packages that would require certification, and to change the reference to Safety Series No. 6 to that for No. TS–R–1.

Section 173.476

We are revising paragraph (c)(4) to specify what the required quality assurance program should cover. In addition, we are adding a new paragraph (c)(5) to require that a description of any planned pre-shipment actions for use in the consignment of special form radioactive material be included in an application for a U.S. Competent Authority Certificate for Special Form Material. The former is in Safety Series No. 6, 1985 Edition, but never included in the HMR; the latter is new to TS–R–1.

Section 173.477

We are adding a new § 173.477 to define the approval requirements for packagings containing more than 0.1 kg of UF_6.

Part 174

Section 174.700

We are revising § 174.700(b) to reflect the fact that the upper TI limit of 50 refers to both the total TI and the total CSI for non-exclusive use shipments. In addition, we are adding a new paragraph (d) to emphasize that the appropriate transport restrictions for fissile material packages apply to transport by rail. In addition, existing paragraphs (d) through (f) are redesignated (e) through (g).

Part 175

Section 175.700

We are revising paragraph (a) by adding a requirement to limit the CSI to a maximum of 3.0 for a fissile material package transported in a passenger carrying aircraft; this is necessary because under TS–R–1 the historical limitation of 3.0 TI on a passenger carrying aircraft would only limit the radiation hazard and not the criticality hazard. In addition, we are adding a new paragraph (e) to ensure that any package, overpack or consignment having a criticality safety index greater than 50 shipped by air must be transported under exclusive use.

Section 175.702

We are revising paragraph (b) to include the requirements for cargo aircraft only, based on the separate TS–R–1 limits on total transport index and total criticality safety index.

Section 175.703

We are revising paragraph (b) to reference the new location for the requirements on overpacks. Paragraph (c) is revised to replace the reference to fissile material, controlled shipment with general requirements for shipments of fissile material by air. Paragraph (e) is revised to indicate that packages with radiation levels higher than those allowed by these regulations may be transported by air under special arrangements approved by the Associate Administrator.

Part 176

Section 176.700

We are removing paragraph (c) due to the elimination of the term ''fissile material, controlled shipment. Paragraphs (d) and (e) are being redesignated (c) and (d) respectively. In addition, the requirement that groups of radioactive material packages containing fissile material be separated by at least 6 m (20 feet) from all other such groups is being moved to § 176.704.

Section 176.704

We are revising § 176.704 including the section title to reflect the introduction of additional transportation controls based on the criticality safety index for fissile material packages, and the decoupling of package controls according to transport indices and criticality safety indices. We are also replacing Table III with Table IIIA to list ''Transport Index Limits'' and Table IIIB for the ''Criticality Safety Index Limits.'' In addition, we are adding to this section the requirement that groups of radioactive material packages containing fissile material be separated by at least 6 m (20 feet) from all other such groups (see discussion under § 176.700).

Section 176.708

We are revising § 176.708 to provide more detailed dose rate guidance pertaining to an alternate method for determining segregation distances, in accordance with the requirements of the latest IMDG Code. We are also restricting the use of this alternate method to the case of exclusive use shipments, for which § 176.704(f) requires a radiation protection program approved by the competent authority of the flag state of the vessel.

Part 177

Section 177.842

In § 177.842, paragraph (f) is revised to remove the reference to fissile material, controlled shipments, and in paragraph (g), a reference to transport index for fissile material packages is being replaced by one to criticality safety index.

Part 178

Section 178.350

In § 178.350, paragraph (b) is being revised to remove the wording ''and Radioactive Material'' from the marking requirement. It is duplicative since all proper shipping names include the words ''Radioactive Material.'' In addition, we are adding a new paragraph (c) to note that each package must comply with the marking requirement of § 178.3(a)(2) and that each DOT specification packaging must be marked with the name and address or symbol of the manufacturer.

Section 178.352

As a result of our discontinued use of DOT Specification 6L metal packagings as an authorized fissile material packaging, we are removing in its entirety § 178.352.

Section 178.354

As a result of our discontinued use of DOT Specification 6M metal packagings as an authorized Type B and fissile material packaging, we are removing in its entirety § 178.354.

Section 178.362

As a result of our discontinued use of DOT Specification 20WC wooden protective jacket as an authorized Type B packaging, we are removing in its entirety § 178.362.

Section 178.364

As a result of our discontinued use of DOT Specification 21WC wooden-steel protective overpack as an authorized Type B packaging, we are removing in its entirety § 178.364.

IV. Regulatory Analyses and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

This final rule is not considered a significant regulatory action under section 3(f) of Executive Order 12866 and, therefore, was not reviewed by the Office of Management and Budget. The final rule is not considered a significant rule under the Regulatory Policies and Procedures of the Department of Transportation [44 FR 11034].

In consideration of the changes in this rule, we looked to and reviewed the ''Regulatory Analysis of Major Revision of 10 CFR Part 71'' NUREG/CR–6713, dated March 2001 prepared for the Nuclear Regulatory Commission (NRC) in support of its related final rule. A copy of that document is available for review in this docket (RSPA–99–6283).

Potential benefits identified in this final rule include enhanced safety resulting from the consistency of domestic and international requirements for transportation of radioactive materials. In addition, the amendments should permit continued access to foreign markets by domestic shippers of radiopharmaceuticals and other radioactive materials.

The NUREG/CR–6713 analysis of regulatory amendments concerning revisions to packaging standards, including the phased elimination of certain DOT specification packagings (*e.g.*, DOT 6L, 6M, 20WC and 21WC) in favor of NRC approved packagings indicates that none of the evaluated changes (individually or collectively) are expected to result in significant economic impacts to NRC licensees. We believe the same holds true for all other shippers, *e.g.*, contractors performing work in support of the Department of Defense and the Department of Energy.

One area that has the greatest potential for substantially increased costs to shippers of radioactive materials concerns large stocks of depleted uranium hexafluoride (UF_6) stored in currently authorized packagings at three different locations. If it is eventually determined that this material should be moved off-site to one or more conversion facilities, it is likely that the current packagings will not meet the new standards. In that case the existing packages likely will be required to be overpacked in order to meet the standard for a hypothetical fire test. That action could result in a one-time cost of $9 million to $13 million to design overpacks, purchase overpacks, and purchase additional trailers with the proper tie-down locations. However, because the likely number and location of UF_6 conversion facilities is purely speculative at this time, these potential costs were not a significant factor in our determination to adopt higher standards for presently on-going shipments of UF_6. As appropriate, we could subsequently revisit the issue of packaging standards for existing packages of depleted UF_6 in a separate rulemaking docket.

B. Executive Order 13132

This rule has been analyzed in accordance with the principles and criteria contained in Executive Order 13132 (''Federalism''). This rule preempts State, local and Indian tribe requirements but does not adopt any regulation that has direct effects on the States, the relationship between the national government and the States, or the distribution of power and responsibilities among the various levels of government. Therefore, the consultation and funding requirements of Executive Order 13132 do not apply.

The Federal hazardous material transportation law, 49 U.S.C. 5101–5127, contains an express preemption provision (49 U.S.C. 5125(b)) that preempts State, local, and Indian tribe requirements on certain covered subjects. Covered subjects are:

(i) The designation, description, and classification of hazardous material;

(ii) The packing, repacking, handling, labeling, marking, and placarding of hazardous material;

(iii) The preparation, execution, and use of shipping documents related to hazardous material and requirements related to the number, contents, and placement of those documents;

(iv) The written notification, recording, and reporting of the unintentional release in transportation of hazardous material; or

(v) The design, manufacturing, fabricating, marking, maintenance, reconditioning, repairing, or testing of a packaging or container represented, marked, certified, or sold as qualified for use in transporting hazardous material.

This rule concerns the classification, packaging, marking, labeling, and handling of hazardous material, among other covered subjects and preempts any State, local, or Indian tribe requirements not meeting the ''substantively the same'' standard. This rule is necessary to incorporate changes already adopted in international standards. If the amendments adopted in this final rule were not made, U.S. companies, including numerous small entities competing in foreign markets, will be at an economic disadvantage. These companies would be forced to comply with a dual system of regulation. The amendments are intended to avoid this result.

Federal hazardous materials transportation law provides at § 5125(b)(2) that, if the Secretary of Transportation issues a regulation concerning any of the covered subjects, the Secretary must determine and publish in the **Federal Register** the effective date of Federal preemption. The effective date may not be earlier than the 90th day following the date of issuance of the final rule and not later than two years after the date of issuance. The effective date of Federal preemption of this final rule is October 1, 2004.

C. Executive Order 13175

This final rule has been analyzed in accordance with the principles and criteria contained in Executive Order 13175 (''Consultation and Coordination with Indian Tribal Governments''). Because this final rule does not have tribal implications, does not impose substantial direct compliance costs, and is required by statute, the funding and consultation requirements of Executive Order 13175 do not apply.

D. Regulatory Flexibility Act, Executive Order 13272, and DOT Regulatory Policies and Procedures

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires an agency to review regulations to assess their impact on small entities unless the agency determines that a rule is not expected to have a significant impact on a substantial number of small entities. We have determined that, while the requirements in this final rule apply to a substantial number of small entities, there will not be a significant economic impact on those small entities.

Need for the final rule. In 1958, at the request of the Economic and Social Council of the United Nations, the International Atomic Energy Agency (IAEA) undertook the development of international regulations for the safe transportation of radioactive materials. The initial regulations published by IAEA in 1961 were recommended to member states as the basis for national regulations and for application to international transportation. Most nations have since adopted the IAEA regulations as a basis for regulations governing the transportation of radioactive materials. In 1964, 1967, 1973, and 1985, IAEA published extensive revisions of these regulations, and again in 1996 as ''Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. ST–1.'' The most recent revision, made in 2000, involved a few minor changes and a redesignation as ''Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. TS–R–1'' (ST–1, Revised).

In October 1968, DOT published amendments to the Hazardous Materials Regulations (HMR; 49 CFR Parts 171–180) for radioactive materials which were in substantial conformance with the 1967 IAEA regulations (Docket HM–2, 33 FR 14918). RSPA updated the Hazardous Materials Regulations (HMR) in 1983 to incorporate the 1973 IAEA revision and in 1995 to incorporate the 1983 IAEA revision. RSPA has not updated the HMR to incorporate the most recent revisions to the IAEA standards. The final rule we are issuing under Docket No. HM–230 will incorporate the 1996 and 2000 IAEA revisions to its radioactive materials transportation standards, known as ''TS–R–1.''

The continually increasing amount of radioactive materials transported in international commerce warrants the harmonization of domestic and international transportation requirements to the greatest extent possible. Harmonization serves to facilitate international transportation while assuring the protection of people, property, and the environment. Shippers and carriers are able to train their hazmat employees in a single set of requirements for packaging, communication of hazards, handling, stowage, and the like, thereby minimizing the possibility of improperly transporting a shipment of radioactive materials because of differences in national regulations. Similarly, many shippers find that consistency in regulations for the transportation of radioactive materials aids their understanding of what is required, thereby permitting them to more easily comply with these safety regulations when shipping radioactive materials in international commerce.

Description of Actions. In this final rule, we are amending the HMR to:

—Adopt the nuclide-specific exemption activity concentrations and the nuclide-specific exemption consignment activities listed in TS–R–1 to assure continued consistency between domestic and international regulations for the basic definition of radioactive material;

—Provide an exception in the HMR that certain naturally occurring radioactive materials would not be subject to the requirements of the HMR so long as their specific activities do not exceed 10 times the activity concentration exemption values;

—Incorporate the TS–R–1 changes in the A1 and A2 values into the HMR;

—Adopt the new proper shipping names and UN identification numbers, except for those referring to Type C packages, to fissile LSA material and to fissile SCOs;

—Require, if customary units are used, that the appropriate quantity and customary units be placed within parentheses positioned after the original quantity expressed in the International System of Units (SI units);

—Adopt the use of the Criticality Safety Index (CSI) to refer to what was formerly the criticality control transport index, and to restrict the use of the concept of transport index (TI) to a number derived purely from the maximum radiation level at one meter from the package;

—Require the new fissile label be placed on each fissile material package, and that the CSI for that package be noted on the fissile label;

—Adopt the requirement that excepted packages be marked with the UN identification number, that industrial packagings be marked with the package type, and that Type IP–2 and IP–3 industrial packages and Type A packages be marked with the international vehicle registration code of the country of origin of packaging design;

—Remove some former requirements that would become redundant upon adoption of the new proper shipping names, such as the requirement that the shipping description contain the words ''Radioactive Material'' unless those words are included in the proper shipping name;

—Remove plutonium-238 (Pu-238) from the definition of fissile material and remove the reference to Pu-238 in the list of fissile radionuclides for which the weight in grams or kilograms may be listed instead of or in addition to the activity, in the shipping paper or radioactive label description of the radioactive contents of a package;

—Adopt a definition of contamination, and include an authority to transport unpackaged LSA material and SCO, and an authority to use qualified tank containers, freight containers and metal intermediate bulk containers as industrial packagings, types 2 and 3 (IP–2 and IP–3);

—Adopt the new class of LSA–I material, consisting of radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the activity concentration exemption level, and to remove the present category referring to mill tailings, contaminated earth, concrete, rubble, other debris, and activated material that is essentially uniformly distributed, with specific activity not exceeding 10^{-6} A_2/g;

—Incorporate the TS–R–1 changes for packagings containing more than 0.1 kg of uranium hexafluoride (UF_6);

—Require UF_6 packagings to meet the pressure, drop and thermal test requirements, to prohibit the use of pressure relief devices, and to certify the packagings in accordance with TS–R–1 requirements;

—Revise § 173.453 to reflect the NRC ''fissile material exemption provisions,'' to remove the definition of ''fissile material, controlled shipment,'' and to revise §§ 173.457 and 173.459 to remove the references to ''fissile material, controlled shipment'' and to base requirements for non-exclusive use and exclusive use shipments of fissile material packages on TS–R–1 package and conveyance CSI limits;

—Accept the IAEA transitional requirements and begin the phase out of packages satisfying the 1967 IAEA requirements, including DOT specification packages;

—Prohibit the manufacture of all Type B specification packages conforming to Safety Series No. 6 (1967) as of the effective date of this rule, while allowing continued use of these packages for three years after the effective date of this rule; and

—Add a requirement that the active material in an instrument or article intended to be transported in an excepted package be completely enclosed by the non-active components.

Identification of potentially affected small entities. Businesses likely to be affected by the final rule are those that ship or transport radioactive materials such as radiopharmaceuticals; radioisotopes; radiography devices; research and industrial sources, including gauges containing radioactive materials for measuring levels, thickness, and density; waste contaminated with low levels of radioactivity from industrial, medical, and electricity-generating facilities; and new and used nuclear power plant fuel.

There are 103 licensed nuclear power plants in the United States; these 103 plants are operated by 41 companies. In addition, there are 750 shippers and carriers registered with RSPA in accordance with 49 CFR Part 107 who say that they ship or transport large quantities of radioactive materials in a single package. There are also many thousands more persons who ship or transport smaller amounts of radioactive material. About 3 million packages of radioactive materials are shipped each year; the vast majority are radiopharmaceuticals and radioisotopes used in medical applications.

Unless alternative definitions have been established by the agency in consultation with the Small Business Administration (SBA), the definition of ''small business'' has the same meaning as under the Small Business Act (the Act). Since no such special definition has been established, we employ the thresholds published by SBA for industries subject to the HMR under the Act the 41 companies operating licensed nuclear power plants in the United States are not small businesses because the electric output of each company exceeds the 4-million-megawatts-per-year threshold established by SBA. Of the 750 shippers and carriers registered with RSPA under 49 CFR Part 107, approximately 71 percent ''self-identify'' as small businesses using the SBA criteria. NRC indicates that 15 companies (12%) of the 127 quality assurance programs licensed in accordance with NRC requirements, are small entities. Based on data compiled by the U.S. Census Bureau in 1977, we believe that approximately 90 percent of firms that ship or transport smaller amounts of radioactive materials are small businesses.

We believe that most revisions to the HMR adopted in this final rule will result in an overall net benefit as measured by increased transportation efficiencies, reduced compliance costs, and decreases in exposure risks for transportation workers and the general public. See ''Regulatory Analysis of Major Revision of 10 CFR Part 71'' prepared by the Nuclear Regulatory Commission and included in the HM–230 rulemaking docket for a detailed discussion of the costs and benefits of the specific provisions of the final rule.

The greatest impact on small entities that ship or transport radioactive materials concerns the revised requirements for hazard communication—reformatting shipping papers and package markings to reflect revised hazardous materials descriptions and proper shipping names, marking the ''UN'' number on excepted packages of Class 7 materials, and a new labeling requirement to communicate the criticality safety index of packages containing fissile materials. These amendments will necessitate modifications to the business procedures of both shippers and carriers and will require retraining of employees, but are not expected to adversely affect on core business operations. Moreover, these revisions will improve the accuracy of the shipping descriptions applicable to specific radioactive materials, providing for a more accurate and complete indication of the hazards related to a specific shipment. Overall, these revisions will result in improved hazard communication, thereby enabling transportation workers and emergency response personnel to quickly and efficiently identify hazards and mitigate potential risks to the public and the environment.

Several commenters to the notice of proposed rulemaking published April 30, 2002 suggest that, for one segment of the industry, the potential impacts of the proposed regulatory changes on small businesses could be significant. These commenters are concerned about the proposals in the NPRM that would eliminate the use of all packagings designed to IAEA standards in effect prior to 1973, including packages built to current DOT specifications for which no NRC approval is now required, in favor of packagings designed and constructed in accordance with the more recent IAEA standards and approved under new Certificates of Compliance issued by NRC.

The TS–R–1 standard on which this final rule is based includes provisions for the continued use of packages and special form sources previously approved in accordance with the 1973 and 1985 editions of the IAEA regulations. However, TS–R–1 does not provide transitional provisions for packages approved under the 1967 edition of the IAEA regulations. NRC has stated that packages approved under the 1967 edition lack the safety enhancements that were incorporated into later editions of the IAEA standards; for example, packages must now be made more leak resistant and must conform to applicable NRC quality assurance requirements. NRC staff believe that the designs for 1967-based packages will fall into one of five categories: (1) Package designs that may meet current safety standards with no modifications but have until now not been submitted to the NRC for review against these standards; (2) package designs that can be shown to meet current safety standards after relatively minor design changes; (3) spent fuel casks certified to the 1967 standards, for which stringent quality assurance requirements for design and fabrication did apply; (4) package designs that cannot be shown to meet current safety standards; and (5) packages for which the safety performance of the package design under the current safety standards is not known. NRC staff believe that it is appropriate to phase out use of designs that fall into the last two categories.

DOT Specification 6L, 6M, 20WC and 21WC packages are packages that have not been shown to satisfy packaging requirements of the 1973, 1985, or 1996 IAEA radioactive material transport regulations. In accordance with the decision by the NRC to phase out packages approved against the 1967 IAEA Regulations, and recognizing that under the Memorandum of Understanding between the two agencies the NRC has cognizance over domestic use of Type B and fissile material packages, we proposed in our NPRM that as of the effective date of this final rule no new manufacture of packages of these types be allowed, and that all use of these packages cease as of two years following the effective date of this final rule.

Among the specific packagings at issue are those used to transport special form Type B shipments of radioactive material. They are used for equipment, such as calibrators and irradiators, that contain Type B quantities of cobalt-60 or cesium-137 sources. This equipment is used by nuclear power plants, universities, hospitals and blood banks, and in private and government research facilities. Most of the packagings used to transport the equipment are designed to qualify under DOT regulations as Type 7A packages, which, when fitted with a metal jacket and placed in a DOT Specification 20WC overpack, are authorized for the transportation of Type B shipments of radioactive materials in special form. Other types of packagings that would be eliminated include containers used to transport iridium-192 and nuclear isotopes for medical or industrial use. Commenters note that these packagings have an excellent safety history.

The commenters state that the proposed prohibition on the use of these 20WC containers would require companies to apply to NRC to requalify existing containers to the new IAEA standards or construct new containers that meet the IAEA standards. One commenter suggests that he would incur costs of at least $500,000 to obtain regulatory approval from NRC for each requalified or newly constructed 20WC packaging and that his costs for replacing currently authorized 20WC packagings could total from $2 million to $8 million. This commenter also asserts that total industry costs to upgrade or replace 20WC packagings could exceed $100 million. Another commenter who ships iridium-192 using a DOT specification packaging states that his costs of compliance with the new regulations will be well over $1 million. A third commenter estimates that replacing the DOT specification packages currently in use with newly-designed and NRC-approved packagings will cost around $500,000. Two of these commenters state that the costs of replacing or requalifying currently authorized DOT specification packagings could well exceed their companies' financial capabilities.

NRC estimates of the potential costs associated with obtaining regulatory approvals are significantly less than the costs suggested by commenters. For package designs that may meet current safety standards without design modifications, the cost of obtaining NRC certification against the TS–R–1 standards would range from $30,000 to $70,000 per design. For package designs that may need minor design changes to meet current safety standards, the cost of obtaining NRC certification against the TS–R–1 standards would range from $40,000 to $190,000 per design. To replace packagings that cannot be shown to meet the TS–R–1 standards, the cost to design, construct, and obtain NRC approval for the new designs would range from $350,000 to $440,000 per new design.

It is possible to gain NRC approval for a Type B packaging with a range of contents and/or a range of dimensions, so long as the applicant demonstrates that the ''worst case'' configuration(s) will satisfy the performance requirements. On this basis, if, as one commenter suggests, there are currently between 50 to 100 20WCs containers in use, it seems reasonable to assume that no more than 10 to 20 replacement packages (packages that would have to be designed from scratch, tested, evaluated, reviewed and approved by the NRC) would need to be approved by NRC to transport the types of shipments made in 20WCs today.

Assuming conservatively, therefore, that on the order of 10 to 20 new package designs for the 20WC would need to be approved by the NRC, that from 50 to 100 replacements for the 20WC packagings would need to be manufactured, using typical cost estimates from the NRC of $300,000 to $390,000 for design, testing, and licensing, manufacturing costs of $50,000 per manufactured package, and a commenter's estimate of $30,000 per package for depreciation costs, we believe that a conservative estimate of the industry-wide cost can be projected as follows:

Cost of design, testing and licensing of new designs: $3,000,000 to $7,800,000
Costs of construction of new overpacks: $2,500,000 to $5,000,000
Loss of value of existing overpacks: $1,500,000 to $3,000,000
Estimated total cost to industry: $7,000,000 to $15,800,000

Over the long term, the benefits of an internationally-harmonized regulatory system will exceed the costs associated with implementing the system. Uniform regulations facilitate compliance and thus enhance overall safety—companies and their employees must know and understand a single set of regulatory requirements rather than multiple requirements applicable to multiple jurisdictions. Carriers are able to train their employees in a single set of requirements for the classification, packaging, communication of hazards, handling, stowage, and the like, thereby minimizing the possibility of improperly transporting a shipment of hazardous materials because of differences in national regulations. Similarly, many shippers find that consistency in regulations for the transportation of hazardous materials aids their understanding of what is required, thereby permitting them to more easily comply with these safety regulations. The continually increasing amount of hazardous materials transported in international commerce warrants the harmonization of domestic and international transportation requirements to the greatest extent possible. Harmonization serves to facilitate international transportation while assuring the protection of people, property, and the environment.

Commenters recommend that the final rule provide for a ''substantially'' longer transition time than the two-year phase-out period proposed in the April 30, 2002 NPRM. We note in this regard that in 1996, IAEA first published that 1967 packagings would be discontinued from use. Thus, persons using such packagings have been on notice since 1996 that new packagings would be required. Nonetheless, we agree with commenters that those companies that may incur increased compliance costs as a result of the elimination of currently authorized packagings for the transportation of certain radioactive materials should be provided with more time to plan for and transition to the new system. Therefore, in this final rule, we are permitting continued use of currently authorized DOT specification 6L, 6M, 20WC, and 21WC packagings for a period of 4 years after the effective date of the final rule; since the effective date of this final rule is October 1, 2004, the industry will actually have a 5-year period to transition to the new packaging system. The 5-year transition period will provide companies with sufficient time to plan and implement the changes in an orderly and deliberate fashion and will help to minimize the costs that will be incurred as a result of the transition. Based on a 5-year transition period and using the cost estimates detailed above, we estimate that total industry costs to develop and obtain approval for packagings to replace the 1967 packagings currently in use will range from $1,400,000 to $3,160,000 per year (undiscounted).

As noted above, of the 127 quality assurance programs registerd with NRC, 15, or 12 percent, are small entities. NRC expects that of these 15 small entities, only 2 or 3 will be adversely affected by the requirements in this final rule applicable to 1967 packagings, based on the nature of the companies' businesses and day-to-day operations. Moreover, our April 30, 2002 NPRM noted that our preliminary assessment of the impact of the IAEA revisions on small business was subject to modification depending on comments received and encouraged commenters to address the potential economic impacts of the proposals. Out of a total of about 150 comments, we received only three comments from persons identifying themselves as small businesses.

Reporting and recordkeeping requirements. This final rule includes no new reporting or recordkeeping requirements.

Related Federal rules and regulations. As in past rulemakings to incorporate updates of the international regulations into the HMR, we are working in close cooperation with NRC in the development of this rulemaking. Currently, DOT and NRC jointly regulate the transportation of radioactive material in the United States in accordance with a July 2, 1979 Memorandum of Understanding (MOU; 44 FR 38690). In accordance with this MOU:

1. DOT regulates both shippers and carriers and has issued:
- Packaging requirements;
- Communication requirements for:
  - —Shipping paper contents,
  - —Package labeling and marking requirements, and
  - —Vehicle placarding requirements;
- Training and emergency response requirements; and
- Highway routing requirements.

2. NRC requires its licensees to satisfy requirements to protect public health and safety and to assure the common defense and security, and:
- Certifies Type B and fissile material package designs and approves package quality assurance programs for its licensees;
- Provides technical support to DOT and works with DOT to ensure consistency with respect to the transportation of radioactive materials; and
- Conducts inspections of licensees in accordance with DOT requirements.

This rulemaking is being coordinated by RSPA with NRC to ensure that consistent regulatory standards are maintained for radioactive material transportation regulations, and to ensure coordinated publication of rules by both agencies.

Alternate proposals for small businesses. The Regulatory Flexibility Act directs agencies to establish exceptions and differing compliance standards small businesses, where it is possible to do so and still meet the objectives of applicable regulatory statutes. In the case of radioactive materials transportation, it is not possible to establish exceptions or differing standards and still accomplish the objectives of Federal hazmat law.

This final rule was developed under the assumption that small businesses make up the overwhelming majority of entities that will be subject to its provisions, particularly regarding the phase-out of currently authorized DOT specification packagings for the transportation of certain types of radioactive material. Thus, we considered how to minimize expected compliance costs as we developed this final rule. As an accommodation to small businesses, the final rule permits continued use of currently authorized DOT specification packagings for a period of 4 years following the final rule's effective date, or effectively 5 years from the date of publication of this final rule. This extended transition period will provide companies with sufficient time to plan and implement the changes in an orderly and deliberate fashion and will help to minimize the costs that will be incurred as a result of the transition.

Conclusion. In consideration of the fact that a limited number of small entities will be affected by the provisions of this final rule and on the basis of the analysis of regulatory amendments prepared by NRC in support of its associated final rule, I hereby certify that, while this final rule applies to a substantial number of small entities, there will not be a significant economic impact on those small entities.

This final rule has been developed in accordance with Executive Order 13272 (''Proper Consideration of Small Entities in Agency Rulemaking'') and DOT's procedures and policies to promote compliance with the Regulatory Flexibility Act to ensure that potential impacts of draft rules on small entities are properly considered.

E. Paperwork Reduction Act

RSPA has a current information collection approval under OMB No. 2137–0510, Radioactive (RAM) Transportation Requirements, with

15,270 burden hours and $139,895.60 annual cost for burden. This final rule identifies information collection that RSPA submitted to OMB for approval based on requirements in the proposed rule. OMB approved the information collection on April 24, 2003. The approved information collection and recordkeeping burden is as follows:

OMB No.: 2137–0510.

Number of Respondents: 3,817.

Total Annual Responses: 21,519.

Total Annual Burden Hours: 15,270.

Total Annual Burden Cost: $139,895.60.

Requests for a copy of the information collection should be directed to Deborah Boothe, Office of Hazardous Materials Standards (DHM–10), Research and Special Programs Administration, Room 8102, 400 Seventh Street, SW., Washington, DC 20590–0001, Telephone (202) 366–8553.

F. Regulation Identifier Number (RIN)

A regulation identifier number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN number contained in the heading of this document can be used to cross-reference this action with the Unified Agenda.

G. Unfunded Mandates Reform Act

This final rule does not impose unfunded mandates under the Unfunded Mandates Reform Act of 1995. It does not result in costs of $100 million or more to either State, local or tribal governments, in the aggregate, or to the private sector, and is the least burdensome alternative that achieves the objective of the rule.

H. Environmental Assessment

The NRC prepared an environmental assessment entitled: ''Environmental Assessment (EA) of Major Revision to Packaging and Transportation of Radioactive Material Regulations'', Final Report, March 2002, on its proposed rule which addresses issues also raised in this rulemaking. On the basis of this EA, we find that there are no significant environmental impacts associated with this final rule. A copy of the environmental assessment prepared by the NRC is available for review in the docket.

I. Privacy Act

Anyone is able to search the electronic form of any written communications and comments received into any of our dockets by the name of the individual submitting the document (or signing the document, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov.*

List of Subjects

49 CFR Part 171

Exports, Hazardous materials transportation, Hazardous waste, Imports, Incorporation by reference, Reporting and recordkeeping requirements.

49 CFR Part 172

Education, Hazardous materials transportation, Hazardous waste, Labeling, Markings, Packaging and containers, Reporting and recordkeeping requirements.

49 CFR Part 173

Hazardous materials transportation, Incorporation by reference, Packaging and containers, Radioactive materials, Reporting and recordkeeping requirements, Uranium.

49 CFR Part 174

Hazardous materials transportation, Radioactive materials, Railroad safety.

49 CFR Part 175

Air carriers, Hazardous materials transportation, Radioactive materials, Reporting and recordkeeping requirements.

49 CFR Part 176

Hazardous materials transportation, Maritime carriers, Radioactive materials, Reporting and recordkeeping requirements.

49 CFR Part 177

Hazardous materials transportation, Motor carriers, Radioactive materials, Reporting and recordkeeping requirements.

49 CFR Part 178

Hazardous materials transportation, Motor vehicle safety, Packaging and containers, Reporting and recordkeeping requirements.

■ In consideration of the foregoing, 49 CFR Chapter I, Subchapter C is amended to read as follows:

PART 171—GENERAL INFORMATION, REGULATIONS, AND DEFINITIONS

■ 1. The authority citation for part 171 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

■ 2. In § 171.7, in paragraph (a)(3), the table is amended as follows:

■ a. Under the entry ''Department of Energy (USDOE),'' the entry for ''USDOE, ORO 651-Uranium Hexafluoride; A Manual of Good Practices, Revision 6, 1991 edition'' is removed;

■ b. Under the entry ''International Atomic Energy Agency (IAEA),'' the entries ''IAEA, Regulations for the Safe Transport of Radioactive Material Safety Series No. 6, 1985 Edition (As Amended 1990); Including 1985 Edition (Supplemented 1986 and 1988)'' and ''IAEA, Regulations for the Safe Transport of Radioactive Material, No. TS–R–1, 1996 Edition'' are removed and a new entry ''IAEA, Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), No. TS–R–1 (ST–1, Revised)'' is added in alphabetical order;

■ c. Under the entry ''International Organization for Standardization,'' the entries for ''ISO/TR 4826–1979(E)–Sealed radioactive sources—Leak test methods'' and ''ISO 1496–3–1995(E)—Series 1 Freight Containers—Specification and Testing—Part 3: Tank Containers for Liquid, Gases and Pressurized Dry Bulk'' are removed and two new entries ''ISO 1496–1: 1990(E)—Series 1 freight containers—Specification and testing, Part 1: General cargo containers'' and ''ISO 9978:1992(E)—Radiation protection—Sealed radioactive sources—Leakage test methods, February 15, 1992, First Edition'' are added in alpha-numeric order; and

■ d. A new entry for ''United States Enrichment Corporation, Inc. (USEC) is added in appropriate alpha-numeric order.

The revisions and additions read as follows:

§ 171.7 Reference material.

(a) Matter incorporated by reference— * * *

(3) Table of material incorporated by reference. * * *

Source and name of material	9 CFR reference
* * * * * * *	
International Atomic Energy Agency (IAEA) * * *	
IAEA, Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), No. TS–R–1 (ST–1, Revised)	171.12, 173.415, 173.416, 173.417, 173.473
* * * * * * *	
International Organization for Standardization * * *	
* * * * * * *	
ISO 1496—1: 1990(E)—Series 1 freight containers—Specification and testing, Part 1: General cargo containers. Fifth Edition, (August 15, 1990)	173.411
* * * * * * *	
ISO 9978:1992(E)—Radiation protection—Sealed radioactive sources—Leakage test methods. First Edition, (February 15, 1992)	173.469
* * * * * * *	
United States Enrichment Corporation, Inc. (USEC):	
USEC Inc., 6903 Rockledge Drive, Bethesda, MD 20817.	
USEC–651—Good Handling Practices for Uranium Hexafluoride, Revision 8, January 1999	173.417

* * * * *

■ 3. In § 171.11, paragraph (d)(6)(vi) is removed and paragraphs (d)(6)(iii) and (d)(6)(iv) are revised to read as follows:

§ 171.11 Use of ICAO Technical Instructions.

* * * * *

(d) * * *

(6) * * *

(iii) Except for excepted packages of Class 7 (radioactive) materials, the provisions of §§ 172.204(c)(4), 173.448(e), (f) and (g)(3) of this subchapter apply.

(iv) Excepted packages of radioactive materials must meet the provisions of §§ 173.421, 173.424, 173.426 or 173.428 of this subchapter, as appropriate.

* * * * *

■ 4. In § 171.12, paragraph (d) is revised to read as follows:

§ 171.12 Import and export shipments.

* * * * *

(d) *Use of International Atomic Energy Agency (IAEA) regulations for Class 7 (radioactive) materials.* Class 7 (radioactive) materials being imported into or exported from the United States, or passing through the United States in the course of being shipped between places outside the United States, may be offered and accepted for transportation when packaged, marked, labeled, and otherwise prepared for shipment in accordance with IAEA ''Regulations for the Safe Transport of Radioactive Material,'' No. TS–R–1 1996 edition (IBR, see § 171.7), if—

(1) Highway route controlled quantities (see § 173.403 of this subchapter) are shipped in accordance with §§ 172.203(d)(4), 172.507 and 173.22(c) of this subchapter;

(2) For fissile materials and Type B packages, the competent authority certification and any necessary revalidation is obtained from the appropriate competent authorities as specified in §§ 173.471, 173.472 and 173.473 of this subchapter and all requirements of the certificates and revalidations are met;

(3) Type A package contents are limited in accordance with § 173.431 of this subchapter;

(4) The country of origin for the shipment has adopted, No. TS–R–1 of the IAEA ''Regulations for the Safe Transport of Radioactive Material,'' 1996 edition;

(5) The requirements of § 173.448 are fulfilled, when applicable; and

(6) Shipments comply with the requirements for emergency response information prescribed in subpart G of part 172 of this subchapter.

* * * * *

PART 172—HAZARDOUS MATERIALS TABLE, SPECIAL PROVISIONS, HAZARDOUS MATERIALS COMMUNICATIONS, EMERGENCY RESPONSE INFORMATION, AND TRAINING REQUIREMENTS

■ 5. The authority citation for part 172 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

■ 6. In § 172.101, the Hazardous Materials Table is amended by removing and revising, in appropriate alphabetical sequence, the following entries to read as follows:

§ 172.101 Purpose and use of hazardous materials table.

* * * * *

§ 172.101 HAZARDOUS MATERIALS TABLE

Symbols	Hazardous materials descriptions and proper shipping names	Hazard class or division	Identification Nos.	PG	Label codes	Special provisions (§ 172.102)	(8) Packaging (§ 173. * * *)			(9) Quantity limitations		(10) Vessel stowage	
							Exceptions	Non-bulk	Bulk	Passenger aircraft/rail	Cargo aircraft only	Location	Other
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8A)	(8B)	(8C)	(9A)	(9B)	(10A)	(10B)
	* * * * * * *												
	[REVISE:]												
	Radioactive material, excepted package—articles manufactured from natural uranium *or* depleted uranium *or* natural thorium.	7	UN2909		None		422, 426	422, 426	422, 426			A	
	* * * * * * *												
	Radioactive material, excepted package—empty packaging.	7	UN2908		Empty		422, 428	422, 428	422, 428			A	
	* * * * * * *												
	Radioactive material, excepted package—instruments *or* articles.	7	UN2911		None		422, 424	422, 424				A	
	* * * * * * *												
	Radioactive material, low specific activity (LSA–I) *non fissile or fissile-excepted*.	7	UN2912		7	A56, T5, TP4, W7.	421, 422, 428.	427	427			A	95, 129
	Radioactive material, low specific activity (LSA–II) *non fissile or fissile-excepted*.	7	UN3321		7	A56, T5, TP4, W7.	421, 422, 428.	427	427			A	95, 129
	Radioactive material, low specific activity (LSA–III) *non fissile or fissile excepted*.	7	UN3322		7	A56, T5, TP4, W7.	421, 422, 428.	427	427			A	95, 129
	* * * * * * *												
	Radioactive material, surface contaminated objects (SCO–I *or* SCO–II) non fissile or fissile-excepted.	7	UN2913		7	A56	421, 422, 428.	427	427			A	95
	Radioactive material, transported under special arrangement, *non fissile or fissile excepted*.	7	UN2919		7	A56, 139						A	95, 105
	Radioactive material, transported under special arrangement, fissile.	7	UN331		7	A56,139						A	95,105
	Radioactive material, Type A package, fissile *non-specdial form*.	7	UN3327		7	A56, W7, W8	453	417	417			A	95, 105, 131
	Radioactive material, Type A package *non-special form, non fissile or fissile-excepted*.	7	UN2915		7	A56, W7, W8		415	415			A	95, 130
	Radioactive material, Type A package, special form *non fissile or fissile-excepted*.	7	UN3332		7	A56, W7, W8		415, 476	415, 476			A	95
	Radioactive material, Type A package, special form, fissile.	7	UN3333		7	A56, W7, W8	453	417, 476	417, 476			A	95, 105
	Radioactive material, Type B(M) package, fissile	7	UN3329		7	A56	453	417	417			A	95, 105
	Radioactive material, Type B(M) package *non fissile or fissile-excepted*.	7	UN2917		7	A56		416	416			A	95, 105
	Radioactive material, Type B(U) package, fissile	7	UN3328		7	A56	453	417	417			A	95, 105
	Radioactive material, Type B(U) package *non fissile or fissile-excepted*.	7	UN2916		7	A56		416	416			A	95, 105
	Radioactive material, uranium hexafluoride *non fissile or fissile-excepted*.	7	UN2978		7, 8		423	420, 427	420, 427			A	95, 132
	* * * * * * *												
	[REMOVE:]												
D	Radioactive material, excepted package—articles manufactured from natural *or* depleted uranium *or* natural thorium.	7	UN2910		None		422, 426	422, 426	422, 426			A	
D	Radioactive material, excepted package—empty package *or* empty packaging.	7	UN2910		empty		428	428	428			A	

D	Radioactive material, excepted package—instruments *or* articles.	7	UN2910		None		422, 424	422, 424	422, 424			A	
D	Radioactive material, fissile, n.o.s	7	UN2918		7	A56	453	417	417			A	95, 105
D	Radioactive material, low specific activity, n.o.s. *or* Radioactive material, LSA, n.o.s..	7	UN2912		7	A56, T5, TP4	421, 428	427	427			A	95, 129
D	Radioactive material, n.o.s	7	UN2982		7	A56	421, 428	415, 416	415, 416			A	95
D	Radioactive material, special form, n.o.s	7	UN2974		7	A56	421, 424	415, 416	415, 416			A	95
D	Radioactive material, surface contaminated object *or* Radioactive material SCO.	7	UN2913		7	A56	421, 424, 426.	427	427			A	95
D	Thorium metal, pyrophoric	7	UN2975		7, 4.2	A56	None	418	None			D	95
D	Thorium nitrate, solid	7	UN2976		7, 5.1		None	419	None	Forbidden	15 kg	A	95
D	Uranium hexafluoride, *fissile excepted or non-fissile*	7	UN2978		7, 8		423	420, 427	420, 427			A	95, 132
D	Uranium hexafluoride, fissile (with more than 1 percent U–235).	7	UN2977		7, 8		453	417, 420	417, 420			A	95, 132
D	Uranium metal, pyrophoric	7	UN2979		7, 4.2	A56	None	418	None			D	95
D	Uranyl nitrate hexahydrate solution	7	UN2980		7, 8		421, 427	415, 416, 417.	415, 416, 417.			D	95
D	Uranyl nitrate, solid	7	UN2981		7, 5.1		None	419	None	Forbidden	15 kg	A	95

■ 7. In § 172.203, paragraph (d) is revised to read as follows:

§ 172.203 Additional description requirements.

* * * * *

(d) *Radioactive material.* The description for a shipment of a Class 7 (radioactive) material must include the following additional entries as appropriate:

(1) The name of each radionuclide in the Class 7 (radioactive) material that is listed in § 173.435 of this subchapter. For mixtures of radionuclides, the radionuclides that must be shown must be determined in accordance with § 173.433(f) of this subchapter. Abbreviations, *e.g.*, ''^{99}Mo,'' are authorized.

(2) A description of the physical and chemical form of the material, if the material is not in special form (generic chemical description is acceptable for chemical form).

(3) The activity contained in each package of the shipment in terms of the appropriate SI units (*e.g.*, Becquerels (Bq), Terabecquerels (TBq), etc.). The activity may also be stated in appropriate customary units (Curies (Ci), milliCuries (mCi), microCuries (uCi), etc.) in parentheses following the SI units. Abbreviations are authorized. Except for plutonium-239 and plutonium-241, the weight in grams or kilograms of fissile radionuclides may be inserted instead of activity units. For plutonium-239 and plutonium-241, the weight in grams of fissile radionuclides may be inserted in addition to the activity units.

(4) The category of label applied to each package in the shipment. For example: ''RADIOACTIVE WHITE-I.''

(5) The transport index assigned to each package in the shipment bearing RADIOACTIVE YELLOW-II OR RADIOACTIVE YELLOW-III labels.

(6) For a package containing fissile Class 7 (radioactive) material:

(i) The words ''Fissile Excepted'' if the package is excepted pursuant to § 173.453 of this subchapter; or otherwise

(ii) The criticality safety index for that package.

(7) For a package approved by the U.S. Department of Energy (DOE) or U.S. Nuclear Regulatory Commission (NRC), a notation of the package identification marking as prescribed in the applicable DOE or NRC approval (see § 173.471 of the subchapter).

(8) For an export shipment or a shipment in a foreign made package, a notation of the package identification marking as prescribed in the applicable International Atomic Energy Agency (IAEA) Certificate of Competent Authority which has been issued for the package (see § 173.473 of the subchapter).

(9) For a shipment required by this subchapter to be consigned as exclusive use:

(i) An indication that the shipment is consigned as exclusive use; or

(ii) If all the descriptions on the shipping paper are consigned as exclusive use, then the statement ''Exclusive Use Shipment'' may be entered only once on the shipping paper in a clearly visible location.

(10) For the shipment of a package containing a highway route controlled quantity of Class 7 (radioactive) materials (see § 173.403 of this subchapter) the words ''Highway route controlled quantity'' or ''HRCQ'' must be entered in association with the basic description.

* * * * *

■ 8. Section 172.310 is revised to read as follows:

§ 172.310 Class 7 (radioactive) materials.

In addition to any other markings required by this subpart, each package containing Class 7 (radioactive) materials must be marked as follows:

(a) Each package with a gross mass greater than 50 kg (110 lb) must have its gross mass including the unit of measurement (which may be abbreviated) marked on the outside of the package.

(b) Each industrial, Type A, Type B(U), or Type B(M) package must be legibly and durably marked on the outside of the packaging, in letters at least 13 mm (0.5 in) high, with the words ''TYPE IP–1,'' ''TYPE IP–2,'' ''TYPE IP–3,'' ''TYPE A,'' ''TYPE B(U)'' or ''TYPE B(M),'' as appropriate. A package which does not conform to Type IP–1, Type IP–2, Type IP–3, Type A, Type B(U) or Type B(M) requirements may not be so marked.

(c) Each package which conforms to an IP–1, IP–2, IP–3 or a Type A package design must be legibly and durably marked on the outside of the packaging with the international vehicle registration code of the country of origin of the design. The international vehicle registration code for packages designed by a United States company or agency is the symbol ''USA.''

(d) Each package which conforms to a Type B(U) or Type B(M) package design must have the outside of the outermost receptacle, which is resistant to the effects of fire and water, plainly marked by embossing, stamping or other means resistant to the effects of fire and water with a radiation symbol that conforms to the requirements of Appendix B of this part.

(e) Each Type B(U), Type B(M) or fissile material package destined for export shipment must also be marked ''USA'' in conjunction with the specification marking, or other package certificate identification. (See §§ 173.471, 173.472, and 173.473 of this subchapter.)

■ 9. In § 172.400, in paragraph (b), the table is amended by adding immediately after the entry for ''7 RADIOACTIVE YELLOW-III'', the following entry to read as follows:

§ 172.400 General labeling requirements.

* * * * *

(b) * * *

Hazard class or division	Label name	Label design or section reference
* * *	* *	*
7 (fissile radioactive material; see § 172.402)	FISSILE	172.441
* * *	* *	*

* * * * *

■ 10. In § 172.402, paragraph (d) is revised to read as follows:

§ 172.402 Additional labeling requirements.

* * * * *

(d) *Class 7 (Radioactive) Materials.* Except as otherwise provided in this paragraph, each package containing a Class 7 material that also meets the definition of one or more additional hazard classes must be labeled as a

Class 7 material as required by § 172.403 and for each additional hazard.

(1) For a package containing a Class 7 material that also meets the definition of one or more additional hazard classes, whether or not the material satisfies § 173.4(a)(1)(iv) of this subchapter, a subsidiary label is not required on the package if the material conforms to the remaining criteria in § 173.4 of this subchapter.

(2) Each package or overpack containing fissile material, other than fissile-excepted material (see § 173.453 of this subchapter) must bear two FISSILE labels, affixed to opposite sides of the package or overpack, which conforms to the figure shown in § 172.441; such labels, where applicable, must be affixed adjacent to the labels for radioactive materials.

* * * * *

■ 11. In § 172.403, a new paragraph (e) is added, paragraph (g) is amended by revising paragraphs (g)(1), (g)(2), and (g)(3), and a new paragraph (h) is added to read as follows:

§ 172.403 Class 7 (radioactive) materials.

* * * * *

(e) *FISSILE label.* For packages required in § 172.402 to bear a FISSILE label, each such label must be completed with the criticality safety index (CSI) assigned in the NRC or DOE package design approval, or in the certificate of approval for special arrangement or the certificate of approval for the package design issued by the Competent Authority for import and export shipments. For overpacks and freight containers required in § 172.402 to bear a FISSILE label, the CSI on the label must be the sum of the CSIs for all of the packages contained in the overpack or freight container.

* * * * *

(g) * * *

(1) *Contents.* Except for LSA–I material, the names of the radionuclides as taken from the listing of radionuclides in § 173.435 of this subchapter (symbols which conform to established radiation protection terminology are authorized, *i.e.*, ^{99}Mo, ^{60}Co, *etc.*). For mixtures of radionuclides, with consideration of space available on the label, the radionuclides that must be shown must be determined in accordance with § 173.433(f) of this subchapter. For LSA–I material, the term ''LSA–I'' may be used in place of the names of the radionuclides.

(2) *Activity.* The activity in the package must be expressed in appropriate SI units (*e.g.*, Becquerels (Bq), Terabecquerels (TBq), *etc.*). The activity may also be stated in appropriate customary units (Curies (Ci), milliCuries (mCi), microCuries (uCi), *etc.*) in parentheses following the SI units. Abbreviations are authorized. Except for plutonium-239 and plutonium-241, the weight in grams or kilograms of fissile radionuclides may be inserted instead of activity units. For plutonium-239 and plutonium-241, the weight in grams of fissile radionuclides may be inserted in addition to the activity units.

(3) *Transport index.* (see § 173.403 of this subchapter.)

(h) When one or more packages of Class 7 (radioactive) material are placed within an overpack, the overpack must be labeled as prescribed in this section, except as follows:

(1) The ''contents'' entry on the label may state ''mixed'' in place of the names of the radionuclides unless each inside package contains the same radionuclide(s).

(2) The ''activity'' entry on the label must be determined by adding together the number of becquerels of the Class 7 (radioactive) materials packages contained therein.

(3) For an overpack, the transport index (TI) must be determined by adding together the transport indices of the Class 7 (radioactive) materials packages contained therein, except that for a rigid overpack, the transport index (TI) may alternatively be determined by direct measurement as prescribed in § 173.403 of this subchapter under the definition for ''transport index,'' taken by the person initially offering the packages contained within the overpack for shipment.

(4) The category of Class 7 label for the overpack must be determined from the table in § 172.403(c) using the TI derived according to paragraph (c)(3) or (c)(4) of this section, and the maximum surface radiation level on the surface of the overpack.

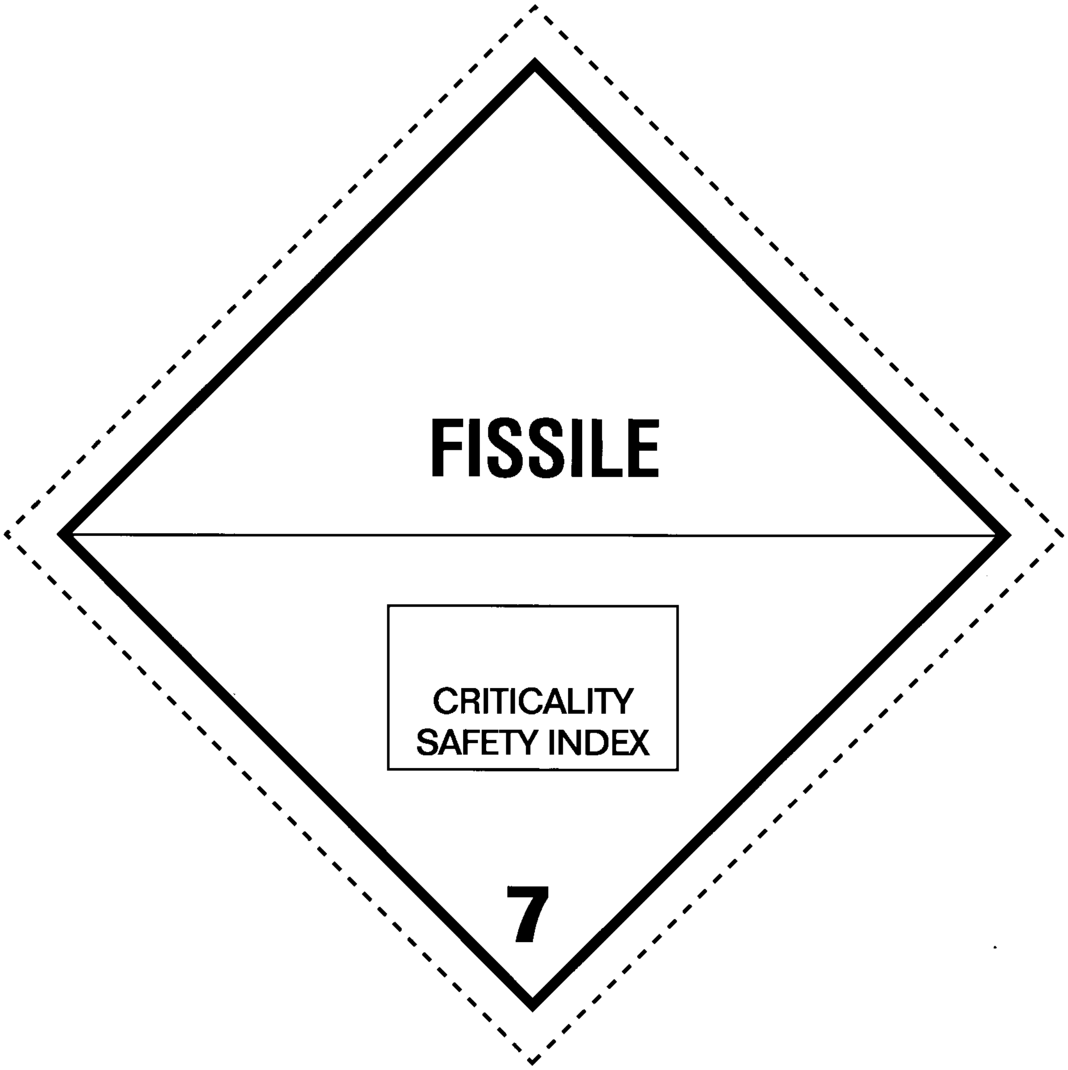
(5) The category of the Class 7 label of the overpack, and not that of any of the packages contained therein, must be used in accordance with Table 1 of § 172.504(e) to determine when the transport vehicle must be placarded.

(6) For fissile material, the criticality safety index which must be entered on the overpack FISSILE label is the sum of the criticality safety indices of the individual packages in the overpack, as stated in the certificate of approval for the package design issued by the NRC or the U.S. Competent Authority.

■ 12. A new § 172.441 is added to read as follow:

§ 172.441 FISSILE label.

(a) Except for size and color, the FISSILE label must be as follows:



(b) In addition to complying with § 172.407, the background color on the FISSILE label must be white.

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

■ 13. The authority citation for part 173 continues to read as follows:

Authority: 49 U.S.C. 5101–5127, 44701; 49 CFR 1.53.

■ 14. In § 173.401, paragraphs (b)(2) and (b)(3) are revised and a new paragraph (b)(4) is added to read as follows:

§ 173.401 Scope.

* * * * *

(b) * * *

(2) Class 7 (radioactive) materials that have been implanted or incorporated into, and are still in, a person or live animal for diagnosis or treatment.

(3) Class 7 (radioactive) material that is an integral part of the means of transport.

(4) Natural material and ores containing naturally occurring radionuclides which are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values specified in § 173.436.

■ 15. Section 173.403 is revised to read as follows:

§ 173.403 Definitions.

For purposes of this subpart—

A_1 means the maximum activity of special form Class 7 (radioactive) material permitted in a Type A package. This value is either listed in § 173.435 or may be derived in accordance with the procedures prescribed in § 173.433.

A_2 means the maximum activity of Class 7 (radioactive) material, other than special form material, LSA material, and SCO, permitted in a Type A package. This value is either listed in § 173.435 or may be derived in accordance with the procedures prescribed in § 173.433.

Class 7 (radioactive) material See the definition of *Radioactive material* in this section.

Closed transport vehicle means a transport vehicle or conveyance equipped with a securely attached exterior enclosure that during normal transportation restricts the access of unauthorized persons to the cargo space containing the Class 7 (radioactive) materials. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the ''see-through'' type, and must limit access from top, sides, and bottom.

Consignment means a package or group of packages or load of radioactive material offered by a person for transport in the same shipment.

Containment system means the assembly of components of the packaging intended to retain the Class 7 (radioactive) material during transport.

Contamination means the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters or 0.04 Bq/cm^2 for all other alpha emitters. Contamination exists in two phases.

(1) *Fixed radioactive contamination* means radioactive contamination that cannot be removed from a surface during normal conditions of transport.

(2) *Non-fixed radioactive contamination* means radioactive contamination that can be removed from a surface during normal conditions of transport.

Conveyance means:

(1) For transport by public highway or rail: any transport vehicle or large freight container;

(2) For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel including any transport vehicle on board the vessel; and

(3) For transport by aircraft, any aircraft.

Criticality Safety Index (CSI) means a number (rounded up to the next tenth) which is used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material. The CSI for packages containing fissile material is determined in accordance with the instructions provided in 10 CFR 71.22, 71.23, and 71.59. The CSI for an overpack, freight container, or consignment containing fissile material packages is the arithmetic sum of the criticality safety indices of all the fissile material packages contained within the overpack, freight container, or consignment.

Design means the description of a special form Class 7 (radioactive) material, a package, packaging, or LSA–III, that enables those items to be fully identified. The description may include specifications, engineering drawings, reports showing compliance with regulatory requirements, and other relevant documentation.

Deuterium means, for the purposes of § 173.453, deuterium and any deuterium compound, including heavy water, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1:5000.

Exclusive use means sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must provide to the initial carrier specific written instructions for maintenance of exclusive use shipment controls, including the vehicle survey requirement of § 173.443 (c) as applicable, and include these instructions with the shipping paper information provided to the carrier by the consignor.

Exemption value means either an exempt material activity concentration or an exempt consignment activity limit listed in the table in § 173.436, or determined according to the procedures described in § 173.433, and used to determine whether a given physically radioactive material is sufficiently radioactive to be subject to the HMR (see definition of radioactive material). An exemption value is different from an exemption, as defined in § 171.8 of this subchapter.

Fissile material means plutonium^{239}, plutonium^{241}, uranium^{233}, uranium^{235}, or any combination of these radionuclides. This term does not apply to material containing fissile nuclides, unirradiated natural uranium and unirradiated depleted uranium, or to natural uranium or depleted uranium that has been irradiated in thermal reactors only.

Freight container means a reusable container having a volume of 1.81 cubic meters (64 cubic feet) or more, designed and constructed to permit it being lifted with its contents intact and intended primarily for containment of packages in unit form during transportation. A ''small freight container'' is one which has either one outer dimension less than 1.5 m (4.9 feet) or an internal volume of not more than 3.0 cubic meters (106 cubic feet). All other freight containers are designated as ''large freight containers.''

Graphite means, for the purposes of § 173.453, graphite with a boron equivalent content less than 5 parts per million and density greater than 1.5 grams per cubic centimeter.

Highway route controlled quantity means a quantity within a single package which exceeds:

(1) 3,000 times the A_1 value of the radionuclides as specified in § 173.435 for special form Class 7 (radioactive) material;

(2) 3,000 times the A_2 value of the radionuclides as specified in § 173.435 for normal form Class 7 (radioactive) material; or

(3) 1,000 TBq (27,000 Ci), whichever is least.

Limited quantity of Class 7 (radioactive) material means a quantity of Class 7 (radioactive) material not exceeding the material's package limits specified in § 173.425 and conforming with requirements specified in § 173.421.

Low Specific Activity (LSA) material means Class 7 (radioactive) with limited specific activity which satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in of three groups:

(1) LSA–I:

(i) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides; or

(ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or

(iii) Radioactive material other than fissile material, for which the A_2 value is unlimited; or

(iv) Other radioactive material, excluding fissile material in quantities not excepted under § 173.453, in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in § 173.436, or 30 times the default values listed in Table 10B of § 173.433.

(2) LSA–II:

(i) Water with tritium concentration up to 0.8 TBq/L (20.0 Ci/L); or

(ii) Other radioactive material in which the activity is distributed throughout and the average specific activity does not exceed 10^{-4} A_2/g for solids and gases, and 10^{-5} A_2/g for liquids.

(3) LSA–III. Solids (*e.g.*, consolidated wastes, activated materials), excluding powders, that meet the requirements of § 173.468 and in which:

(i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, *etc.*);

(ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that, even under loss of packaging, the loss of Class 7 (radioactive) material per package by leaching when placed in water for seven days would not exceed 0.1 A_2; and

(iii) The estimated average specific activity of the solid, excluding any shielding material, does not exceed 2×10^{-3} A_2/g.

Low toxicity alpha emitters means natural uranium; depleted uranium; natural thorium; uranium-235 or uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates; and alpha emitters with a half-life of less than 10 days.

Maximum normal operating pressure means the maximum gauge pressure that would develop in a containment system during a period of one year, in the absence of venting or cooling, under the heat conditions specified in 10 CFR 71.71(c)(1).

Multilateral approval means approval of a package design or shipment by the relevant Competent Authority of the country of origin and of each country through or into which the package or shipment is to be transported. This definition does not include approval from a country over which Class 7 (radioactive) materials are carried in aircraft, if there is no scheduled stop in that country.

Natural thorium means thorium with the naturally occurring distribution of thorium isotopes (essentially 100 percent by weight of thorium-232).

Normal form Class 7 (radioactive) material means Class 7 (radioactive) which has not been demonstrated to qualify as ‘‘special form Class 7 (radioactive) material.’’

Package means the packaging together with its radioactive contents as presented for transport.

(1) ‘‘Excepted package’’ means a packaging together with its excepted Class 7 (radioactive) materials as specified in §§ 173.421–173.426 and 173.428.

(2) ‘‘Industrial package’’ means a packaging that, together with its low specific activity (LSA) material or surface contaminated object (SCO) contents, meets the requirements of §§ 173.410 and 173.411. Industrial packages are categorized in § 173.411 as either:

(i) ‘‘Industrial package Type 1 (IP–1)’’;

(ii) ‘‘Industrial package Type 2 (IP–2)’’; or

(iii) ‘‘Industrial package Type 3 (IP–3)’’.

(3) ‘‘Type A package’’ means a packaging that, together with its radioactive contents limited to A_1 or A_2 as appropriate, meets the requirements of §§ 173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this part under normal conditions of transport as demonstrated by the tests set forth in § 173.465 or § 173.466, as appropriate. A Type A package does not require Competent Authority approval.

(4) ‘‘Type B package’’ means a packaging designed to transport greater than an A_1 or A_2 quantity of radioactive material that, together with its radioactive contents, is designed to retain the integrity of containment and shielding required by this part when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR part 71.

(i) ‘‘Type B(U) package’’ means a Type B packaging that, together with its radioactive contents, for international shipments requires unilateral approval only of the package design and of any stowage provisions that may be necessary for heat dissipation.

(ii) ‘‘Type B(M) package’’ means a Type B packaging, together with its radioactive contents, that for international shipments requires multilateral approval of the package design, and may require approval of the conditions of shipment. Type B(M) packages are those Type B package designs which have a maximum normal operating pressure of more than 700 kPa/cm² (100 lb/in²) gauge or a relief device which would allow the release of Class 7 (radioactive) material to the environment under the hypothetical accident conditions specified in 10 CFR part 71.

(5) ‘‘Fissile material package’’ means a packaging, together with its fissile material contents, which meets the requirements for fissile material packages described in subpart E of 10 CFR 71. A fissile material package may be a Type AF package, a Type B(U)F package, or a Type B(M)F package.

Packaging means, for Class 7 (radioactive) materials, the assembly of components necessary to ensure compliance with the packaging requirements of this subpart. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, service equipment for filling, emptying, venting and pressure relief, and devices for cooling or absorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging.

Quality assurance means a systematic program of controls and inspections applied by each person involved in the transport of radioactive material which provides confidence that a standard of safety prescribed in this subchapter is achieved in practice.

Radiation level means the radiation dose-equivalent rate expressed in millisievert(s) per hour or mSv/h (millirems(s) per hour or mrem/h). Neutron flux densities may be converted into radiation levels according to Table 1:

TABLE 1.—NEUTRON FLUENCE RATES TO BE REGARDED AS EQUIVALENT TO A RADIATION LEVEL OF 0.01 MSV/H (1 MREM/H)[1]

Energy of neutron	Flux density equivalent to 0.01 mSv/h (1 mrem/h) neutrons per square centimeter per second (n/cm²/s)
Thermal (2.510E–8) MeV	272.0
1 keV	272.0
10 keV	281.0
100 keV	47.0
500 keV	11.0
1 MeV	7.5
5 MeV	6.4
10 MeV	6.7

[1] Flux densities equivalent for energies between those listed in this table may be obtained by linear interpolation.

Radioactive contents means a Class 7 (radioactive) material, together with any contaminated or activated solids, liquids and gases within the packaging.

Radioactive instrument or article means any manufactured instrument or article such as an instrument such as an instrument, clock, electronic tube or apparatus, or similar instrument or article having Class 7 (radioactive) material in gaseous or non-dispersible solid form as a component part.

Radioactive material means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the table in § 173.436 or values derived according to the instructions in § 173.433.

Special form Class 7 (radioactive) material means either an indispersible solid radioactive material or a sealed capsule containing radioactive material which satisfies the following conditions:

(1) It is either a single solid piece or a sealed capsule containing radioactive material that can be opened only by destroying the capsule;

(2) The piece or capsule has at least one dimension not less than 5 mm (0.2 in); and

(3) It satisfies the test requirements of § 173.469. Special form encapsulations designed in accordance with the requirements of § 173.389(g) in effect on June 30, 1983 (see 49 CFR part 173, revised as of October 1, 1982), and constructed prior to July 1, 1985 and special form encapsulations designed in accordance with the requirements of § 173.403 in effect on March 31, 1996 (see 49 CFR part 173, revised as of October 1, 1995), and constructed prior to April 1, 1997, may continue to be used. Any other special form

encapsulation must meet the requirements of this paragraph (3).

Specific activity of a radionuclide means the activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

Surface Contaminated Object (SCO) means a solid object which is not itself radioactive but which has radioactive material distributed on its surface. SCO exists in two phases:

(1) SCO–I: A solid object on which:

(i) The non-fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4 Bq/cm² (10^{-4} microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm² (10^{-5} microcurie/cm²) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4×10^4 Bq/cm² (1.0 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 4×10^3 Bq/cm² (0.1 microcurie/cm²) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4×10^4 Bq/cm² (1 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 4×10^3 Bq/cm² (0.1 microcurie/cm²) for all other alpha emitters.

(2) SCO–II: A solid object on which the limits for SCO–I are exceeded and on which:

(i) The non-fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 400 Bq/cm² (10^{-2} microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 40 Bq/cm² (10^{-3} microcurie/cm²) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8×10^5 Bq/cm² (20 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 8×10^4 Bq/cm² (2 microcuries/cm²) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8×10^5 Bq/cm² (20 microcuries/cm²) for beta and gamma and low toxicity alpha emitters, or 8×10^4 Bq/cm² (2 microcuries/cm²) for all other alpha emitters.

Transport index (TI) means the dimensionless number (rounded up to the next tenth) placed on the label of a package, to designate the degree of control to be exercised by the carrier during transportation. The transport index is determined by multiplying the maximum radiation level in millisieverts (mSv) per hour at 1 m (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at 1 m (3.3 ft)).

Type A quantity means a quantity of Class 7 (radioactive) material, the aggregate radioactivity which does not exceed A_1 for special form Class 7 (radioactive) material of A_2 for normal form Class 7 (radioactive) material, where A_1 and A_2 values are given in §173.435 or are determined in accordance with §173.433.

Type B quantity means a quantity of material greater than a Type A quantity.

Unilateral approval means approval of a package design solely by the Competent Authority of the country of origin of the design.

Unirradiated thorium means thorium containing not more than 10^{-7} grams uranium-233 per gram of thorium-232.

Unirradiated uranium means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235 and not more than 5×10^{-3} g of uranium-236 per gram of uranium-235.

Uranium—natural, depleted or enriched means the following:

(1)(i) ''Natural uranium'' means chemically separated uranium containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72% uranium-235 by mass).

(ii) ''Depleted uranium'' means uranium containing a lesser mass percentage of uranium-235 than in natural uranium.

(iii) ''Enriched uranium'' means uranium containing a greater mass percentage of uranium-235 than 0.72%.

(2) In all cases listed in this definition, a very small mass percentage of uranium-234 is present.

■ 16. In §173.411, paragraph (b)(5)(ii) is revised to read as follows:

§173.411 Industrial packagings.

* * * * *

(b) * * *

(5) * * *

(ii) Be designed to conform to the standards prescribed in ISO 1496–1: 1990(E) ''Series 1 Freight Containers—Specification and testing—Part 1: General cargo containers,'' excluding dimensions and ratings (IBR, see §171.7 of this subchapter);

* * * * *

■ 17. In § 173.415, paragraphs (a), (c) and (d) are revised to read as follows:

§ 173.415 Authorized Type A packages.

* * * * *

(a) DOT Specification 7A (see § 178.350 of this subchapter) Type A general packaging. Each offeror of a Specification 7A package must maintain on file for at least one year after the latest shipment, and shall provide to DOT on request, complete documentation of tests and an engineering evaluation or comparative data showing that the construction methods, packaging design, and materials of construction comply with that specification.

* * * * *

(c) Any Type B(U) or Type B(M) packaging authorized pursuant to § 173.416.

(d) Any foreign-made packaging that meets the standards in ''IAEA Regulations for the Safe Transport of Radioactive Material No. TS–R–1'' (IBR, see § 171.7 of this subchapter) and bears the marking ''Type A''. Such packagings may be subsequently used for domestic and export shipments of Class 7 (radioactive) materials provided the offeror obtains the applicable documentation of tests and engineering evaluations and maintains the documentation on file in accordance with paragraph (a) of this section. These packagings must conform with requirements of the country of origin (as indicated by the packaging marking) and the IAEA regulations applicable to Type A packagings.

■ 18. Section 173.416 is revised to read as follows:

§ 173.416 Authorized Type B packages.

Each of the following packages is authorized for shipment of quantities exceeding A_1 or A_2, as appropriate:

(a) Any Type B(U) or Type B(M) packaging that meets the applicable requirements of 10 CFR part 71 and that has been approved by the U.S. Nuclear Regulatory Commission may be shipped pursuant to § 173.471.

(b) Any Type B(U) or B(M) packaging that meets the applicable requirements in ''IAEA Regulations for the Safe Transport of Radioactive Material, No. TS–R–1'' (IBR, see § 171.7 of this subchapter) and for which the foreign Competent Authority Certificate has been revalidated by DOT pursuant to § 173.473. These packagings are authorized only for export and import shipments.

(c) Continued use of an existing Type B packaging constructed to DOT Specification 6M, 20WC, or 21WC is authorized until October 1, 2008 if it conforms in all aspects to the requirements of this subchapter in effect on October 1, 2003.

■ 19. Section 173.417 is revised to read as follows:

§ 173.417 Authorized fissile materials packages.

(a) Except as provided in § 173.453, fissile materials containing not more than A_1 or A_2 as appropriate, must be packaged in one of the following packagings:

(1)(i) Any packaging listed in § 173.415, limited to the Class 7 (radioactive) materials specified in 10 CFR part 71, subpart C;

(ii) Any Type AF, Type B(U)F, or Type B(M)F packaging that meets the applicable standards for fissile material packages in 10 CFR part 71; or

(iii) Any Type AF, Type B(U)F, or Type B(M)F packaging that meets the applicable requirements for fissile material packages in Section VI of the International Atomic Energy Agency ''Regulations for the Safe Transport of Radioactive Material, No. TS–R–1 (IBR, see § 171.7 of this subchapter),'' and for which the foreign Competent Authority certificate has been revalidated by the U.S. Competent Authority, in accordance with § 173.473. These packages are authorized only for export and import shipments.

(2) A residual ''heel'' of enriched solid uranium hexafluoride may be transported without a protective overpack in any metal cylinder that meets both the requirements of § 173.415 and § 178.350 of this subchapter for Specification 7A Type A packaging, and the requirements of § 173.420 for packagings containing greater than 0.1 kg of uranium hexafluoride. Any such shipment must be made in accordance with Table 2, as follows:

TABLE 2.—ALLOWABLE CONTENT OF URANIUM HEXAFLUORIDE (UF_6 ''HEELS'' IN A SPECIFICATION 7A CYLINDER

Maximum cylinder diameter		Cylinder volume		Maximum uranium 235-enrichment (weight) percent	Maximum ''Heel'' weight per cylinder			
					UF6		Uranium-235	
Centimeters	Inches	Liters	Cubic feet		kg	lb	kg	lb
12.7	5	8.8	0.311	100.0	0.045	0.1	0.031	0.07
20.3	8	39.0	1.359	12.5	0.227	0.5	0.019	0.04
30.5	12	68.0	2.410	5.0	0.454	1.0	0.015	0.03
76.0	30	725.0	25.64	5.0	11.3	25.0	0.383	0.84
122.0	48	3,084.0	[1] 108.9	4.5	22.7	50.0	0.690	1.52
122.0	48	4,041.0	[2] 142.7	4.5	22.7	50.0	0.690	1.52

[1] 10 ton.
[2] 14 ton.

(3) DOT Specification 20PF–1, 20PF–2, or 20PF–3 (see § 178.356 of this subchapter), or Specification 21PF–1A, 21PF–1B, or 21PF–2 (see § 178.358 of this subchapter) phenolic-foam insulated overpack with snug fittings inner metal cylinders, meeting all requirements of §§ 173.24, 173.410, 173.412, and 173.420 and the following:

(i) Handling procedures and packaging criteria must be in accordance with United States Enrichment Corporation Report No. USEC–651 or ANSI N14.1 (IBR, see § 171.7 of this subchapter); and

(ii) Quantities of uranium hexafluoride are authorized as shown in Table 3 of this section, with each package assigned a minimum criticality safety index as also shown.

(b) Fissile Class 7 (radioactive) materials with radioactive content exceeding A_1 or A_2 must be packaged in one of the following packagings:

(1) Type B(U), or Type B(M) packaging that meets the standards for packaging of fissile materials in 10 CFR part 71, and is approved by the U.S. Nuclear Regulatory Commission and used in accordance with § 173.471;

(2) Type B(U) or Type B(M) packaging that also meets the applicable requirements for fissile material packaging in Section VI of the International Atomic Energy Agency ''Regulations for the Safe Transport of Radioactive Material, No. TS–R–1,'' and for which the foreign Competent Authority certificate has been revalidated by the U.S. Competent Authority in accordance with § 173.473. These packagings are authorized only for import and export shipments; or

(3) DOT Specifications 20PF–1, 20PF–2, or 20PF–3 (see § 178.356 of this subchapter), for DOT Specifications 21PF–1A or 21PF–1B (see § 178.356 of this subchapter) phenolic-foam insulated overpack with snug fitting inner metal cylinders, meeting all requirements of §§ 173.24, 173.410, and 173.412, and the following:

(i) Handling procedures and packaging criteria must be in accordance with United States Enrichment Corporation Report No. USEC–651 or ANSI N14.1; and

(ii) Quantities of uranium hexafluoride are authorized as shown in Table 3, with each package assigned a minimum criticality safety index as also shown:

TABLE 3.—AUTHORIZED QUANTITIES OF URANIUM HEXAFLUORIDE

Protective overpack specification number	Maximum inner cyclinder diameter		Maximum weight of UF6 contents		Maximum U–235 enrichment (weight/percent)	Minimum criticality safety index
	Centimeters	Inches	Kilograms	Pounds		
20PF–1	12.7	5	25	55	100.0	0.1
20PF–2	20.3	8	116	255	12.5	0.4
20PF–3	30.5	12	209	460	5.0	1.1
21PF–1A [1] or 21PF–1B [1]	[2] 76.0	[2] 30	2,250	4,950	5.0	5.0
21PF–1A [1] or 21PF–1B [1]	[3] 76.0	[3] 30	2,282	5,020	5.0	5.0

TABLE 3.—AUTHORIZED QUANTITIES OF URANIUM HEXAFLUORIDE—Continued

Protective overpack specification number	Maximum inner cyclinder diameter		Maximum weight of UF6 contents		Maximum U–235 enrichment (weight/percent)	Minimum criticality safety index
	Centimeters	Inches	Kilograms	Pounds		
21PF–2[1]	[2]76.0	[2]30	2,250	4,950	5.0	5.0
21PF–2[1]	[3]76.0	[3]30	2,282	5,020	5.0	5.0

[1] For 76 cm (30 in) cylinders, the maximum H/U atomic ratio is 0.088.
[2] Model 30A inner cylinder (reference USEC–651).
[3] Model 30B inner cylinder (reference USEC–651).

(c) Continued use of an existing fissile material packaging constructed to DOT Specification 6L, 6M, or 1A2, is authorized until October 1, 2008 if it conforms in all respects to the requirements of this subchapter in effect on October 1, 2003.

■ 20. Section 173.420 is revised to read as follows:

§ 173.420 Uranium hexafluoride (fissile, fissile excepted and non-fissile).

(a) In addition to any other applicable requirements of this subchapter, quantities greater than 0.1 kg of fissile, fissile excepted or non-fissile uranium hexafluoride must be offered for transportation as follows:

(1) Before initial filling and during periodic inspection and test, packagings must be cleaned in accordance with American National Standard N14.1 (IBR, see § 171.7 of this subchapter).

(2) Packagings must be designed, fabricated, inspected, tested and marked in accordance with—

(i) American National Standard N14.1 in effect at the time the packaging was manufactured;

(ii) Specifications for Class DOT–106A multi-unit tank car tanks (see §§ 179.300 and 179.301 of this subchapter);

(iii) Section VIII of the ASME Code (IBR, see § 171.7 of this subchapter), provided the packaging—

(A) Was manufactured on or before June 30, 1987;

(B) Conforms to the edition of the ASME Code in effect at the time the packaging was manufactured;

(C) Is used within its original design limitations; and

(D) Has shell and head thicknesses that have not decreased below the minimum value specified in the following table:

Packaging model	Minimum thickness; millimeters (inches)
1S, 2S	1.58 (0.062)
5A, 5B, 8A	3.17 (0.125)
12A, 12B	4.76 (0.187)
30B	7.93 (0.312)
48A, F, X, and Y	12.70 (0.500)
48T, O, OM, OM Allied, HX, H, and G	6.35 (0.250)

(3) Each package shall be designed so that it will:

(i) withstand a hydraulic test at an internal pressure of at least 1.4 MPa (200 psi) without leakage;

(ii) withstand the test specified in § 173.465(c) without loss or dispersal of the uranium hexafluoride; and

(iii) withstand the test specified in 10 CFR 71.73(c)(4) without rupture of the containment system.

(4) Uranium hexafluoride must be in solid form.

(5) The volume of solid uranium hexafluoride, except solid depleted uranium hexafluoride, at 20°C (68° F) may not exceed 61% of the certified volumetric capacity of the packaging. The volume of solid depleted uranium hexafluoride at 20° C (68° F) may not exceed 62% of the certified volumetric capacity of the packaging.

(6) The pressure in the package at 20° C (68° F) must be less than 101.3 kPa (14.8 psig).

(b) Each packaging for uranium hexafluoride must be periodically inspected, tested, marked and otherwise conform with the American National Standard N14.1.

(c) Each repair to a packaging for uranium hexafluoride must be performed in accordance with the American National Standard N14.1.

(d) Non-fissile uranium hexafluoride, in quantities of less than 0.1 kg, may be shipped in packaging that meets §§ 173.24, 173.24a, and 173.410.

■ 21. In § 173.421, paragraph (a) introductory text is revised to read as follows:

§ 173.421 Excepted packages for limited quantities of Class 7 (radioactive) materials.

(a) A Class 7 (radioactive) material with an activity per package which does not exceed the limited quantity package limits specified in Table 4 in § 173.425, and its packaging, are excepted from requirements in this subchapter for specification packaging, labeling, marking (except for the UN identification number marking requirement described in § 173.422(a)), and if not a hazardous substance or hazardous waste, shipping papers, and the requirements of this subpart if:

* * * * *

■ 22. Section 173.422 is revised to read as follows:

§ 173.422 Additional requirements for excepted packages containing Class 7 (radioactive) materials.

An excepted package of Class 7 (radioactive) material that is prepared for shipment under the provisions of § 173.421, § 173.424, § 173.426, or § 173.428 is not subject to any additional requirements of this subchapter, except for the following:

(a) The outside of each package must be marked with the four digit UN identification number for the material preceded by the letters UN, as shown in column (4) of the Hazardous Materials Table in § 172.101 of this subchapter;

(b) Sections 171.15 and 171.16 of this subchapter, pertaining to the reporting of incidents;

(c) Sections 174.750, 175.700(b), and 176.710 of this subchapter (depending on the mode of transportation), pertaining to the reporting of decontamination;

(d) The training requirements of subpart H of part 172 of this subchapter; and

(e) For materials that meet the definition of a hazardous substance or a hazardous waste, the shipping paper requirements of subpart C of part 172 of this subchapter.

■ 23. Section 173.424 is revised to read as follows:

§ 173.424 Excepted packages for radioactive instruments and articles.

A radioactive instrument or article and its packaging are excepted from requirements in this subchapter for specification packaging, labeling, marking (except for the UN identification number marking requirement described in § 173.422(a)), and if not a hazardous substance or hazardous waste, shipping papers and the requirements of this subpart if:

(a) Each package meets the general design requirements of § 173.410;

(b) The activity of the instrument or article does not exceed the relevant limit listed in Table 4 in § 173.425;

(c) The total activity per package does not exceed the relevant limit listed in Table 4 in § 173.425;

(d) The radiation level at 10 cm (4 in) from any point on the external surface of any unpackaged instrument or article does not exceed 0.1 mSv/hour (10 mrem/hour);

(e) The active material is completely enclosed by non-active components (a device performing the sole function of containing radioactive material shall not be considered to be an instrument or manufactured article);

(f) The radiation level at any point on the external surface of a package bearing the article or instrument does not exceed 0.005 mSv/hour (0.5 mrem/hour), or, for exclusive use domestic shipments, 0.02 mSv/hour (2 mrem/hour);

(g) The nonfixed (removable) radioactive surface contamination on the external surface of the package does not exceed the limits specified in § 173.443(a);

(h) Except as provided in § 173.426, the package does not contain more than 15 g of uranium-235; and

(i) The package is otherwise prepared for shipment as specified in § 173.422.

§ 173.425 [Amended]

■ 24. In § 173.425:

■ a. In the introductory text, ''table 7'' is revised to read ''Table 4''.

b. In the table heading the wording ''TABLE 7'' is revised to read ''TABLE 4''.

■ 25. In § 173.426, the introductory text is revised to read as follows:

§ 173.426 Excepted packages for articles containing natural uranium or thorium.

A manufactured article in which the sole Class 7 (radioactive) material content is natural uranium, unirradiated depleted uranium or natural thorium, and its packaging, are excepted from the requirements in this subchapter for specification packaging, labeling, marking (except for the UN identification number marking requirement described in § 173.422(a)), and if not a hazardous substance or hazardous waste, shipping papers and the requirements of this subpart if:

* * * * *

■ 26. Section 173.427 is revised to read as follows:

§ 173.427 Transport requirements for low specific activity (LSA) Class 7 (radioactive) materials and surface contaminated objects (SCO).

(a) In addition to other applicable requirements specified in this subchapter, LSA materials and SCO, unless excepted by paragraph (c) or (d) of this section, must be packaged in accordance with paragraph (b) of this section and, unless excepted by paragraph (d) of this section, must be transported in accordance with the following conditions:

(1) The external dose rate may not exceed an external radiation level of 10 mSv/h (1 rem/h) at 3 m from the unshielded material;

(2) The quantity of LSA and SCO material in any single conveyance may not exceed the limits specified in Table 5;

(3) LSA material and SCO that are or contain fissile material must conform to the applicable requirements of § 173.453;

(4) Packaged and unpackaged Class 7 (radioactive) materials must conform to the contamination control limits specified in § 173.443;

(5) External radiation levels may not exceed those specified in § 173.441; and

(6) For LSA material and SCO consigned as exclusive use:

(i) Shipments shall be loaded by the consignor and unloaded by the consignee from the conveyance or freight container in which originally loaded;

(ii) There may be no loose radioactive material in the conveyance; however, when the conveyance is the packaging, there may not be any leakage of radioactive material from the conveyance;

(iii) Packaged and unpackaged Class 7 (radioactive) materials must be braced so as to prevent shifting of lading under conditions normally incident to transportation;

(iv) Specific instructions for maintenance of exclusive use shipment controls shall be provided by the offeror to the carrier. Such instructions must be included with the shipping paper information;

(v) Except for shipments of unconcentrated uranium or thorium ores, the transport vehicle must be placarded in accordance with subpart F of part 172 of this subchapter;

(vi) For domestic transportation only, packaged and unpackaged Class 7 (radioactive) materials containing less than an A_2 quantity are excepted from the marking and labeling requirements of this subchapter. However, the exterior of each package or unpackaged Class 7 (radioactive) materials must be stenciled or otherwise marked ''RADIOACTIVE—LSA'' or ''RADIOACTIVE—SCO'', as appropriate, and packages or unpackaged Class 7 (radioactive) materials that contain a hazardous substance must be stenciled or otherwise marked with the letters ''RQ'' in association with the description in this paragraph (a)(6)(vi); and

(vii) Transportation by aircraft is prohibited except when transported in an industrial package in accordance with Table 6 of this section, or in an authorized Type A or Type B package.

(b) Except as provided in paragraph (c) of this section, LSA material and SCO must be packaged as follows:

(1) In an industrial package (IP–1, IP–2 or IP–3; § 173.411), subject to the limitations of Table 6;

(2) In a DOT Specification 7A (§ 178.350 of this subchapter) Type A package;

(3) In any Type B, B(U), or B(M) packaging authorized pursuant to § 173.416;

(4) For domestic, exclusive use transport of less than an A_2 quantity only, in a packaging which meets the requirements of §§ 173.24, 173.24a, and 173.410; or

(5) For exclusive use transport of liquid LSA–I only, in either:

(i) Specification 103CW, 111A60W7 (§§ 179.200, 179.201, 179.202 of this subchapter) tank cars. Bottom openings in tanks are prohibited; or

(ii) Specification MC 310, MC 311, MC 312, MC 331 or DOT 412 (§ 178.348 or § 178.337 of this subchapter) cargo tank motor vehicles. Bottom outlets are not authorized. Trailer-on-flat-car service is not authorized.

(c) LSA material and SCO in groups LSA–I and SCO–I may be transported unpackaged under the following conditions:

(1) All unpackaged material, other than ores containing only naturally occurring radionuclides, shall be transported in such a manner that under normal conditions of transport there will be no escape of the radioactive contents from the conveyance nor will there be any loss of shielding;

(2) Each conveyance must be under exclusive use, except when only transporting SCO–I on which the contamination on the accessible and the inaccessible surfaces is not greater than 4.0 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters and 0.4 Bq/cm^2 for all other alpha emitters; and

(3) For SCO–I where it is suspected that non-fixed contamination exists on inaccessible surfaces in excess of the values specified in paragraph (c)(2) of this section, measures shall be taken to

ensure that the radioactive material is not released into the conveyance or to the environment.

(d) LSA and SCO that exceed the packaging limits in this section must be packaged in accordance with 10 CFR part 71.

(e) Tables 5 and 6 are as follows:

TABLE 5.—CONVEYANCE ACTIVITY LIMITS FOR LSA MATERIAL AND SCO

Nature of material	Activity limit for conveyances
1. LSA–I	No limit.
2. LSA–II and LSA–III; non-Combustible solids.	No limit.
3. LSA–II and LSA–III; Combustible solids and all liquids and gases.	100 A_2
4. SCO	100 A_2

TABLE 6.—INDUSTRIAL PACKAGE INTEGRITY REQUIREMENTS FOR LSA MATERIAL AND SCO

Contents	Industrial packaging type	
	Exclusive use shipment	Non exclusive use shipment
1. LSA–I:		
Solid	IP–1	IP–1
Liquid	IP–1	IP–2
2. LSA–II:		
Solid	IP–2	IP–2
Liquid and gas	IP–2	IP–3
3. LSA–III:	IP–2	IP–3
SCO–I	IP–1	IP–1
SCO–II	IP–2	IP–2

■ 27. In § 173.428, the introductory text is revised, paragraphs (c), (d) and (e) are redesignated as paragraphs (d), (e) and (f) respectively, and a new paragraph (c) is added to read as follows:

§ 173.428 Empty Class 7 (radioactive) materials packaging.

A packaging which previously contained Class 7 (radioactive) materials and has been emptied of contents as far as practical, is excepted from the shipping paper and marking (except for the UN identification number marking requirement described in § 173.422(a)) requirements of this subchapter, provided that—

* * * * *

(c) The outer surface of any uranium or thorium in its structure is covered with an inactive sheath made of metal or some other substantial material;

* * * * *

■ 28. In § 173.431, paragraph (b) is revised to read as follows:

§ 173.431 Activity limits for Type A and Type B packages.

* * * * *

(b) The limits on activity contained in a Type B(U) or Type B(M) package are those prescribed in §§ 173.416 and 173.417, or in the applicable approval certificate under §§ 173.471, 173.472 or 173.473.

■ 29. Section 173.433 is revised to read as follows:

§ 173.433 Requirements for determining basic radionuclide values, and for the listing of radionuclides on shipping papers and labels.

(a) For individual radionuclides listed in the table in § 173.435 and § 173.436:

(1) A_1 and A_2 values are given in the table in § 173.435; and

(2) Activity concentration exemption values and consignment activity exemption values are given in the table in § 173.436.

(b) For individual radionuclides which are not listed in the tables in § 173.435 or § 173.436:

(1) the radionuclide values in Tables 7 or 8 of this section may be used; or

(2) other basic radionuclide values may be used provided they are first approved by the Associate Administrator or, for international transport, multilateral approval is obtained from the pertinent Competent Authorities.

(c) In calculating A_1 or A_2 values for a radionuclide not listed in the table in § 173.435:

(1) Where the chemical form of each radionuclide is known, it is permissible to use the A_2 value related to its solubility class as recommended by the International Commission on Radiological Protection, if the chemical forms under both normal and accident conditions of transport are taken into consideration.

(2) A single radioactive decay chain in which the radionuclides are present in their naturally-occurring proportions, and in which no daughter nuclide has a half life either longer than 10 days or longer than that of the parent nuclide, will be considered as a single radionuclide, and the activity to be taken into account and the A_1 or A_2 value to be applied will be those corresponding to the parent nuclide of that chain. Otherwise, the parent and daughter nuclides will be considered as a mixture of different nuclides.

(d) Mixtures of radionuclides whose identities and respective activities are known must conform to the following conditions:

(1) For special form Class 7 (radioactive) material, the activity which may be transported in a Type A package must satisfy:

$$\sum_i \frac{B(i)}{A_1(i)} \le 1$$

Where:

B(i) is the activity of radionuclide i in special form; and

A_1 (i) is the A_1 value for radionuclide i.

(2) For normal form Class 7 (radioactive) material, the activity which may be transported in a Type A package must satisfy:

$$\sum_j \frac{C(j)}{A_2(j)} \le 1$$

Where:

C(j) is the activity of radionuclide j in normal form; and

A_2(j) is the A_2 value for radionuclide j.

(3) If the package contains both special and normal form Class 7 (radioactive) material, the activity which may be transported in a Type A package must satisfy:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)} \le 1$$

Where:

The symbols are defined as in paragraphs (d)(2) and (d)(3) of this section.

(4) Alternatively, the A_1 value for a mixture of special form material may be determined as follows:

$$A_1 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_1(i)}}$$

Where:

f(i) is the fraction of activity for radionuclide i in the mixture; and

A_1(i) is the appropriate A_1 value for radionuclide i.

(5) Alternatively, the A_2 value for mixtures of normal form material may be determined as follows:

$$A_2 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

Where:

f(i) is the fraction of activity for normal form radionuclide i in the mixture; and

A_2(i) is the appropriate A_2 value for radionuclide i.

(6) The exempt activity concentration for mixtures of nuclides may be determined as follows:

$$\text{Exempt consignment activity limit for mixture} = \frac{1}{\sum_i \frac{f(i)}{[A](i)}}$$

Where:

f(i) is the fraction of activity concentration of nuclide i in the mixture; and

[A] (i) is the activity concentration for exempt material containing nuclide i.

(7) The activity limit for an exempt consignment for mixtures of nuclides may be determined as follows:

$$\text{Exempt consignment activity limit for mixture} = \frac{1}{\sum_i \frac{f(i)}{A(i)}}$$

Where:

f(i) is the fraction of activity of nuclide i in the mixture; and

A(i) is the activity limit for exempt consignments for nuclide i.

(e) When the identity of each nuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest A_1 or A_2 value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraphs (d)(1) through (d)(5) of this section. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest A_1 or A_2 values for the alpha emitters or beta/gamma emitters, respectively.

(f) When the identity of each nuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest [A] (activity concentration for exempt material) or A (activity limit for exempt consignment) value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraphs (d)(6) and (d)(7) of this section. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest [A] or A values for the alpha emitters or beta/gamma emitters, respectively.

(g) *Shipping papers and labeling.* For mixtures of radionuclides, the radionuclides (n) that must be shown on shipping papers and labels in accordance with §§ 172.203 and 172.403 of this subchapter, respectively, must be determined on the basis of the following formula:

$$\sum_{i=1}^{n} \frac{a_{(i)}}{A_{(i)}} \geq 0.95 \sum_{i=1}^{n+m} \frac{a_{(i)}}{A_{(i)}}$$

Where:

n + m represents all the radionuclides in the mixture;

m are the radionuclides that do not need to be considered;

$a_{(i)}$ is the activity of radionuclide i in the mixture; and

$A_{(i)}$ is the A_1 or A_2 value, as appropriate for radionuclide i.

(h) Tables 7 and 8 are as follows:

TABLE 7.—GENERAL VALUES FOR A_1 AND A_2

Radioactive contents	A_1		A_2	
	(TBq)	(Ci)	(TBq)	(Ci)
1. Only beta or gamma emitting nuclides are known to be present	1×10^{-1}	2.7×10^{0}	2×10^{-2}	5.4×10^{-1}
2. Only alpha emitting nuclides are known to be present	2×10^{-1}	5.4×10^{0}	9×10^{-5}	2.4×10^{-3}
3. No relevant data are available	1×10^{-3}	2.7×10^{-2}	9×10^{-5}	2.4×10^{-3}

TABLE 8.—GENERAL EXEMPTION VALUES

Radioactive contents	Activity concentration for exempt material		Activity limits for exempt consignments	
	(Bq/g)	(Ci/g)	(Bq)	Ci)
1. Only beta or gamma emitting nuclides are known to be present	1×10^{1}	2.7×10^{-10}	1×10^{4}	2.7×10^{-7}
2. Only alpha emitting nuclides are known to be present	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}
3. No relevant data are available	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}

■ 30. Section 173.435 is revised to read as follows:

§ 173.435 Table of A_1 and A_2 values for radionuclides.

The table of A_1 and A_2 values for radionuclides is as follows:

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity	
						(TBq/g)	(Ci/g)
Ac-225 (a)	Actinium (89)	8.0×10^{-1}	2.2×10^{1}	6.0×10^{-3}	1.6×10^{-1}	2.1×10^{3}	5.8×10^{4}

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity	
						(TBq/g)	(Ci/g)
Ac-227 (a)		9.0×10^{-1}	2.4×10^{1}	9.0×10^{-5}	2.4×10^{-3}	2.7	7.2×10^{1}
Ac-228		6.0×10^{-1}	1.6×10^{1}	5.0×10^{-1}	1.4×10^{1}	8.4×10^{4}	2.2×10^{6}
Ag-105	Silver (47)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	1.1×10^{3}	3.0×10^{4}
Ag-108m (a)		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	9.7×10^{-1}	2.6×10^{1}
Ag-110m (a)		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.8×10^{2}	4.7×10^{3}
Ag-111		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	5.8×10^{3}	1.6×10^{5}
Al-26	Aluminum (13)	1.0×10^{-1}	2.7	1.0×10^{-1}	2.7	7.0×10^{-4}	1.9×10^{-2}
Am-241	Americium (95)	1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	1.3×10^{-1}	3.4
Am-242m (a)		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	3.6×10^{-1}	1.0×10^{1}
Am-243 (a)		5.0	1.4×10^{2}	1.0×10^{-3}	2.7×10^{-2}	7.4×10^{-3}	2.0×10^{-1}
Ar-37	Argon (18)	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	3.7×10^{3}	9.9×10^{4}
Ar-39		4.0×10^{1}	1.1×10^{3}	2.0×10^{1}	5.4×10^{2}	1.3	3.4×10^{1}
Ar-41		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.5×10^{6}	4.2×10^{7}
As-72	Arsenic (33)	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	6.2×10^{4}	1.7×10^{6}
As-73		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	8.2×10^{2}	2.2×10^{4}
As-74		1.0	2.7×10^{1}	9.0×10^{-1}	2.4×10^{1}	3.7×10^{3}	9.9×10^{4}
As-76		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	5.8×10^{4}	1.6×10^{6}
As-77		2.0×10^{1}	5.4×10^{2}	7.0×10^{-1}	1.9×10^{1}	3.9×10^{4}	1.0×10^{6}
At-211 (a)	Astatine (85)	2.0×10^{1}	5.4×10^{2}	5.0×10^{-1}	1.4×10^{1}	7.6×10^{4}	2.1×10^{6}
Au-193	Gold (79)	7.0	1.9×10^{2}	2.0	5.4×10^{1}	3.4×10^{4}	9.2×10^{5}
Au-194		1.0	2.7×10^{1}	1.0	2.7×10^{1}	1.5×10^{4}	4.1×10^{5}
Au-195		1.0×10^{1}	2.7×10^{2}	6.0	1.6×10^{2}	1.4×10^{2}	3.7×10^{3}
Au-198		1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	9.0×10^{3}	2.4×10^{5}
Au-199		1.0×10^{1}	2.7×10^{2}	6.0×10^{-1}	1.6×10^{1}	7.7×10^{3}	2.1×10^{5}
Ba-131 (a)	Barium (56)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	3.1×10^{3}	8.4×10^{4}
Ba-133		3.0	8.1×10^{1}	3.0	8.1×10^{1}	9.4	2.6×10^{2}
Ba-133m		2.0×10^{1}	5.4×10^{2}	6.0×10^{-1}	1.6×10^{1}	2.2×10^{4}	6.1×10^{5}
Ba-140 (a)		5.0×10^{-1}	1.4×10^{1}	3.0×10^{-1}	8.1	2.7×10^{3}	7.3×10^{4}
Be-7	Beryllium (4)	2.0×10^{1}	5.4×10^{2}	2.0×10^{1}	5.4×10^{2}	1.3×10^{4}	3.5×10^{5}
Be-10		4.0×10^{1}	1.1×10^{3}	6.0×10^{-1}	1.6×10^{1}	8.3×10^{-4}	2.2×10^{-2}
Bi-205	Bismuth (83)	7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	1.5×10^{-3}	4.2×10^{4}
Bi-206		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	3.8×10^{3}	1.0×10^{5}
Bi-207		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	1.9	5.2×10^{1}
Bi-210		1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	4.6×10^{3}	1.2×10^{5}
Bi-210m (a)		6.0×10^{-1}	1.6×10^{1}	2.0×10^{-2}	5.4×10^{-1}	2.1×10^{-5}	5.7×10^{-4}
Bi-212 (a)		7.0×10^{-1}	1.9×10^{1}	6.0×10^{-1}	1.6×10^{1}	5.4×10^{5}	1.5×10^{7}
Bk-247	Berkelium (97)	8.0	2.2×10^{2}	8.0×10^{-4}	2.2×10^{-2}	3.8×10^{-2}	1.0
Bk-249 (a)		4.0×10^{1}	1.1×10^{3}	3.0×10^{-1}	8.1	6.1×10^{1}	1.6×10^{3}
Br-76	Bromine (35)	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	9.4×10^{4}	2.5×10^{6}
Br-77		3.0	8.1×10^{1}	3.0	8.1×10^{1}	2.6×10^{4}	7.1×10^{5}
Br-82		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	4.0×10^{4}	1.1×10^{6}
C-11	Carbon (6)	1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.1×10^{7}	8.4×10^{8}
C-14		4.0×10^{1}	1.1×10^{3}	3.0	8.1×10^{1}	1.6×10^{-1}	4.5
Ca-41	Calcium (20)	Unlimited	Unlimited	Unlimited	Unlimited	3.1×10^{-3}	8.5×10^{-2}
Ca-45		4.0×10^{1}	1.1×10^{3}	1.0	2.7×10^{1}	6.6×10^{2}	1.8×10^{4}
Ca-47 (a)		3.0	8.1×10^{1}	3.0×10^{-1}	8.1	2.3×10^{4}	6.1×10^{5}
Cd-109	Cadmium (48)	3.0×10^{1}	8.1×10^{2}	2.0	5.4×10^{1}	9.6×10^{1}	2.6×10^{3}
Cd-113m		4.0×10^{1}	1.1×10^{3}	5.0×10^{-1}	1.4×10^{1}	8.3	2.2×10^{2}
Cd-115 (a)		3.0	8.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.9×10^{4}	5.1×10^{5}
Cd-115m		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	9.4×10^{2}	2.5×10^{4}
Ce-139	Cerium (58)	7.0	1.9×10^{2}	2.0	5.4×10^{1}	2.5×10^{2}	6.8×10^{3}
Ce-141		2.0×10^{1}	5.4×10^{2}	6.0×10^{-1}	1.6×10^{1}	1.1×10^{3}	2.8×10^{4}
Ce-143		9.0×10^{-1}	2.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.5×10^{4}	6.6×10^{5}
Ce-144 (a)		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	1.2×10^{2}	3.2×10^{3}
Cf-248	Californium (98)	4.0×10^{1}	1.1×10^{3}	6.0×10^{-3}	1.6×10^{-1}	5.8×10^{1}	1.6×10^{3}
Cf-249		3.0	8.1×10^{1}	8.0×10^{-4}	2.2×10^{-2}	1.5×10^{-1}	4.1
Cf-250		2.0×10^{1}	5.4×10^{2}	2.0×10^{-3}	5.4×10^{-2}	4.0	1.1×10^{2}
Cf-251		7.0	1.9×10^{2}	7.0×10^{-4}	1.9×10^{-2}	5.9×10^{-2}	1.6
Cf-252 (h)		5.0×10^{-2}	1.4	3.0×10^{-3}	8.1×10^{-2}	2.0×10^{1}	5.4×10^{2}
Cf-253 (a)		4.0×10^{1}	1.1×10^{3}	4.0×10^{-2}	1.1	1.1×10^{3}	2.9×10^{4}
Cf-254		1.0×10^{-3}	2.7×10^{-2}	1.0×10^{-3}	2.7×10^{-2}	3.1×10^{2}	8.5×10^{3}
Cl-36	Chlorine (17)	1.0×10^{1}	2.7×10^{2}	6.0×10^{-1}	1.6×10^{1}	1.2×10^{-3}	3.3×10^{-2}
Cl-38		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	4.9×10^{6}	1.3×10^{8}
Cm-240	Curium (96)	4.0×10^{1}	1.1×10^{3}	2.0×10^{-2}	5.4×10^{-1}	7.5×10^{2}	2.0×10^{4}
Cm-241		2.0	5.4×10^{1}	1.0	2.7×10^{1}	6.1×10^{2}	1.7×10^{4}
Cm-242		4.0×10^{1}	1.1×10^{3}	1.0×10^{-2}	2.7×10^{-1}	1.2×10^{2}	3.3×10^{3}
Cm-243		9.0	2.4×10^{2}	1.0×10^{-3}	2.7×10^{-2}	1.9×10^{-3}	5.2×10^{1}
Cm-244		2.0×10^{1}	5.4×10^{2}	2.0×10^{-3}	5.4×10^{-2}	3.0	8.1×10^{1}
Cm-245		9.0	2.4×10^{2}	9.0×10^{-4}	2.4×10^{-2}	6.4×10^{-3}	1.7×10^{-1}
Cm-246		9.0	2.4×10^{2}	9.0×10^{-4}	2.4×10^{-2}	1.1×10^{-2}	3.1×10^{-1}
Cm-247 (a)		3.0	8.1×10^{1}	1.0×10^{-3}	2.7×10^{-2}	3.4×10^{-6}	9.3×10^{-5}
Cm-248		2.0×10^{-2}	5.4×10^{-1}	3.0×10^{-4}	8.1×10^{-3}	1.6×10^{-5}	4.2×10^{-3}

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity	
						(TBq/g)	(Ci/g)
Co-55	Cobalt (27)	5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	1.1×10^{5}	3.1×10^{6}
Co-56		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.1×10^{3}	3.0×10^{4}
Co-57		1.0×10^{1}	2.7×10^{2}	1.0×10^{1}	2.7×10^{2}	3.1×10^{2}	8.4×10^{3}
Co-58		1.0	2.7×10^{1}	1.0	2.7×10^{1}	1.2×10^{3}	3.2×10^{4}
Co-58m		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	2.2×10^{5}	5.9×10^{6}
Co-60		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	4.2×10^{1}	1.1×10^{3}
Cr-51	Chromium (24)	3.0×10^{1}	8.1×10^{2}	3.0×10^{1}	8.1×10^{2}	3.4×10^{3}	9.2×10^{4}
Cs-129	Cesium (55)	4.0	1.1×10^{2}	4.0	1.1×10^{2}	2.8×10^{4}	7.6×10^{5}
Cs-131		3.0×10^{1}	8.1×10^{2}	3.0×10^{1}	8.1×10^{2}	3.8×10^{3}	1.0×10^{5}
Cs-132		1.0	2.7×10^{1}	1.0	2.7×10^{1}	5.7×10^{3}	1.5×10^{5}
Cs-134		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	4.8×10^{1}	1.3×10^{3}
Cs-134m		4.0×10^{1}	1.1×10^{3}	6.0×10^{-1}	1.6×10^{1}	3.0×10^{5}	8.0×10^{6}
Cs-135		4.0×10^{1}	1.1×10^{3}	1.0	2.7×10^{1}	4.3×10^{-5}	1.2×10^{-3}
Cs-136		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	2.7×10^{3}	7.3×10^{4}
Cs-137 (a)		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.2	8.7×10^{1}
Cu-64	Copper (29)	6.0	1.6×10^{2}	1.0	2.7×10^{1}	1.4×10^{5}	3.9×10^{6}
Cu-67		1.0×10^{1}	2.7×10^{2}	7.0×10^{-1}	1.9×10^{1}	2.8×10^{4}	7.6×10^{5}
Dy-159	Dysprosium (66)	2.0×10^{1}	5.4×10^{2}	2.0×10^{1}	5.4×10^{2}	2.1×10^{2}	5.7×10^{3}
Dy-165		9.0×10^{-1}	2.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.0×10^{5}	8.2×10^{6}
Dy-166 (a)		9.0×10^{-1}	2.4×10^{1}	3.0×10^{-1}	8.1	8.6×10^{3}	2.3×10^{5}
Er-169	Erbium (68)	4.0×10^{1}	1.1×10^{3}	1.0	2.7×10^{1}	3.1×10^{3}	8.3×10^{4}
Er-171		8.0×10^{-1}	2.2×10^{1}	5.0×10^{-1}	1.4×10^{1}	9.0×10^{4}	2.4×10^{6}
Eu-147	Europium (63)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	1.4×10^{3}	3.7×10^{4}
Eu-148		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	6.0×10^{2}	1.6×10^{4}
Eu-149		2.0×10^{1}	5.4×10^{2}	2.0×10^{1}	5.4×10^{2}	3.5×10^{2}	9.4×10^{3}
Eu-150 (short lived).		2.0	5.4×10^{1}	7.0×10^{-1}	1.9×10^{1}	6.1×10^{4}	1.6×10^{6}
Eu-150 (long lived).		7 x 10−1	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	6.1×10^{4}	1.6×10^{6}
Eu-152		1.0	2.7×10^{1}	1.0	2.7×10^{1}	6.5	1.8×10^{2}
Eu-152m		8.0×10^{-1}	2.2×10^{1}	8.0×10^{-1}	2.2×10^{1}	8.2×10^{4}	2.2×10^{6}
Eu-154		9.0×10^{-1}	2.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	9.8	2.6×10^{2}
Eu-155		2.0×10^{1}	5.4×10^{2}	3.0	8.1×10^{1}	1.8×10^{1}	4.9×10^{2}
Eu-156		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	2.0×10^{3}	5.5×10^{4}
F-18	Fluorine (9)	1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.5×10^{6}	9.5×10^{7}
Fe-52 (a)	Iron (26)	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	2.7×10^{5}	7.3×10^{6}
Fe-55		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	8.8×10^{1}	2.4×10^{3}
Fe-59		9.0×10^{-1}	2.4×10^{1}	9.0×10^{-1}	2.4×10^{1}	1.8×10^{3}	5.0×10^{4}
Fe-60 (a)		4.0×10^{1}	1.1×10^{3}	2.0×10^{-1}	5.4	7.4×10^{-4}	2.0×10^{-2}
Ga-67	Gallium (31)	7.0	1.9×10^{2}	3.0	8.1×10^{1}	2.2×10^{4}	6.0×10^{5}
Ga-68		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	1.5×10^{6}	4.1×10^{7}
Ga-72		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.1×10^{5}	3.1×10^{6}
Gd-146 (a)	Gadolinium (64)	5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	6.9×10^{2}	1.9×10^{4}
Gd-148		2.0×10^{1}	5.4×10^{2}	2.0×10^{-3}	5.4×10^{-2}	1.2	3.2×10^{1}
Gd-153		1.0×10^{1}	2.7×10^{2}	9.0	2.4×10^{2}	1.3×10^{2}	3.5×10^{3}
Gd-159		3.0	8.1×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.9×10^{4}	1.1×10^{6}
Ge-68 (a)	Germanium (32)	5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	2.6×10^{2}	7.1×10^{3}
Ge-71		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	5.8×10^{3}	1.6×10^{5}
Ge-77		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.3×10^{5}	3.6×10^{6}
Hf-172 (a)	Hafnium (72)	6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	4.1×10^{1}	1.1×10^{3}
Hf-175		3.0	8.1×10^{1}	3.0	8.1×10^{1}	3.9×10^{2}	1.1×10^{4}
Hf-181		2.0	5.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	6.3×10^{2}	1.7×10^{4}
Hf-182		Unlimited	Unlimited	Unlimited	Unlimited	8.1×10^{-6}	2.2×10^{-4}
Hg-194 (a)	Mercury (80)	1.0	2.7×10^{1}	1.0	2.7×10^{1}	1.3×10^{-1}	3.5
Hg-195m (a)		3.0	8.1×10^{1}	7.0×10^{-1}	1.9×10^{1}	1.5×10^{4}	4.0×10^{5}
Hg-197		2.0×10^{1}	5.4×10^{2}	1.0×10^{1}	2.7×10^{2}	9.2×10^{3}	2.5×10^{5}
Hg-197m		1.0×10^{1}	2.7×10^{2}	4.0×10^{-1}	1.1×10^{1}	2.5×10^{4}	6.7×10^{5}
Hg-203		5.0	1.4×10^{2}	1.0	2.7×10^{1}	5.1×10^{2}	1.4×10^{4}
Ho-166	Holmium (67)	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	2.6×10^{4}	7.0×10^{5}
Ho-166m		6.0×10^{-1}	1.6×10^{1}	5.0×10^{-1}	1.4×10^{1}	6.6×10^{-2}	1.8
I-123	Iodine (53)	6.0	1.6×10^{2}	3.0	8.1×10^{1}	7.1×10^{4}	1.9×10^{6}
I-124		1.0	2.7×10^{1}	1.0	2.7×10^{1}	9.3×10^{3}	2.5×10^{5}
I-125		2.0×10^{1}	5.4×10^{2}	3.0	8.1×10^{1}	6.4×10^{2}	1.7×10^{4}
I-126		2.0	5.4×10^{1}	1.0	2.7×10^{1}	2.9×10^{3}	8.0×10^{4}
I-129		Unlimited	Unlimited	Unlimited	Unlimited	6.5×10^{-6}	1.8×10^{-4}
I-131		3.0	8.1×10^{1}	7.0×10^{-1}	1.9×10^{1}	4.6×10^{3}	1.2×10^{5}
I-132		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	3.8×10^{5}	1.0×10^{7}
I-133		7.0×10^{-1}	1.9×10^{1}	6.0×10^{-1}	1.6×10^{1}	4.2×10^{4}	1.1×10^{6}
I-134		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	9.9×10^{5}	2.7×10^{7}
I-135 (a)		6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.3×10^{5}	3.5×10^{6}
In-111	Indium (49)	3.0	8.1×10^{1}	3.0	8.1×10^{1}	1.5×10^{4}	4.2×10^{5}
In-113m		4.0	1.1×10^{2}	2.0	5.4×10^{1}	6.2×10^{5}	1.7×10^{7}

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity	
						(TBq/g)	(Ci/g)
In-114m (a)		1.0×10^{1}	2.7×10^{2}	5.0×10^{-1}	1.4×10^{1}	8.6×10^{2}	2.3×10^{4}
In-115m		7.0	1.9×10^{2}	1.0	2.7×10^{1}	2.2×10^{5}	6.1×10^{6}
Ir-189 (a)	Iridium (77)	1.0×10^{1}	2.7×10^{2}	1.0×10^{1}	2.7×10^{2}	1.9×10^{3}	5.2×10^{4}
Ir-190		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	2.3×10^{3}	6.2×10^{4}
Ir-192 (c)		1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.4×10^{2}	9.2×10^{3}
Ir-194		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	3.1×10^{4}	8.4×10^{5}
K-40	Potassium (19)	9.0×10^{-1}	2.4×10^{1}	9.0×10^{-1}	2.4×10^{1}	2.4×10^{-7}	6.4×10^{-6}
K-42		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	2.2×10^{5}	6.0×10^{6}
K-43		7.0×10^{-1}	1.9×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.2×10^{5}	3.3×10^{6}
Kr-81	Krypton (36)	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	7.8×10^{-4}	2.1×10^{-2}
Kr-85		1.0×10^{1}	2.7×10^{2}	1.0×10^{1}	2.7×10^{2}	1.5×10^{1}	3.9×10^{2}
Kr-85m		8.0	2.2×10^{2}	3.0	8.1×10^{1}	3.0×10^{5}	8.2×10^{6}
Kr-87		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	1.0×10^{6}	2.8×10^{7}
La-137	Lanthanum (57)	3.0×10^{1}	8.1×10^{2}	6.0	1.6×10^{2}	1.6×10^{-3}	4.4×10^{-2}
La-140		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	2.1×10^{4}	5.6×10^{5}
Lu-172	Lutetium (71)	6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	4.2×10^{3}	1.1×10^{5}
Lu-173		8.0	2.2×10^{2}	8.0	2.2×10^{2}	5.6×10^{1}	1.5×10^{3}
Lu-174		9.0	2.4×10^{2}	9.0	2.4×10^{2}	2.3×10^{1}	6.2×10^{2}
Lu-174m		2.0×10^{1}	5.4×10^{2}	1.0×10^{1}	2.7×10^{2}	2.0×10^{2}	5.3×10^{3}
Lu-177		3.0×10^{1}	8.1×10^{2}	7.0×10^{-1}	1.9×10^{1}	4.1×10^{3}	1.1×10^{5}
Mg-28 (a)	Magnesium (12)	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	2.0×10^{5}	5.4×10^{6}
Mn-52	Manganese (25)	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.6×10^{4}	4.4×10^{5}
Mn-53		Unlimited	Unlimited	Unlimited	Unlimited	6.8×10^{-5}	1.8×10^{-3}
Mn-54		1.0	2.7×10^{1}	1.0	2.7×10^{1}	2.9×10^{2}	7.7×10^{3}
Mn-56		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	8.0×10^{5}	2.2×10^{7}
Mo-93	Molybdenum (42)	4.0×10^{1}	1.1×10^{3}	2.0×10^{1}	5.4×10^{2}	4.1×10^{-2}	1.1
Mo-99 (a) (i)		1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.8×10^{4}	4.8×10^{5}
N-13	Nitrogen (7)	9.0×10^{-1}	2.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	5.4×10^{7}	1.5×10^{9}
Na-22	Sodium (11)	5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	2.3×10^{2}	6.3×10^{3}
Na-24		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	3.2×10^{5}	8.7×10^{6}
Nb-93m	Niobium (41)	4.0×10^{1}	1.1×10^{3}	3.0×10^{1}	8.1×10^{2}	8.8	2.4×10^{2}
Nb-94		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	6.9×10^{-3}	1.9×10^{-1}
Nb-95		1.0	2.7×10^{1}	1.0	2.7×10^{1}	1.5×10^{3}	3.9×10^{4}
Nb-97		9.0×10^{-1}	2.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	9.9×10^{5}	2.7×10^{7}
Nd-147	Neodymium (60)	6.0	1.6×10^{2}	6.0×10^{-1}	1.6×10^{1}	3.0×10^{3}	8.1×10^{4}
Nd-149		6.0×10^{-1}	1.6×10^{1}	5.0×10^{-1}	1.4×10^{1}	4.5×10^{5}	1.2×10^{7}
Ni-59	Nickel (28)	Unlimited	Unlimited	Unlimited	Unlimited	3.0×10^{-3}	8.0×10^{-2}
Ni-63		4.0×10^{1}	1.1×10^{3}	3.0×10^{1}	8.1×10^{2}	2.1	5.7×10^{1}
Ni-65		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	7.1×10^{5}	1.9×10^{7}
Np-235	Neptunium (93)	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	5.2×10^{1}	1.4×10^{3}
Np-236 (short-lived).		2.0×10^{1}	5.4×10^{2}	2.0	5.4×10^{1}	4.7×10^{-4}	1.3×10^{-2}
Np-236 (long-lived).		9.0×10^{0}	2.4×10^{2}	2.0×10^{-2}	5.4×10^{-1}	4.7×10^{-4}	1.3×10^{-2}
Np-237		2.0×10^{1}	5.4×10^{2}	2.0×10^{-3}	5.4×10^{-2}	2.6×10^{-5}	7.1×10^{-4}
Np-239		7.0	1.9×10^{2}	4.0×10^{-1}	1.1×10^{1}	8.6×10^{3}	2.3×10^{5}
Os-185	Osmium (76)	1.0	2.7×10^{1}	1.0	2.7×10^{1}	2.8×10^{2}	7.5×10^{3}
Os-191		1.0×10^{1}	2.7×10^{2}	2.0	5.4×10^{1}	1.6×10^{3}	4.4×10^{4}
Os-191m		4.0×10^{1}	1.1×10^{3}	3.0×10^{1}	8.1×10^{2}	4.6×10^{4}	1.3×10^{6}
Os-193		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.0×10^{4}	5.3×10^{5}
Os-194 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.1×10^{1}	3.1×10^{2}
P-32	Phosphorus (15)	5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	1.1×10^{4}	2.9×10^{5}
P-33		4.0×10^{1}	1.1×10^{3}	1.0	2.7×10^{1}	5.8×10^{3}	1.6×10^{5}
Pa-230 (a)	Protactinium (91)	2.0	5.4×10^{1}	7.0×10^{-2}	1.9	1.2×10^{3}	3.3×10^{4}
Pa-231		4.0	1.1×10^{2}	4.0×10^{-4}	1.1×10^{-2}	1.7×10^{-3}	4.7×10^{-2}
Pa-233		5.0	1.4×10^{2}	7.0×10^{-1}	1.9×10^{1}	7.7×10^{2}	2.1×10^{4}
Pb-201	Lead (82)	1.0	2.7×10^{1}	1.0	2.7×10^{1}	6.2×10^{4}	1.7×10^{6}
Pb-202		4.0×10^{1}	1.1×10^{3}	2.0×10^{1}	5.4×10^{2}	1.2×10^{-4}	3.4×10^{-3}
Pb-203		4.0	1.1×10^{2}	3.0	8.1×10^{1}	1.1×10^{4}	3.0×10^{5}
Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	4.5×10^{-6}	1.2×10^{-4}
Pb-210 (a)		1.0	2.7×10^{1}	5.0×10^{-2}	1.4	2.8	7.6×10^{1}
Pb-212 (a)		7.0×10^{-1}	1.9×10^{1}	2.0×10^{-1}	5.4	5.1×10^{4}	1.4×10^{6}
Pd-103 (a)	Palladium (46)	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	2.8×10^{3}	7.5×10^{4}
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	1.9×10^{-5}	5.1×10^{-4}
Pd-109		2.0	5.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	7.9×10^{4}	2.1×10^{6}
Pm-143	Promethium (61)	3.0	8.1×10^{1}	3.0	8.1×10^{1}	1.3×10^{2}	3.4×10^{3}
Pm-144		7.0×10^{-1}	1.9×10^{1}	7.0×10^{-1}	1.9×10^{1}	9.2×10^{1}	2.5×10^{3}
Pm-145		3.0×10^{1}	8.1×10^{2}	1.0×10^{1}	2.7×10^{2}	5.2	1.4×10^{2}
Pm-147		4.0×10^{1}	1.1×10^{3}	2.0	5.4×10^{1}	3.4×10^{1}	9.3×10^{2}
Pm-148m (a)		8.0×10^{-1}	2.2×10^{1}	7.0×10^{-1}	1.9×10^{1}	7.9×10^{2}	2.1×10^{4}
Pm-149		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.5×10^{4}	4.0×10^{5}
Pm-151		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.7×10^{4}	7.3×10^{5}

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity	
						(TBq/g)	(Ci/g)
Po-210	Polonium (84)	4.0×10^{1}	1.1×10^{3}	2.0×10^{-2}	5.4×10^{-1}	1.7×10^{2}	4.5×10^{3}
Pr-142	Praseodymium (59)	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	4.3×10^{4}	1.2×10^{6}
Pr-143		3.0	8.1×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.5×10^{3}	6.7×10^{4}
Pt-188 (a)	Platinum (78)	1.0	2.7×10^{1}	8.0×10^{-1}	2.2×10^{1}	2.5×10^{3}	6.8×10^{4}
Pt-191		4.0	1.1×10^{2}	3.0	8.1×10^{1}	8.7×10^{3}	2.4×10^{5}
Pt-193		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	1.4	3.7×10^{1}
Pt-193m		4.0×10^{1}	1.1×10^{3}	5.0×10^{-1}	1.4×10^{1}	5.8×10^{3}	1.6×10^{5}
Pt-195m		1.0×10^{1}	2.7×10^{2}	5.0×10^{-1}	1.4×10^{1}	6.2×10^{3}	1.7×10^{5}
Pt-197		2.0×10^{1}	5.4×10^{2}	6.0×10^{-1}	1.6×10^{1}	3.2×10^{4}	8.7×10^{5}
Pt-197m		1.0×10^{1}	2.7×10^{2}	6.0×10^{-1}	1.6×10^{1}	3.7×10^{5}	1.0×10^{7}
Pu-236	Plutonium (94)	3.0×10^{1}	8.1×10^{2}	3.0×10^{-3}	8.1×10^{-2}	2.0×10^{1}	5.3×10^{2}
Pu-237		2.0×10^{1}	5.4×10^{2}	2.0×10^{1}	5.4×10^{2}	4.5×10^{2}	1.2×10^{4}
Pu-238		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	6.3×10^{-1}	1.7×10^{1}
Pu-239		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	2.3×10^{-3}	6.2×10^{-2}
Pu-240		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	8.4×10^{-3}	2.3×10^{-1}
Pu-241 (a)		4.0×10^{1}	1.1×10^{3}	6.0×10^{-2}	1.6	3.8	1.0×10^{2}
Pu-242		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	1.5×10^{-4}	3.9×10^{-3}
Pu-244 (a)		4.0×10^{-1}	1.1×10^{1}	1.0×10^{-3}	2.7×10^{-2}	6.7×10^{-7}	1.8×10^{-5}
Ra-223 (a)	Radium (88)	4.0×10^{-1}	1.1×10^{1}	7.0×10^{-3}	1.9×10^{-1}	1.9×10^{3}	5.1×10^{4}
Ra-224 (a)		4.0×10^{-1}	1.1×10^{1}	2.0×10^{-2}	5.4×10^{-1}	5.9×10^{3}	1.6×10^{5}
Ra-225 (a)		2.0×10^{-1}	5.4	4.0×10^{-3}	1.1×10^{-1}	1.5×10^{3}	3.9×10^{4}
Ra-226 (a)		2.0×10^{-1}	5.4	3.0×10^{-3}	8.1×10^{-2}	3.7×10^{-2}	1.0
Ra-228 (a)		6.0×10^{-1}	1.6×10^{1}	2.0×10^{-2}	5.4×10^{-1}	1.0×10^{1}	2.7×10^{2}
Rb-81	Rubidium (37)	2.0	5.4×10^{1}	8.0×10^{-1}	2.2×10^{1}	3.1×10^{5}	8.4×10^{6}
Rb-83 (a)		2.0	5.4×10^{1}	2.0	5.4×10^{1}	6.8×10^{2}	1.8×10^{4}
Rb-84		1.0	2.7×10^{1}	1.0	2.7×10^{1}	1.8×10^{3}	4.7×10^{4}
Rb-86		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	3.0×10^{3}	8.1×10^{4}
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	3.2×10^{-9}	8.6×10^{-8}
Rb(nat)		Unlimited	Unlimited	Unlimited	Unlimited	6.7×10^{6}	1.8×10^{8}
Re-184	Rhenium (75)	1.0	2.7×10^{1}	1.0	2.7×10^{1}	6.9×10^{2}	1.9×10^{4}
Re-184m		3.0	8.1×10^{1}	1.0	2.7×10^{1}	1.6×10^{2}	4.3×10^{3}
Re-186		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	6.9×10^{3}	1.9×10^{5}
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	1.4×10^{-9}	3.8×10^{-8}
Re-188		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	3.6×10^{4}	9.8×10^{5}
Re-189 (a)		3.0	8.1×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.5×10^{4}	6.8×10^{5}
Re(nat)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	2.4×10^{-8}
Rh-99	Rhodium (45)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	3.0×10^{3}	8.2×10^{4}
Rh-101		4.0	1.1×10^{2}	3.0	8.1×10^{1}	4.1×10^{1}	1.1×10^{3}
Rh-102		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	4.5×10^{1}	1.2×10^{3}
Rh-102m		2.0	5.4×10^{1}	2.0	5.4×10^{1}	2.3×10^{2}	6.2×10^{3}
Rh-103m		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	1.2×10^{6}	3.3×10^{7}
Rh-105		1.0×10^{1}	2.7×10^{2}	8.0×10^{-1}	2.2×10^{1}	3.1×10^{4}	8.4×10^{5}
Rn-222 (a)	Radon (86)	3.0×10^{-1}	8.1	4.0×10^{-3}	1.1×10^{-1}	5.7×10^{3}	1.5×10^{5}
Ru-97	Ruthenium (44)	5.0	1.4×10^{2}	5.0	1.4×10^{2}	1.7×10^{4}	4.6×10^{5}
Ru-103 (a)		2.0	5.4×10^{1}	2.0	5.4×10^{1}	1.2×10^{3}	3.2×10^{4}
Ru-105		1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.5×10^{5}	6.7×10^{6}
Ru-106 (a)		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	1.2×10^{2}	3.3×10^{3}
S-35	Sulphur (16)	4.0×10^{1}	1.1×10^{3}	3.0	8.1×10^{1}	1.6×10^{3}	4.3×10^{4}
Sb-122	Antimony (51)	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.5×10^{4}	4.0×10^{5}
Sb-124		6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	6.5×10^{2}	1.7×10^{4}
Sb-125		2.0	5.4×10^{1}	1.0	2.7×10^{1}	3.9×10^{1}	1.0×10^{3}
Sb-126		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	3.1×10^{3}	8.4×10^{4}
Sc-44	Scandium (21)	5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	6.7×10^{5}	1.8×10^{7}
Sc-46		5.0×10^{-1}	1.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	1.3×10^{3}	3.4×10^{4}
Sc-47		1.0×10^{1}	2.7×10^{2}	7.0×10^{-1}	1.9×10^{1}	3.1×10^{4}	8.3×10^{5}
Sc-48		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	5.5×10^{4}	1.5×10^{6}
Se-75	Selenium (34)	3.0	8.1×10^{1}	3.0	8.1×10^{1}	5.4×10^{2}	1.5×10^{4}
Se-79		4.0×10^{1}	1.1×10^{3}	2.0	5.4×10^{1}	2.6×10^{-3}	7.0×10^{-2}
Si-31	Silicon (14)	6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.4×10^{6}	3.9×10^{7}
Si-32		4.0×10^{1}	1.1×10^{3}	5.0×10^{-1}	1.4×10^{1}	3.9	1.1×10^{2}
Sm-145	Samarium (62)	1.0×10^{1}	2.7×10^{2}	1.0×10^{1}	2.7×10^{2}	9.8×10^{1}	2.6×10^{3}
Sm-147		Unlimited	Unlimited	Unlimited	Unlimited	8.5×10^{-1}	2.3×10^{-8}
Sm-151		4.0×10^{1}	1.1×10^{3}	1.0×10^{1}	2.7×10^{2}	9.7×10^{-1}	2.6×10^{1}
Sm-153		9.0	2.4×10^{2}	6.0×10^{-1}	1.6×10^{1}	1.6×10^{4}	4.4×10^{5}
Sn-113 (a)	Tin (50)	4.0	1.1×10^{2}	2.0	5.4×10^{1}	3.7×10^{2}	1.0×10^{4}
Sn-117m		7.0	1.9×10^{2}	4.0×10^{-1}	1.1×10^{1}	3.0×10^{3}	8.2×10^{4}
Sn-119m		4.0×10^{1}	1.1×10^{3}	3.0×10^{1}	8.1×10^{2}	1.4×10^{2}	3.7×10^{3}
Sn-121m (a)		4.0×10^{1}	1.1×10^{3}	9.0×10^{-1}	2.4×10^{1}	2.0	5.4×10^{1}
Sn-123		8.0×10^{-1}	2.2×10^{1}	6.0×10^{-1}	1.6×10^{1}	3.0×10^{2}	8.2×10^{3}
Sn-125		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	4.0×10^{3}	1.1×10^{5}
Sn-126 (a)		6.0×10^{-1}	1.6×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.0×10^{-3}	2.8×10^{-2}
Sr-82 (a)	Strontium (38)	2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	2.3×10^{3}	6.2×10^{4}

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity	
						(TBq/g)	(Ci/g)
Sr-85		2.0	5.4×10^{1}	2.0	5.4×10^{1}	8.8×10^{2}	2.4×10^{4}
Sr-85m		5.0	1.4×10^{2}	5.0	1.4×10^{2}	1.2×10^{6}	3.3×10^{7}
Sr-87m		3.0	8.1×10^{1}	3.0	8.1×10^{1}	4.8×10^{5}	1.3×10^{7}
Sr-89		6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.1×10^{3}	2.9×10^{4}
Sr-90 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	5.1	1.4×10^{2}
Sr-91 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.3×10^{5}	3.6×10^{6}
Sr-92 (a)		1.0	2.7×10^{1}	3.0×10^{-1}	8.1	4.7×10^{5}	1.3×10^{7}
T(H-3)	Tritium (1)	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	3.6×10^{2}	9.7×10^{3}
Ta-178 (long-lived).	Tantalum (73)	1.0	2.7×10^{1}	8.0×10^{-1}	2.2×10^{1}	4.2×10^{6}	1.1×10^{8}
Ta-179		3.0×10^{1}	8.1×10^{2}	3.0×10^{1}	8.1×10^{2}	4.1×10^{1}	1.1×10^{3}
Ta-182		9.0×10^{-1}	2.4×10^{1}	5.0×10^{-1}	1.4×10^{1}	2.3×10^{2}	6.2×10^{3}
Tb-157	Terbium (65)	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	5.6×10^{-1}	1.5×10^{1}
Tb-158		1.0	2.7×10^{1}	1.0	2.7×10^{1}	5.6×10^{-1}	1.5×10^{1}
Tb-160		1.0	2.7×10^{1}	6.0×10^{-1}	1.6×10^{1}	4.2×10^{2}	1.1×10^{4}
Tc-95m (a)	Technetium (43)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	8.3×10^{2}	2.2×10^{4}
Tc-96		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.2×10^{4}	3.2×10^{5}
Tc-96m (a)		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.4×10^{6}	3.8×10^{7}
Tc-97		Unlimited	Unlimited	Unlimited	Unlimited	5.2×10^{-5}	1.4×10^{-3}
Tc-97m		4.0×10^{1}	1.1×10^{3}	1.0	2.7×10^{1}	5.6×10^{2}	1.5×10^{4}
Tc-98		8.0×10^{-1}	2.2×10^{1}	7.0×10^{-1}	1.9×10^{1}	3.2×10^{-5}	8.7×10^{-4}
Tc-99		4.0×10^{1}	1.1×10^{3}	9.0×10^{-1}	2.4×10^{1}	6.3×10^{-4}	1.7×10^{-2}
Tc-99m		1.0×10^{1}	2.7×10^{2}	4.0	1.1×10^{2}	1.9×10^{5}	5.3×10^{6}
Te-121	Tellurium (52)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	2.4×10^{3}	6.4×10^{4}
Te-121m		5.0	1.4×10^{2}	3.0	8.1×10^{1}	2.6×10^{2}	7.0×10^{3}
Te-123m		8.0	2.2×10^{2}	1.0	2.7×10^{1}	3.3×10^{2}	8.9×10^{3}
Te-125m		2.0×10^{1}	5.4×10^{2}	9.0×10^{-1}	2.4×10^{1}	6.7×10^{2}	1.8×10^{4}
Te-127		2.0×10^{1}	5.4×10^{2}	7.0×10^{-1}	1.9×10^{1}	9.8×10^{4}	2.6×10^{6}
Te-127m (a)		2.0×10^{1}	5.4×10^{2}	5.0×10^{-1}	1.4×10^{1}	3.5×10^{2}	9.4×10^{3}
Te-129		7.0×10^{-1}	1.9×10^{1}	6.0×10^{-1}	1.6×10^{1}	7.7×10^{5}	2.1×10^{7}
Te-129m (a)		8.0×10^{-1}	2.2×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.1×10^{3}	3.0×10^{4}
Te-131m (a)		7.0×10^{-1}	1.9×10^{1}	5.0×10^{-1}	1.4×10^{1}	3.0×10^{4}	8.0×10^{5}
Te-132 (a)		5.0×10^{-1}	1.4×10^{1}	4.0×10^{-1}	1.1×10^{1}	1.1×10^{4}	8.0×10^{5}
Th-227	Thorium (90)	1.0×10^{1}	2.7×10^{2}	5.0×10^{-3}	1.4×10^{-1}	1.1×10^{3}	3.1×10^{4}
Th-228 (a)		5.0×10^{-1}	1.4×10^{1}	1.0×10^{-3}	2.7×10^{-2}	3.0×10^{1}	8.2×10^{2}
Th-229		5.0	1.4×10^{2}	5.0×10^{-4}	1.4×10^{-2}	7.9×10^{-3}	2.1×10^{-1}
Th-230		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	7.6×10^{-4}	2.1×10^{-2}
Th-231		4.0×10^{1}	1.1×10^{3}	2.0×10^{-2}	5.4×10^{-1}	2.0×10^{4}	5.3×10^{5}
Th-232		Unlimited	Unlimited	Unlimited	Unlimited	4.0×10^{-9}	1.1×10^{-7}
Th-234 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	8.6×10^{2}	2.3×10^{4}
Th(nat)		Unlimited	Unlimited	Unlimited	Unlimited	8.1×10^{-9}	2.2×10^{-7}
Ti-44 (a)	Titanium (22)	5.0×10^{-1}	1.4×10^{1}	4.0×10^{-1}	1.1×10^{1}	6.4	1.7×10^{2}
Tl-200	Thallium (81)	9.0×10^{-1}	2.4×10^{1}	9.0×10^{-1}	2.4×10^{1}	2.2×10^{4}	6.0×10^{5}
Tl-201		1.0×10^{1}	2.7×10^{2}	4.0	1.1×10^{2}	7.9×10^{3}	2.1×10^{5}
Tl-202		2.0	5.4×10^{1}	2.0	5.4×10^{1}	2.0×10^{3}	5.3×10^{4}
Tl-204		1.0×10^{1}	2.7×10^{2}	7.0×10^{-1}	1.9×10^{1}	1.7×10^{1}	4.6×10^{2}
Tm-167	Thulium (69)	7.0	1.9×10^{2}	8.0×10^{-1}	2.2×10^{1}	3.1×10^{3}	8.5×10^{4}
Tm-170		3.0	8.1×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.2×10^{2}	6.0×10^{3}
Tm-171		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}
U-230 (fast lung absorption) (a)(d).	Uranium (92)	4.0×10^{1}	1.1×10^{3}	1.0×10^{-1}	2.7	1.0×10^{3}	2.7×10^{4}
U-230 (medium lung absorption) (a)(e).		4.0×10^{1}	1.1×10^{3}	4.0×10^{-3}	1.1×10^{-1}	1.0×10^{3}	2.7×10^{4}
U-230 (slow lung absorption) (a)(f).		3.0×10^{1}	8.1×10^{2}	3.0×10^{-3}	8.1×10^{-2}	1.0×10^{3}	2.7×10^{4}
U-232 (fast lung absorption) (d).		4.0×10^{1}	1.1×10^{3}	1.0×10^{-2}	2.7×10^{-1}	8.3×10^{-1}	2.2×10^{1}
U-232 (medium lung absorption) (e).		4.0×10^{1}	1.1×10^{3}	7.0×10^{-3}	1.9×10^{-1}	8.3×10^{-1}	2.2×10^{1}
U-232 (slow lung absorption) (f).		1.0×10^{1}	2.7×10^{2}	1.0×10^{-3}	2.7×10^{-2}	8.3×10^{-1}	2.2×10^{1}
U-233 (fast lung absorption) (d).		4.0×10^{1}	1.1×10^{3}	9.0×10^{-2}	2.4	3.6×10^{-4}	9.7×10^{-3}
U-233 (medium lung absorption) (e).		4.0×10^{1}	1.1×10^{3}	2.0×10^{-2}	5.4×10^{-1}	3.6×10^{-4}	9.7×10^{-3}

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
U-233 (slow lung absorption) (f).		4.0×10^{1}	1.1×10^{3}	6.0×10^{-3}	1.6×10^{-1}	3.6×10^{-4}	9.7×10^{-3}
U-234 (fast lung absorption) (d).		4.0×10^{1}	1.1×10^{3}	9.0×10^{-2}	2.4	2.3×10^{-4}	6.2×10^{-3}
U-234 (medium lung absorption) (e).		4.0×10^{1}	1.1×10^{3}	2.0×10^{-2}	5.4×10^{-1}	2.3×10^{-4}	6.2×10^{-3}
U-234 (slow lung absorption) (f).		4.0×10^{1}	1.1×10^{3}	6.0×10^{-3}	1.6×10^{-1}	2.3×10^{-4}	6.2×10^{-3}
U-235 (all lung absorption types) (a),(d),(e),(f).		Unlimited	Unlimited	Unlimited	Unlimited	8.0×10^{-8}	2.2×10^{-6}
U-236 (fast lung absorption) (d).		Unlimited	Unlimited	Unlimited	Unlimited	2.4×10^{-6}	6.5×10^{-5}
U-236 (medium lung absorption) (e).		4.0×10^{1}	1.1×10^{3}	2.0×10^{-2}	5.4×10^{-1}	2.4×10^{-6}	6.5×10^{-5}
U-236 (slow lung absorption) (f).		4.0×10^{1}	1.1×10^{3}	6.0×10^{-3}	1.6×10^{-1}	2.4×10^{-6}	6.5×10^{-5}
U-238 (all lung absorption types) (d),(e),(f).		Unlimited	Unlimited	Unlimited	Unlimited	1.2×10^{-8}	3.4×10^{-7}
U (nat)		Unlimited	Unlimited	Unlimited	Unlimited	2.6×10^{-8}	7.1×10^{-7}
U (enriched to 20% or less)(g).		Unlimited	Unlimited	Unlimited	Unlimited	see § 173.434	see § 173.434
U (dep)		Unlimited	Unlimited	Unlimited	Unlimited	see § 173.434	see § 173.434
V-48	Vanadium (23)	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	6.3×10^{3}	1.7×10^{5}
V-49		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	3.0×10^{2}	8.1×10^{3}
W-178 (a)	Tungsten (74)	9.0	2.4×10^{2}	5.0	1.4×10^{2}	1.3×10^{3}	3.4×10^{4}
W-181		3.0×10^{1}	8.1×10^{2}	3.0×10^{1}	8.1×10^{2}	2.2×10^{2}	6.0×10^{3}
W-185		4.0×10^{1}	1.1×10^{3}	8.0×10^{-1}	2.2×10^{1}	3.5×10^{2}	9.4×10^{3}
W-187		2.0	5.4×10^{1}	6.0×10^{-1}	1.6×10^{1}	2.6×10^{4}	7.0×10^{5}
W-188 (a)		4.0×10^{-1}	1.1×10^{1}	3.0×10^{-1}	8.1	3.7×10^{2}	1.0×10^{4}
Xe-122 (a)	Xenon (54)	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	4.8×10^{4}	1.3×10^{6}
Xe-123		2.0	5.4×10^{1}	7.0×10^{-1}	1.9×10^{1}	4.4×10^{5}	1.2×10^{7}
Xe-127		4.0	1.1×10^{2}	2.0	5.4×10^{1}	1.0×10^{3}	2.8×10^{4}
Xe-131m		4.0×10^{1}	1.1×10^{3}	4.0×10^{1}	1.1×10^{3}	3.1×10^{3}	8.4×10^{4}
Xe-133		2.0×10^{1}	5.4×10^{2}	1.0×10^{1}	2.7×10^{2}	6.9×10^{3}	1.9×10^{5}
Xe-135		3.0	8.1×10^{1}	2.0	5.4×10^{1}	9.5×10^{4}	2.6×10^{6}
Y-87 (a)	Yttrium (39)	1.0	2.7×10^{1}	1.0	2.7×10^{1}	1.7×10^{4}	4.5×10^{5}
Y-88		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	5.2×10^{2}	1.4×10^{4}
Y-90		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	2.0×10^{4}	5.4×10^{5}
Y-91		6.0×10^{-1}	1.6×10^{1}	6.0×10^{-1}	1.6×10^{1}	9.1×10^{2}	2.5×10^{4}
Y-91m		2.0	5.4×10^{1}	2.0	5.4×10^{1}	1.5×10^{6}	4.2×10^{7}
Y-92		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	3.6×10^{5}	9.6×10^{6}
Y-93		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.2×10^{5}	3.3×10^{6}
Yb-169	Ytterbium (70)	4.0	1.1×10^{2}	1.0	2.7×10^{1}	8.9×10^{2}	2.4×10^{4}
Yb-175		3.0×10^{1}	8.1×10^{2}	9.0×10^{-1}	2.4×10^{1}	6.6×10^{3}	1.8×10^{5}
Zn-65	Zinc (30)	2.0	5.4×10^{1}	2.0	5.4×10^{1}	3.0×10^{2}	8.2×10^{3}
Zn-69		3.0	8.1×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.8×10^{6}	4.9×10^{7}
Zn-69m (a)		3.0	8.1×10^{1}	6.0×10^{-1}	1.6×10^{1}	1.2×10^{5}	3.3×10^{6}
Zr-88	Zirconium (40)	3.0	8.1×10^{1}	3.0	8.1×10^{1}	6.6×10^{2}	1.8×10^{4}
Zr-93		Unlimited	Unlimited	Unlimited	Unlimited	9.3×10^{-5}	2.5×10^{-3}
Zr-95 (a)		2.0	5.4×10^{1}	8.0×10^{-1}	2.2×10^{1}	7.9×10^{2}	2.1×10^{4}
Zr-97 (a)		4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	7.1×10^{4}	1.9×10^{6}

[a] A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days.
[b] [Reserved]
[c] The quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.
[d] These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO_3)_2$ in both normal and accident conditions of transport.
[e] These values apply only to compounds of uranium that take the chemical form of UO_3, UF_4, UCl_4 and hexavalent compounds in both normal and accident conditions of transport.
[f] These values apply to all compounds of uranium other than those specified in notes (d) and (e) of this table.
[g] These values apply to unirradiated uranium only.
[h] A_1 = 0.1 TBq (2.7 Ci) and A_2 = 0.001 TBq (0.027 Ci) for Cf-252 for domestic use.
[i] A_2 = 0.74 TBq (20 Ci) for Mo-99 for domestic use.

■ 31. A new § 173.436 is added to read as follows:

§ 173.436 Exempt material activity concentrations and exempt consignment activity limits for radionuclides.

The Table of Exempt material activity concentrations and exempt consignment activity limits for radionuclides is as follows:

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Ac-225	Actinium (89)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Ac-227		1.0×10^{-1}	2.7×10^{-12}	1.0×10^{3}	2.7×10^{-8}
Ac-228		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ag-105	Silver (47)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ag-108m (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ag-110m		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ag-111		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Al-26	Aluminum (13)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Am-241	Americium (95)	1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Am-242m (b)		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Am-243 (b)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Ar-37	Argon (18)	1.0×10^{6}	2.7×10^{-5}	1.0×10^{8}	2.7×10^{-3}
Ar-39		1.0×10^{7}	2.7×10^{-4}	1.0×10^{4}	2.7×10^{-7}
Ar-41		1.0×10^{2}	2.7×10^{-9}	1.0×10^{9}	2.7×10^{-2}
As-72	Arsenic (33)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
As-73		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
As-74		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
As-76		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
As-77		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
At-211	Astatine (85)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Au-193	Gold (79)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Au-194		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Au-195		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Au-198		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Au-199		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ba-131	Barium (56)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ba-133		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ba-133m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ba-140 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Be-7	Beryllium (4)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Be-10		1.0×10^{4}	2.7×10^{-7}	1.0×10^{6}	2.7×10^{-5}
Bi-205	Bismuth (83)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Bi-206		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Bi-207		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Bi-210		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Bi-210m		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Bi-212 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Bk-247	Berkelium (97)	1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Bk-249		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Br-76	Bromine (35)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Br-77		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Br-82		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
C-11	Carbon (6)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
C-14		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Ca-41	Calcium (20)	1.0×10^{5}	2.7×10^{-6}	1.0×10^{7}	2.7×10^{-4}
Ca-45		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Ca-47		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Cd-109	Cadmium (48)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{6}	2.7×10^{-5}
Cd-113m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Cd-115		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Cd-115m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Ce-139	Cerium (58)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ce-141		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Ce-143		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ce-144 (b)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Cf-248	Californium (98)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Cf-249		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Cf-250		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Cf-251		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Cf-252		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Cf-253		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Cf-254		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Cl-36	Chlorine (17)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{6}	2.7×10^{-5}
Cl-38		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Cm-240	Curium (96)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Cm-241		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Cm-242		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Cm-243		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Cm-244		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Cm-245		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Cm-246		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Cm-247		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Cm-248		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Co-55	Cobalt (27)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Co-56		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Co-57		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Co-58		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Co-58m		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Co-60		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Cr-51	Chromium (24)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Cs-129	Cesium (55)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Cs-131		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Cs-132		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Cs-134		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Cs-134m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{5}	2.7×10^{-6}
Cs-135		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Cs-136		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Cs-137 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Cu-64	Copper (29)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Cu-67		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Dy-159	Dysprosium (66)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Dy-165		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Dy-166		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Er-169	Erbium (68)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Er-171		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Eu-147	Europium (63)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Eu-148		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Eu-149		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Eu-150 (short lived)		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Eu-150 (long lived)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Eu-152		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Eu-152m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Eu-154		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Eu-155		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Eu-156		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
F-18	Fluorine (9)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Fe-52	Iron (26)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Fe-55		1.0×10^{4}	2.7×10^{-7}	1.0×10^{6}	2.7×10^{-5}
Fe-59		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Fe-60		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Ga-67	Gallium (31)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ga-68		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Ga-72		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Gd-146	Gadolinium (64)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Gd-148		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Gd-153		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Gd-159		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Ge-68	Germanium (32)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Ge-71		1.0×10^{4}	2.7×10^{-7}	1.0×10^{8}	2.7×10^{-3}
Ge-77		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Hf-172	Hafnium (72)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Hf-175		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Hf-181		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Hf-182		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Hg-194	Mercury (80)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Hg-195m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Hg-197		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Hg-197m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Hg-203		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Ho-166	Holmium (67)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{5}	2.7×10^{-6}
Ho-166m		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
I-123	Iodine (53)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
I-124		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
I-125		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
I-126		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
I-129		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
I-131		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
I-132		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
I-133		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
I-134		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
I-135		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
In-111	Indium (49)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
In-113m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
In-114m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
In-115m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ir-189	Iridium (77)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Ir-190		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ir-192		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Ir-194		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
K-40	Potassium (19)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
K-42		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
K-43		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Kr-81	Krypton (36)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Kr-85		1.0×10^{5}	2.7×10^{-6}	1.0×10^{4}	2.7×10^{-7}
Kr-85m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{10}	2.7×10^{-1}
Kr-87		1.0×10^{2}	2.7×10^{-9}	1.0×10^{9}	2.7×10^{-2}
La-137	Lanthanum (57)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
La-140		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Lu-172	Lutetium (71)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Lu-173		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Lu-174		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Lu-174m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Lu-177		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Mg-28	Magnesium (12)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Mn-52	Manganese (25)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Mn-53		1.0×10^{4}	2.7×10^{-7}	1.0×10^{9}	2.7×10^{-2}
Mn-54		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Mn-56		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Mo-93	Molybdenum (42)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{8}	2.7×10^{-3}
Mo-99		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
N-13	Nitrogen (7)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{9}	2.7×10^{-2}
Na-22	Sodium (11)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Na-24		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Nb-93m	Niobium (41)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Nb-94		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Nb-95		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Nb-97		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Nd-147	Neodymium (60)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Nd-149		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ni-59	Nickel (28)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{8}	2.7×10^{-3}
Ni-63		1.0×10^{5}	2.7×10^{-6}	1.0×10^{8}	2.7×10^{-3}
Ni-65		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Np-235	Neptunium (93)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Np-236 (short-lived)		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Np-236 (long-lived)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Np-237 (b)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Np-239		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Os-185	Osmium (76)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Os-191		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Os-191m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Os-193		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Os-194		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
P-32	Phosphorus (15)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{5}	2.7×10^{-6}
P-33		1.0×10^{5}	2.7×10^{-6}	1.0×10^{8}	2.7×10^{-3}
Pa-230	Protactinium (91)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Pa-231		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Pa-233		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Pb-201	Lead (82)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Pb-202		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Pb-203		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Pb-205		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Pb-210 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Pb-212 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Pd-103	Palladium (46)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{8}	2.7×10^{-3}

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Pd-107		1.0×10^{5}	2.7×10^{-6}	1.0×10^{8}	2.7×10^{-3}
Pd-109		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Pm-143	Promethium (61)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Pm-144		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Pm-145		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Pm-147		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Pm-148m		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Pm-149		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Pm-151		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Po-210	Polonium (84)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Pr-142	Praseodymium (59)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Pr-143		1.0×10^{4}	2.7×10^{-7}	1.0×10^{6}	2.7×10^{-5}
Pt-188	Platinum (78)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Pt-191		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Pt-193		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Pt-193m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Pt-195m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Pt-197		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Pt-197m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Pu-236	Plutonium (94)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Pu-237		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Pu-238		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Pu-239		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Pu-240		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Pu-241		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Pu-242		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Pu-244		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Ra-223 (b)	Radium (88)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Ra-224 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Ra-225		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Ra-226 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Ra-228 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Rb-81	Rubidium (37)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Rb-83		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Rb-84		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Rb-86		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Rb-87		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Rb(nat)		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Re-184	Rhenium (75)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Re-184m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Re-186		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Re-187		1.0×10^{6}	2.7×10^{-5}	1.0×10^{9}	2.7×10^{-2}
Re-188		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Re-189		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Re(nat)		1.0×10^{6}	2.7×10^{-5}	1.0×10^{9}	2.7×10^{-2}
Rh-99	Rhodium (45)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Rh-101		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Rh-102		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Rh-102m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Rh-103m		1.0×10^{4}	2.7×10^{-7}	1.0×10^{8}	2.7×10^{-3}
Rh-105		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Rn-222 (b)	Radon (86)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{8}	2.7×10^{-3}
Ru-97	Ruthenium (44)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Ru-103		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ru-105		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ru-106 (b)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
S-35	Sulphur (16)	1.0×10^{5}	2.7×10^{-6}	1.0×10^{8}	2.7×10^{-3}
Sb-122	Antimony (51)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{4}	2.7×10^{-7}
Sb-124		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Sb-125		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Sb-126		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Sc-44	Scandium (21)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Sc-46		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Sc-47		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Sc-48		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Se-75	Selenium (34)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Se-79		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Si-31	Silicon (14)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Si-32		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Sm-145	Samarium (62)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Sm-147		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Sm-151		1.0×10^{4}	2.7×10^{-7}	1.0×10^{8}	2.7×10^{-3}
Sm-153		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Sn-113	Tin (50)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Sn-117m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Sn-119m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Sn-121m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Sn-123		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Sn-125		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Sn-126		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Sr-82	Strontium (38)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Sr-85		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Sr-85m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Sr-87m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Sr-89		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Sr-90 (b)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{4}	2.7×10^{-7}
Sr-91		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Sr-92		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
T(H-3)	Tritium (1)	1.0×10^{6}	2.7×10^{-5}	1.0×10^{9}	2.7×10^{-2}
Ta-178 (long-lived)	Tantalum (73)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ta-179		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Ta-182		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Tb-157	Terbium (65)	1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Tb-158		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Tb-160		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Tc-95m	Technetium (43)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Tc-96		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Tc-96m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Tc-97		1.0×10^{3}	2.7×10^{-8}	1.0×10^{8}	2.7×10^{-3}
Tc-97m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Tc-98		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Tc-99		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
Tc-99m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Te-121	Tellurium (52)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Te-121m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Te-123m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Te-125m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Te-127		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Te-127m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Te-129		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Te-129m		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Te-131m		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Te-132		1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Th-227	Thorium (90)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Th-228 (b)		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Th-229 (b)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Th-230		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Th-231		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Th-232		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Th-234 (b)		1.0×10^{3}	2.7×10^{-8}	1.0×10^{5}	2.7×10^{-6}
Th (nat) (b)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
Ti-44	Titanium (22)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Tl-200	Thallium (81)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Tl-201		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Tl-202		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Tl-204		1.0×10^{4}	2.7×10^{-7}	1.0×10^{4}	2.7×10^{-7}
Tm-167	Thulium (69)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Tm-170		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Tm-171		1.0×10^{4}	2.7×10^{-7}	1.0×10^{8}	2.7×10^{-3}
U-230 (fast lung absorption) (b),(d).	Uranium (92)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
U-230 (medium lung absorption) (e).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-230 (slow lung absorption) (f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-232 (fast lung absorption) (b),(d).		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
U-232 (medium lung absorption) (e).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-232 (slow lung absorption) (f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
U-233 (fast lung absorption) (d).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-233 (medium lung absorption) (e).		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
U-233 (slow lung absorption) (f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
U-234 (fast lung absorption) (d).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-234 (medium lung absorption) (e).		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
U-234 (slow lung absorption) (f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
U-235 (all lung absorption types) (b),(d),(e),(f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-236 (fast lung absorption) (d).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-236 (medium lung absorption) (e).		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
U-236 (slow lung absorption) (f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-238 (all lung absorption types) (b),(d),(e),(f).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U (nat) (b)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
U (enriched to 20% or less)(g).		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
U (dep)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
V-48	Vanadium (23)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
V-49		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
W-178	Tungsten (74)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
W-181		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
W-185		1.0×10^{4}	2.7×10^{-7}	1.0×10^{7}	2.7×10^{-4}
W-187		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
W-188		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Xe-122	Xenon (54)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{9}	2.7×10^{-2}
Xe-123		1.0×10^{2}	2.7×10^{-9}	1.0×10^{9}	2.7×10^{-2}
Xe-127		1.0×10^{3}	2.7×10^{-8}	1.0×10^{5}	2.7×10^{-6}
Xe-131m		1.0×10^{4}	2.7×10^{-7}	1.0×10^{4}	2.7×10^{-7}
Xe-133		1.0×10^{3}	2.7×10^{-8}	1.0×10^{4}	2.7×10^{-7}
Xe-135		1.0×10^{3}	2.7×10^{-8}	1.0×10^{10}	2.7×10^{-1}
Y-87	Yttrium (39)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Y-88		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Y-90		1.0×10^{3}	2.7×10^{-8}	1.0×10^{5}	2.7×10^{-6}
Y-91		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Y-91m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Y-92		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Y-93		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Yb-169	Ytterbium (70)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{7}	2.7×10^{-4}
Yb-175		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Zn-65	Zinc (30)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Zn-69		1.0×10^{4}	2.7×10^{-7}	1.0×10^{6}	2.7×10^{-5}
Zn-69m		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Zr-88	Zirconium (40)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Zr-93 (b)		1.0×10^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
Zr-95		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Zr-97 (b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}

[a] [Reserved]

[b] Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90 Y-90
Zr-93 Nb-93m
Zr-97 Nb-97
Ru-106 Rh-106
Cs-137 Ba-137m
Ce-134 La-134
Ce-144 Pr-144
Ba-140 La-140
Bi-212 Tl-208 (0.36), Po-212 (0.64)
Pb-210 Bi-210, Po-210
Pb-212 Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220 Po-216
Rn-222 Po-218, Pb-214, Bi-214, Po-214
Ra-223 Rn-219, Po-215, Pb-211, Bi-211, Tl-207

Ra-224 Rn-220, Po-216, Pb-212, Bi-212, Tl-208(0.36), Po-212 (0.64)
Ra-226 Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228 Ac-228
Th-226 Ra-222, Rn-218, Po-214
Th-228 Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229 Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234 Pa-234m
U-230 Th-226, Ra-222, Rn-218, Po-214
U-232 Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235 Th-231
U-238 Th-234, Pa-234m
U-nat Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240 Np-240m
Np-237 Pa-233
Am-242m Am-242
Am-243 Np-239

[c] [Reserved]

[d] These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO_3)_2$ in both normal and accident conditions of transport.

[e] These values apply only to compounds of uranium that take the chemical form of UO_3, UF_4, UCl_4 and hexavalent compounds in both normal and accident conditions of transport.

[f] These values apply to all compounds of uranium other than those specified in notes (d) and (e) of this table.

[g] These values apply to unirradiated uranium only.

■ 32. In § 173.441, the section title is revised, paragraph (d) is redesignated as paragraph (e) and revised and a new paragraph (d) is added to read as follows:

§ 173.441 Radiation level limitations and exclusive use provisions.

* * * * *

(d) Conveyance limits on the sum of package transport indices are as follows:

(1) Except for shipments by cargo aircraft only or by seagoing vessel, the sum of transport indices for a non-exclusive use shipment may not exceed 50.

(2) Where a consignment is transported under exclusive use, there is no limit on the sum of the transport indices aboard a single conveyance. The conditions of paragraphs (b)(2), (b)(3), (b)(4) and (c) must be met.

(3) Provisions for shipments of Class 7 (radioactive) materials by air are described in §§ 175.700–175.705 of this subchapter.

(4) Provisions for shipment of Class 7 (radioactive) materials by vessel are described in §§ 176.700–176.720 of this subchapter.

(e) A package exceeding the maximum surface radiation level or maximum transport index prescribed in paragraph (a) of this section may not be transported by aircraft.

■ 33. In § 173.443, paragraphs (a)(1) and (a)(2) are revised to read as follows:

§ 173.443 Contamination control.

(a) * * *

(1) Wiping an area of 300 cm² of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the non-fixed contamination levels. The amount of radioactivity measured on any single wiping material, divided by the surface area wiped and divided by the efficiency of the wipe procedure (the fraction of removable contamination transferred from the surface to the absorbent material), may not exceed the limits set forth in Table 9 at any time during transport. For this purpose the actual wipe efficiency may be used, or the wipe efficiency may be assumed to be 0.10; or

(2) Alternatively, the level of non-fixed radioactive contamination may be determined by using other methods of equal or greater efficiency.

Table 9 is as follows:

TABLE 9.—NON-FIXED EXTERNAL RADIOACTIVE CONTAMINATION LIMITS FOR PACKAGES

Contaminant	Maximum permissible limits		
	Bq/cm²	uCi/cm²	dpm/cm²
1. Beta and gamma emitters and low toxicity alpha emitters	4	10^{-4}	220
2. All other alpha emitting radionuclides	0.4	10^{-5}	22

* * * * *

■ 34. In § 173.447, paragraphs (a) and (b) are revised to read as follows:

§ 173.447 Storage during transportation—general requirements.

* * * * *

(a) The number of packages and overpacks bearing FISSILE labels stored in any one storage area, such as a transit area, terminal building, storeroom, waterfront pier, or assembly yard, must be limited so that the total sum of the criticality safety indices in any individual group of such packages and overpacks does not exceed 50. Groups of such packages and overpacks must be stored so as to maintain a spacing of at least 6 m (20 feet) from all other groups of such packages and overpacks.

(b) Storage requirements for Class 7 (radioactive) material transported in vessels are described in subpart M of part 176 of this subchapter.

■ 35. Section 173.448 is revised to read as follows:

§ 173.448 General transportation requirements.

(a) Each shipment of Class 7 (radioactive) materials must be secured to prevent shifting during normal transportation conditions.

(b) Except as provided in §§ 174.81, 176.83, and 177.848 of this subchapter, or as otherwise required by the Competent Authority in the applicable certificate, a package or overpack of Class 7 (radioactive) materials may be carried among packaged general cargo without special stowage provisions, if—

(1) The heat output in watts does not exceed 0.1 times the minimum package dimension in centimeters; or

(2) The average surface heat flux of the package or overpack does not exceed 15 watts per square meter and the immediately surrounding cargo is not in sacks or bags or otherwise in a form that would seriously impede air circulation for heat removal.

(c) Packages or overpacks bearing labels prescribed in § 172.403 of this subchapter may not be carried in compartments occupied by passengers, except in those compartments exclusively reserved for couriers accompanying those packages.

(d) Mixing of different kinds of packages that include fissile packages is authorized only in accordance with § 173.459.

(e) No person shall offer for transportation or transport aboard a passenger-carrying aircraft any single package or overpack with a transport index greater than 3.0.

(f) No person shall offer for transportation or transport aboard a passenger-carrying aircraft any Class 7 (radioactive) material unless that material is intended for use in, or incident to, research, medical diagnosis or treatment.

(g) If an overpack is used to consolidate individual packages or to enclose a single package of Class 7 (radioactive) materials, the package(s) must comply with the packaging, marking, and labeling requirements of this subchapter, and:

(1) The overpack must be labeled as prescribed in § 172.403(h) of this subchapter;

(2) The overpack must be marked as prescribed in subpart D of part 172 of this subchapter and § 173.25(a); and

(3) The transport index of the overpack may not exceed 3.0 for passenger-carrying aircraft shipments, or 10.0 for cargo-aircraft shipments.

■ 36. Section 173.453 is revised to read as follows:

§ 173.453 Fissile materials—exceptions.

Fissile materials meeting the requirements of at least one of the paragraphs (a) through (f) of this section are excepted from the requirements of this subpart for fissile materials, including the requirements of §§ 173.457 and 173.459, but are subject to all other requirements of this subpart, except as noted.

(a) An individual package containing 2 grams or less of fissile material.

(b) An individual or bulk packaging containing 15 grams or less of fissile material provided the package has at least 200 grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.

(c) Low concentrations of solid fissile material commingled with solid nonfissile material, provide that:

(1) There is at least 2000 grams of nonfissile material for every gram of fissile material, and

(2) There is no more than 180 grams of fissile material distributed within 360 kg of contiguous nonfissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass of solid nonfissile material.

(d) Uranium enriched in uranium-235 to a maximum of 1 percent by weight, and with total plutonium and uranium-233 content of up to 1 percent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium constitute less than 5 percent of the uranium mass.

(e) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 percent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 percent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2. The material must be contained in at least a DOT Type A package.

(f) Packages containing, individually, a total plutonium mass of not more than 1000 grams, of which not more than 20 percent by mass may consist of plutonium-239, plutonium-241, or any combination of these radionuclides.

■ 37. Section 173.457 is revised to read as follows:

§ 173.457 Transportation of fissile material packages—specific requirements.

(a) Packages containing fissile radioactive material which are not excepted under § 173.453 must be assigned by the offeror, in accordance with their definitions in § 173.403, a criticality safety index (CSI) and a transport index (TI).

(b) Fissile material packages and conveyances transporting fissile material packages must satisfy the radiation level restrictions of § 173.441.

(c) Except for consignments under exclusive use, the CSI of any package or overpack may not exceed 50. A fissile material package with CSI greater than 50 must be transported by exclusive use.

(d) For non-exclusive use shipments of fissile material packages, except on vessels, the total sum of CSI's in a freight container or on a conveyance may not exceed 50.

(e) For exclusive use shipments of fissile material packages, except on vessels, the total sum of CSI's in a freight container or on a conveyance may not exceed 100.

(f) Exclusive use shipments of fissile material packages must satisfy the radiation level and administrative requirements of § 173.441(b).

(g) The number of packages, overpacks and freight containers containing fissile material stored in transit in any one storage area must be so limited that the total sum of the CSI's in any group of packages, overpacks or freight containers does not exceed 50. Groups of packages shall be stored so as to maintain a spacing of a least 6 m (20 ft) between the closest surfaces of any two groups.

(h) Provisions for shipment by vessel of Class 7 (radioactive) material packages, including fissile material packages by vessel are described in §§ 176.700–176.720 of this subchapter.

■ 38. Section 173.459 is revised to read as follows:

§ 173.459 Mixing of fissile material packages with non-fissile or fissile-excepted material packages.

Mixing of fissile material packages with other types of Class 7 (radioactive) materials in any conveyance or storage location is authorized only if the TI of any single package does not exceed 10, the CSI of any single package does not exceed 50, and the provisions of §§ 173.441 and 173.457 are satisfied.

§ 173.465 [Amended]

■ 39. In § 173.465:

■ a. In paragraph (c)(1) the wording ''Table 12'' is revised to read ''Table 10'' each place it appears.

■ b. In the table heading the wording ''TABLE 12'' is revised to read ''TABLE 10''.

■ 40. In § 173.469, paragraphs (a)(4)(ii), (c)(1)(i), (c)(1)(iv), (c)(2)(i), (c)(2)(iv), and (d)(1) are revised to read as follows:

§ 173.469 Tests for special form Class 7 (radioactive) materials.

(a) * * *

(4) * * *

(ii) A specimen that comprises or simulates Class 7 (radioactive) material contained in a sealed capsule need not be subjected to the leaching assessment specified in paragraph (c) of this section provided it is alternatively subjected to any of the volumetric leakage assessment tests prescribed in the International Organization for Standardization document ISO 9978–1992(E): ''Radiation protection—Sealed radioactive sources—Leakage test methods'' (IBR, see § 171.7 of this subchapter).

* * * * *

(c) * * *

(1) * * *

(i) The specimen shall be immersed for seven days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the seven day test period the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6–

8 and a maximum conductivity of 1 mS/m (10 micromho/cm) at 20°C (68°F).

* * * * *

(iv) The specimen shall then be kept for at least seven days in still air at not less than 30°C (86°F) and relative humidity not less than 90%.

* * * * *

(2) * * *

(i) The specimen shall be immersed in water at ambient temperature. The water shall have an initial pH of 6–8 and a maximum conductivity of 1 mS/m (10 micromho/cm) at 20°C (68°F).

* * * * *

(iv) The specimen shall then be kept for at least seven days in still air at not less than 30°C (86°F) and relative humidity not less than 90%.

* * * * *

(d) * * *

(1) The impact test and the percussion test of this section provided that the mass of the special form radioactive material is less than 200 g and it is alternatively subjected to the Class 4 impact test prescribed in ISO 2919, ''Sealed Radioactive Sources—Classification'' (IBR, see § 171.7 of this subchapter); and

* * * * *

■ 41. In § 173.471, the introductory text is revised to read as follows:

§ 173.471 Requirements for U.S. Nuclear Regulatory Commission approved packages.

In addition to the applicable requirements of the U.S. Nuclear Regulatory Commission (NRC) and other requirements of this subchapter, any offeror of a Type B(U), Type B(M), or fissile material package that has been approved by the NRC in accordance with 10 CFR part 71 must also comply with the following requirements:

* * * * *

■ 42. In § 173.473, the introductory text is revised to read as follows:

§ 173.473 Requirements for foreign-made packages.

In addition to other applicable requirements of this subchapter, each offeror of a foreign-made Type B(U), Type B(M), Type C, Type CF, Type H(U), Type H(M), or fissile material package for which a Competent Authority Certificate is required by IAEA's ''Regulations for the Safe Transport of Radioactive Material, No. TS–R–1, '' (IBR, see § 171.7 of this subchapter) shall also comply with the following requirements:

* * * * *

■ 43. In § 173.476, ''; and'' at the end of paragraph (c)(3) is removed and a semicolon is added in its place, paragraph (c)(4) is revised and a new paragraph (c)(5) is added to read as follows:

§ 173.476 Approval of special form Class 7 (radioactive) materials.

* * * * *

(c) * * *

(4) For the original request for a Competent Authority Certificate, evidence of a quality assurance program based on international, national or other standards, for the design, manufacture, testing, documentation, use, maintenance and inspection, as appropriate, of all special form material offered for transport by the requester; and

(5) A description of any proposed pre-shipment actions, such as leak testing, for use in the consignment of special form radioactive material for transport.

* * * * *

■ 44. A new § 173.477 is added to read as follows:

§ 173.477 Approval of packagings containing greater than 0.1 kg of non-fissile or fissile-excepted uranium hexafluoride.

(a) Each offeror of a package containing more than 0.1 kg of uranium hexafluoride must maintain on file for at least one year after the latest shipment, and provide to the Associate Administrator on request, a complete safety analysis, including documentation of any tests, demonstrating that the package meets the requirements of § 173.420. An IAEA Certificate of Competent Authority issued for the design of the packaging containing greater than 0.1 kg of non-fissile or fissile-excepted uranium hexafluoride may be used to satisfy this requirement.

(b) Prior to the first export shipment of a package containing greater than 0.1 kg of uranium hexafluoride from the United States, each offeror shall obtain a U.S. Competent Authority Certificate for the packaging design. For packagings manufactured outside the United States, each offeror shall comply with § 173.473.

(c) Each request for a U.S. Competent Authority Certificate as required by the IAEA regulations must be submitted in writing, in triplicate, by mail or other delivery service to the Associate Administrator. Alternatively, the request with any attached supporting documentation submitted in an appropriate format may be sent by facsimile (fax) to (202) 366–3753 or (202) 366–3650, or by electronic mail (e-mail) to *ramcert@rspa.dot.gov.* Each request is considered in the order in which it is received. To allow sufficient time for consideration, requests must be received at least 90 days before the requested effective date. Each request for a U.S. Competent Authority Certificate must include the following information:

(1) A safety analysis report which, at a minimum, provides a detailed description of the packaging and contents; a description of the manufacturing process used for the packaging; and details of the tests conducted and copy of their results, evidence based on calculative methods to show that the package is able to pass the tests, or other evidence that the package complies with § 173.420; and

(2) For the original request for a Competent Authority Certificate, evidence of a quality assurance program.

PART 174—CARRIAGE BY RAIL

■ 45. The authority citation for part 174 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

■ 46. In § 174.700, paragraph (b) is revised, paragraphs (d) through (f) are redesignated as paragraphs (e) through (g), respectively, and a new paragraph (d) is added to read as follows:

§ 174.700 Special handling requirements for Class 7 (radioactive) materials.

* * * * *

(b) The number of packages of Class 7 (radioactive) materials that may be transported by rail car or stored at any single location is limited to a total transport index and a total criticality safety index (as defined in § 173.403 of this subchapter) of not more than 50 each. This provision does not apply to exclusive use shipments as described in §§ 173.403, 173.427, 173.441, and 173.457 of this subchapter.

* * * * *

(d) Each shipment of fissile material packages must conform to requirements of §§ 173.457 and 173.459.

* * * * *

PART 175—CARRIAGE BY AIRCRAFT

■ 47. The authority citation for part 175 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

■ 48. In § 175.700, paragraph (a) is revised to read as follows:

§ 175.700 Special limitations and requirements for Class 7 (radioactive) materials.

(a) In addition to other requirements, no person may transport in a passenger-carrying aircraft any package required to be labeled in accordance with § 172.403

of this subchapter with a RADIOACTIVE YELLOW-II, RADIOACTIVE YELLOW-III or FISSILE label unless:

(1) For a package required to be labeled RADIOACTIVE YELLOW-III, the transport index does not exceed 3.0;

(2) For a package required to carry a FISSILE label, the criticality safety index does not exceed 3.0;

(3) The package is carried on the floor of the cargo compartment, or freight container;

(4) The package is carried in the aircraft in accordance with §§ 175.701 and 175.703;

(5) The total sum of transport indices of all packages in the aircraft does not exceed 50; and

(6) The total sum of criticality safety indices of all packages in the aircraft does not exceed 50.

* * * * *

■ 49. In § 175.702, paragraph (b) is revised to read as follows:

§ 175.702 Requirements for carriage of packages containing Class 7 (radioactive) materials in a cargo aircraft only.

* * * * *

(b) No person may transport in a cargo aircraft only any package required by § 172.403 of this subchapter to be labeled RADIOACTIVE YELLOW–II or RADIOACTIVE YELLOW–III or FISSILE unless:

(1) The total transport index for all of the packages does not exceed 50.0, the total criticality safety index for all of the packages does not exceed 50.0, and the package is carried in accordance with § 175.701(a); or

(2) The total transport index for all of the packages is greater than 50.0 but does not exceed 200.0, the total criticality safety index for all of the packages does not exceed 100.0. Any package, overpack or consignment having a criticality safety index greater than 50 must be transported under exclusive use; and:

(i) The transport index for any group of packages does not exceed 50.0;

(ii) Each group of packages is separated from every other group in the aircraft by not less than 6 m (20 feet), measured from the outer surface of each group; and

(iii) The separation distance between the surfaces of the Class 7 (radioactive) materials packages, overpacks or freight containers and any space occupied by—

(A) Humans is at least 9 m (30 feet); and

(B) Live animals is at least 0.5 m (20 inches) for journeys not exceeding 24 hours and at least 1.0 m (39 inches) for journeys longer than 24 hours.

■ 50. In § 175.703, paragraphs (b), (c), and (e) are revised to read as follows:

§ 175.703 Other special requirements for the acceptance and carriage of packages containing Class 7 (radioactive) materials.

* * * * *

(b) No person may accept for carriage in an aircraft packages of Class 7 (radioactive) materials, other than limited quantities, contained in an overpack unless they have been prepared for shipment in accordance with § 172.403(h) of this subchapter.

(c) Each shipment of fissile material packages must conform to the requirements of §§ 173.457 and 173.459 of this subchapter.

* * * * *

(e) Packages with radiation levels at the package surface or a transport index in excess of the limits specified in § 173.441(a) of this subchapter may not be transported by aircraft except under special arrangements approved by the Associate Administrator.

PART 176—CARRIAGE BY VESSEL

■ 51. The authority citation for part 176 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

§ 176.700 [Amended]

■ 52. In § 176.700, paragraph (c) is removed, and paragraphs (d) and (e) are redesignated as paragraphs (c) and (d), respectively.

■ 53. Section 176.704 is revised to read as follows:

§ 176.704 Requirements relating to transport indices and criticality safety indices.

(a) The sum of the transport indices (TI's) for all packages of Class 7 (radioactive) materials on board a vessel may not exceed the limits specified in Table IIIA of this section.

(b) For freight containers containing packages and overpacks of Class 7 (radioactive) materials, the radiation level may not exceed 2 mSv per hour (200 mrem per hour) at any point on the outside surface and 0.1 mSv per hour (10 mrem per hour) at 2 m (6.6 ft) from the outside surface of the freight container.

(c) The limitations specified in Table IIIA of this section do not apply to consignments of LSA–I material.

(d) The sum of the criticality safety indices (CSI's) for all packages and overpacks of fissile Class 7 (radioactive) materials on board a vessel may not exceed the limits specified in Table IIIB of this section.

(e) Each group of fissile Class 7 (radioactive) material packages and overpacks, containing a sum of CSIs no greater than 50 for a non-exclusive use shipment, or no greater than 100 for an exclusive use shipment, must be separated from all other groups containing fissile material packages and overpacks by a distance of at least 6 m (20 ft) at all times.

(f) The limitations specified in paragraphs (a) through (c) of this section do not apply when the entire vessel is reserved or chartered for use by a single offeror under exclusive use conditions if—

(1) The number of packages of fissile Class 7 (radioactive) material satisfies the individual package CSI limits of § 173.457 of this subchapter, except that the total sums of CSI's in the last column of Table IIIB of this section, including table note (d) apply;

(2) A radiation protection program for the shipment has been established and approved by the competent authority of the flag state of the vessel and, when requested, by the competent authority at each port of call;

(3) Stowage arrangements have been predetermined for the whole voyage, including any consignments to be loaded at ports of call;

(4) The loading, transport and unloading are to be supervised by persons qualified in the transport of radioactive material; and

(5) The entire shipment operation is approved by the Associate Administrator in advance.

(g) Table IIIA is as follows:

TABLE IIIA.—TI LIMITS FOR FREIGHT CONTAINERS AND CONVEYANCES

Type of freight container or conveyance	Limit on total sum of transport indices in a single freight container or aboard a conveyance	
	Not under exclusive use	Under exclusive use
I. Freight container—small	50	N/A.
II. Freight container—large	50	No limit.
III. Vessel: [a] [b]		
1. Hold, compartment or defined deck area:		
i. Packages, overpacks, small freight containers	50	No limit.
ii. Large freight containers	200	No limit.
2. Total vessel:		
i. Packages, overpacks, small freight containers	200	No limit.
ii. Large freight containers	No limit	No limit.

Notes:

[a] For vessels, the requirements in both 1 and 2 must be fulfilled.

[b] Packages or overpacks transported in or on a vehicle which are offered for transport in accordance with the provisions of § 173.441(b) of this subchapter may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel.

(h) Table IIIB is as follows:

TABLE IIIB.—CSI LIMITS FOR FREIGHT CONTAINERS AND CONVEYANCES

Type of freight container or conveyance	Limit on total sum of criticality safety indices in a single freight container or aboard a conveyance	
	Not under exclusive use	Under exclusive use
I. Freight container—small	50	N/A.
II. Freight container—large	50	100.
III. Vessel: [a] [b]		
1. Hold, compartment or defined deck area:		
i. Packages, overpacks, small freight containers	50	100.
ii. Large freight containers	50	100.
2. Total vessel:		
i. Packages, overpacks, small freight containers	200 [c]	200 [d].
ii. Large freight containers	No limit [c]	No limit [d].

Notes:

[a] For vessels, the requirements in both 1 and 2 must be fulfilled.

[b] Packages or overpacks transported in or on a vehicle which are offered for transport in accordance with the provisions of § 173.441(b) of this subchapter may be transported by vessels provided that they are not removed from the vehicle at any time while on board the vessel. In that case, the entries under the heading ''under exclusive use'' apply.

[c] The consignment must be handled and stowed such that the total sum of CSIs in any group does not exceed 50, and such that each group is handled and stowed so that the groups are separated from each other by at least 6 m (20 ft).

[d] The consignment must be handled and stowed such that the total sum of CSIs in any group does not exceed 100, and such that each group is handled and stowed so that the groups are separated from each other by at least 6 m (20 ft). The intervening space between groups may be occupied by other cargo.

■ 54. In § 176.708 the section title, paragraphs (a) through (e), and footnote 6 to Table IV are revised to read as follows:

§ 176.708 Segregation distances.

(a) Table IV lists minimum separation distances between radioactive materials and spaces regularly occupied by crew members or passengers, or between radioactive materials and undeveloped photographic film. It expresses the separation distances as a function of the sum of the TIs of all packages in a single consignment, in the case of 0 or 3 feet of intervening cargo of unit density for persons, and 0, 3, or 6 feet of intervening cargo of unit density for undeveloped film. Cargo of unit density is stowed cargo with a density of 1 long ton (2240 lbs.) per 36 cubic feet. Separation distances may be interpolated from the table where appropriate.

(b) Table IV is to be used to determine the separation distance for undeveloped film.

(c) Category YELLOW–II or YELLOW–III packages or overpacks must not be transported in spaces occupied by passengers, except those exclusively reserved for couriers specially authorized to accompany such packages or overpacks.

(d) The separation distances for crew members and passengers may be determined by one of two methods:

(1) By using Table IV to determine the minimum distances between the radioactive material packages and regularly occupied spaces or living quarters; or

(2) For one or more consignments of Class 7 (radioactive) material to be loaded on board a vessel under the exclusive use conditions described in § 176.704(f), by demonstration through direct measurement, made and documented by a suitably qualified person, that for the indicated exposure times the dose rate in regularly occupied spaces or living quarters is less than—

(i) For the crew: 7.0 μSv/h (0.70 mrem/h) up to 700 hours in a year, or

1.8 μSv/h (0.18 mrem/h) up to 2750 hours in a year; and

(ii) For the passengers: 1.8 μSv/h (0.18 mrem/h) up to 550 hours in a year, taking into account any relocation of cargo during the voyage.

(e) Any departure from the segregation provisions should be approved by the competent authority of the flag state of the ship and, when requested, by the competent authority at each port of call.

* * * * *

TABLE IV

* * * * *

Note:

* * * * *

(6) The figures below the double line of the table shall be used in those cases where the appropriate provisions of this class permit the sum of the transport indices to exceed 200.

* * * * *

PART 177—CARRIAGE BY PUBLIC HIGHWAY

■ 55. The authority citation for part 177 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

■ 56. In § 177.842, paragraphs (f) and (g) are revised to read as follows:

§ 177.842 Class 7 (radioactive) material.

* * * * *

(f) The number of packages of fissile Class 7 (radioactive) material in any non-exclusive use transport vehicle must be limited so that the sum of the criticality safety indices (CSIs) does not exceed 50. In loading and storage areas, fissile material packages must be grouped so that the sum of CSIs in any one group is not greater than 50; there may be more than one group of fissile material packages in a loading or storage area, so long as each group is at least 6 m (20 feet) away from all other such groups. All pertinent requirements of §§ 173.457 and 173.459 apply.

(g) For shipments transported under exclusive use conditions the radiation dose rate may not exceed 0.02 mSv per hour (2 mrem per hour) in any position normally occupied in the motor vehicle. For shipments transported as exclusive use under the provisions of § 173.441(b) of this subchapter for packages with external radiation levels in excess of 2 mSv (200 mrem per hour) at the package surface, the motor vehicle must meet the requirements of a closed transport vehicle (see § 173.403 of this subchapter). The sum of criticality safety indices (CSIs) for packages containing fissile material may not exceed 100 in an exclusive use vehicle.

PART 178—SPECIFICATIONS FOR PACKAGINGS

■ 57. The authority citation for part 178 continues to read as follows:

Authority: 49 U.S.C. 5101–5127; 49 CFR 1.53.

■ 58. In § 178.350, paragraph (b) is revised and a new paragraph (c) is added to read as follows:

§ 178.350 Specification 7A; general packaging, Type A.

* * * * *

(b) Each Specification 7A packaging must be marked on the outside ''USA DOT 7A Type A.''

(c) Each Specification 7A packaging must comply with the marking requirements of § 178.3.

§§ 178.352 and 178.352–1—178.352–6 [Removed]

■ 59. Sections 178.352 and 178.352–1 through 178.352–6 are removed.

§§ 178.354 and 178.354–1—178.354–5 [Removed]

■ 60. Sections 178.354 and 178.354–1 through 178.354–5 are removed.

§§ 178.362 and 178.362–1—178.362–7 [Removed]

■ 61. Sections 178.362 and 178.362–1 through 178.362–7 are removed.

§§ 178.364 and 178.364–1—178.364–6 [Removed]

■ 62. Sections 178.364 and 178.364–1 through 178.364–6 are removed.

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Samuel G. Bonasso,

Deputy Administrator.

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