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: Notice of proposed rulemaking (NPRM).

SUMMARY: RSPA proposes to amend 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: Comments must be received by July 29, 2002.

ADDRESSES: Address comments to the Dockets Unit, U.S. Department of Transportation, Room PL 401, 400 Seventh St., SW., Washington, DC 20590–0001. Comments should identify the docket number RSPA–99–6283 (HM–230) and be submitted in two copies. Persons wishing to receive confirmation of receipt of their comments should include a self-addressed stamped postcard. You may also submit comments to the docket electronically by accessing the Dockets Management System website at ''*http://dms.dot.gov*.'' Click on ''Help & Information'' to obtain instructions for filing the document electronically. The Dockets Unit is located on the Plaza Level of the Nassif Building at the U.S. Department of Transportation at the above address. Public dockets may be reviewed between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, except on Federal holidays. Internet users may access all comments received by the U.S. Department of Transportation at *http://dms.dot.gov*. An electronic copy of the document may be downloaded using a modem and suitable communications software from the Government Printing Office Electronic Bulletin Board Service at (202) 512–1661.

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:

CONTENTS

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 (Title 49, Code of Federal Regulations, Parts 171–180; HMR) 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 Notice, 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 NPRM addresses only the areas over which DOT has jurisdiction as defined in the MOU. Comments on non-DOT issues or on DOT issues not in the scope of this rulemaking will not be addressed in this NPRM. Comments responding to the NRC's parallel NPRM should be submitted directly to the NRC through its rulemaking process.

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 or radioactive materials. Additionally, we retained Safety Series No. 6 with the same restrictions. Under this final rule, domestic shipments remain subject to the HMR requirements that are based on Safety Series No. 6. This NPRM will address the adoption of TS–R–1 for domestic use.

This rulemaking will not propose any security related changes to the HMR. As a result of the terrorist incidents of September 11, 2001, and subsequent threats related to biological materials, we are reviewing the HMR to determine if additional requirements are necessary to assure the security of hazardous materials in transportation. We initiated a rulemaking project to address security issues related to the transportation of hazardous materials by all modes. We are examining hazard communication, shipping documentation, training, and other requirements to determine if rulemaking action is necessary.

II. Proposed Changes in This NPRM

A. Summary

We have identified ten major issues concerning adoption of TS–R–1 requirements, which are discussed in detail in Section B of this preamble. In addition, Section B also contains the analysis of comments.

For incorporation into the HMR this NPRM proposes 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 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 UF_6;

• Authorize the use of the 1993 edition of ISO 7195 as an alternative to 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;

• 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;

• Require that manufacture of all Type B specification packages conforming to Safety Series No. 6 (1967) be prohibited as of the effective date of this rule and that use of these packages be prohibited two 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. The HMR currently use a specific activity threshold of 70 Bq/g (0.002 μCi/g) for defining a material as radioactive for purposes of transportation (see definition of radioactive material in § 173.403), and radioactive material is not subject to the requirements of the HMR if its specific activity is equal to or below this value. The total activity per gram of all radionuclides present in a material is considered; *i.e.*, if a chain of radionuclides is present, the material is regulated if the sum of the activities/gram of all radionuclides in the chain is 70 Bq/g or more.

We use a threshold specific activity to determine the applicability of regulatory requirements because all material contains some level of radioactivity, although often in trivial amounts. In order not to regulate as radioactive material everything that is transported, it is necessary to specify what materials should be regulated in transport. The threshold value of 70 Bq/g has been thought by the international regulatory authorities to be sufficiently low as to present a negligible risk to transport workers or to members of the public from the radioactive nature of the material.

In issuing TS–R–1, IAEA decided to replace the 70 Bq/g specific activity or activity concentration threshold with values that may be different for each radionuclide. In addition, TS–R–1 establishes threshold values for the total activity in a consignment, below which the risk is so small that the material could be transported without being subject to transportation regulatory requirements. These threshold values for specific activity and activity in a consignment are termed ''exemption values'' in TS–R–1. According to paragraph 236 of TS–R–1, ''radioactive material,'' *i.e.*, radioactive material that is considered radioactive for purposes of transport, is defined as the subset of radioactive material for which both the specific activity and the consignment activity are greater than the exemption values.

The principles upon which the determination of the exemption values is based are that:

(a) The radiation risks to individuals caused by the exempted practice or source are sufficiently low as to be of no regulatory concern;

(b) The collective radiological impact of the exempted practice or source is sufficiently low as to not warrant regulatory control under the prevailing circumstances; and

(c) The exempted practices and sources are inherently safe, with no appreciable likelihood of scenarios that could lead to a failure to meet the criteria in (a) and (b).

The members of IAEA in deliberations leading to the adoption of Safety Series No. 115, ''International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources,'' IAEA, Vienna (1996) (also known as BSS), agreed to adopt exemption values for activity concentrations and total activities related to practices involving radioactive materials and to sources of radioactive material in fixed facilities. In accordance with ''Radiation Protection-65: Principles and Methods for Establishing Concentrations and Quantities (Exemption Values) Below Which Reporting is not Required in the European Directive,'' by M. Harvey *et al.,* Commission of the European Communities Doc. XI–028/93, 1993, each exemption value was selected to be the lesser of:

(a) That at which a member of the critical group, under defined models (representative scenarios, including guiding assumptions) for practices and sources, would receive an effective dose of 10 μSv (1 mrem) in a year under normal conditions; or

(b) That for which the collective dose to all persons exposed to those practices and sources in a year for normal conditions is 1 person-Sv (100 person-rem).

The BSS calculations used three scenarios: (1) Normal use in the workplace, (2) an accident in the workplace where the probability of an exposure due to the accident was taken into account, and

(3) exposure to the public as the result of disposal in a public landfill. Criteria (a) and (b) were applied to all scenarios considered. Criterion (a) was used with all scenarios to determine initial BSS exemption values. The collective dose criterion (b) was also applied, but found not to affect the results.

The BSS calculation also incorporated two other criteria. One was an annual limit of 50 mSv (5 rem) to the skin of an individual. The other was that the exemption level would be chosen to assure that in the case of an accident, even in pessimistic situations, a dose limit of 1 mSv (100 mrem) would not be exceeded.

In principle, the BSS exemption values assure that, for exempt practices and sources within practices at fixed facilities, no member of the public would likely receive an annual dose greater than 10 μSv (1 mrem). In practice, however, since about 300 radionuclides are involved, the values obtained were simplified by rounding to powers of 10, such that calculated xxx values between 3×10^{x} and $3\times10^{x+1}$ would be replaced in the BSS tables by $1\times10^{x+1}$. By determining the exemption values for each radionuclide so that they correspond to a single annual dose of 10 μSv (1 mrem), the calculations assure, within the uncertainty of the models employed, that the use of each radionuclide at its specific activity or total activity exemption value level will involve roughly the same small risk, since radioactivity is regulated under the assumption that the risk is proportional to the dose received. The rounding process used reduces that uniformity in risk, although it should be emphasized that the risks among which those variations occur are still small.

Because the BSS exposure scenarios and pathways do not explicitly address the transport of radioactive material, during the development of TS–R–1 additional calculations were performed for 20 commonly transported radionuclides. The calculations considered transport scenarios consisting of a subset of the BSS scenarios thought to be pertinent to transportation and additional transport-specific scenarios [A. Carey *et al.,* ''The Application of Exemption Values to the Transport of Radioactive Materials,'' Final Report, CEC Contract CT/PST6/1540/1123 (September 1995). The calculations were originally performed for presentation at the Fourth Technical

Committee Meeting on the Revision of the IAEA Regulations for the Safe Transport of Radioactive Material, Vienna, 25–29 September, 1995, at the request of SAGSTRAM–XI (11th Meeting of the IAEA Standing Advisory Group on the Safe Transport of Radioactive Material, TC–407.9, 6–10 March, 1995). Synopses of this report may be found in: ''The Application of Exemption Values to the Transport of Radioactive Materials,'' by P. Francois *et al.*, Proceedings of the 11th International Conference on the Packaging and Transportation of Radioactive Materials (PATRAM '95), Las Vegas, NV, Vol. I, p. 462 (1995); and ''The Application of Exemption Values to the Transport of Radioactive Materials,'' by P. Francois *et al.*, Proceedings of the IRPA 9 Conference, Vienna, Vol. 4, p. 674 (1996).].

For purposes of the calculations, it was first shown that at the current threshold activity concentration of 70 Bq/g, under the transport-derived scenarios, 14 of the 20 radionuclides considered were predicted to result in an annual individual dose greater than 1 mrem with 4 resulting in doses greater than 1 mSv (100 mrem); the highest was Th-232N (Th-232 in secular equilibrium with its decay products), with a predicted dose of about 2.3 mSv (230 mrem). Of the six radionuclides with annual doses less than 1 mrem, S–35 had the lowest dose, about 0.02 μSv (0.002 mrem). The average annual dose for these 20 nuclides was about 0.50 mSv (50 mrem). When the calculations were reversed, to find what activity concentration for each nuclide would result in an annual dose of 10 μSv, the necessary threshold activity concentrations ranged from 0.3 Bq/g for Th-232N to 36,000 Bq/g for S–35.

The same conditions used for fixed facilities were applied to the transport exemption value calculations for the 20 nuclides, namely that a member of the public (including transport workers, since the objective is to estimate the dose they might receive if they were not subject to the transportation regulations) receive no more than about 10 μSv (1 mrem) per year, and that the annual collective dose be no greater than 1 person-Sv (100 person-rem). The main purpose of this analysis was to check the adequacy, with regard to the dose criteria, of the BSS exemption values in the case of exposure situations associated with transport. SAGSTRAM–XI accepted that if the exemption values provided by the analysis of transport scenarios differed by no more than one to two orders of magnitude, then it would be preferable to directly apply the BSS exemption values to the transport regulations, instead of defining a separate set of exemption values for transportation, in order to provide consistency with other practices. The results of the analysis of transport scenarios did in fact result in exemption values that did not differ from the BSS values by more than two orders of magnitude, with the exception of one radionuclide, Kr-85, for which it was argued that because Kr-85 is not transported in such large containers the scenarios used were overly conservative. On this basis it was decided to utilize the BSS exemption values for the transport regulations. For those radionuclides in the transport regulations not listed in the BSS, transportation exemption values were calculated using the BSS methodology.

Because of the rounding procedure used to obtain the BSS values and the differences between the BSS- and transport-derived exemption values even without rounding, the annual individual doses derived using the transport scenarios combined with the BSS exemption activity concentrations for the 20 nuclides considered are no longer equal to 10 μSv (1 mrem). A rough calculation, assuming strict proportionality between the annual dose and the transport-derived activity concentration exemption values, indicates that those calculated doses, using the BSS values in TS–R–1 for the 20 nuclides, now range (except for Kr-85, which gave an anomalously high value) from about 3 μSv (0.3 mrem) for C–14 to about 420 μSv (42 mrem) for Au-198. If Kr-85 is included, the estimated annual dose to a transport worker transporting one of these 20 radionuclides at the TS–R–1 exemption activity concentrations, averaged over these 20 radionuclides, is about 230 μSv (23 mrem).

There are some nuclides listed in Table I of TS–R–1 that contain a reference to footnote (b). These nuclides have the radiological contributions from their listed decay products, assumed to be in secular equilibrium with the initial radionuclide in the decay chain (activities of all members in the chain assumed equal, taking into account branching ratios), already included in the footnoted exemption value. For example, Sr–90 has a TS–R–1 exemption activity concentration of 100 Bq/g. This means that one may transport up to 100 Bq/g of Sr–90, which is equivalent to up to 200 Bq/g of Sr–90 combined with its decay product Y–90, before becoming subject to the regulations for transporting radioactive material.

Discussion. Commenters to the 1999 ANPRM who address this issue generally do not support a change in the HMR definition of ''radioactive material.'' One commenter who supports the change states that requiring materials to meet both the concentration criteria and the consignment activity level to be classed as Class 7 (radioactive) material adds much needed flexibility to the rules and suggests that this revision would be of great value, particularly for research institutions that frequently need to transfer small quantities and low concentrations of radioactive materials.

Among commenters who oppose the IAEA revisions, several state that the use of radionuclide-specific concentration and total consignment exemption thresholds to determine whether a material is to be considered ''radioactive'' for purposes of transport would require substantial additional effort with few, if any, benefits. Other comments note that the current definition of radioactive material has served the United States well for several decades and assert that the benefits to be derived from a risk-based system that spans 7 orders of magnitude are not significant when compared to the simplicity of the current system.

Another commenter states that the new IAEA thresholds will create problems with the transportation of consumer products since the new thresholds would result in varying points at which the regulations would apply, depending on the material.

Many commenters who addressed this issue as part of the HM–215D rulemaking [Docket No. RSPA–2000–7702] state that the TS–R–1 revised definition of radioactive material lowers the level of safety provided by the current regulations, because under TS–R–1 some of the exemption activity concentrations are higher than the current 70 Bq/g.

Several commenters suggest combinations of the current and proposed radioactive material definitions, such as using the TS–R–1 approach for international shipments while retaining the 70 Bq/g threshold for domestic shipments or adopting the new specific activity exemption values only in those cases where the new values are greater than 70 Bq/g and retaining the 70 Bq/g threshold for the remainder.

RSPA believes that the improved risk basis for the proposed exemption values and the advantages of harmonization with the international radioactive material transport regulations outweigh the benefits of the current more simple system. The proposed activity concentration exemption values distribute the risk to workers and

members of the public more equitably, around a value corresponding to an annual dose of approximately 230 μSv (23 mrem). This should be compared with the situation using the single activity concentration threshold of 70 Bq/g, which for the same 20 radionuclides distributes the risk around a value corresponding to an annual dose of about 500 μSv (50 mrem).

We agree that the new system is more complex. However, for most manufactured products the determination of whether those products fall under the domain of the HMR need be made only once or very occasionally. For those cases where there is more variation in the specific activity of the consumer product, such as might be the case for products manufactured from ores containing small amounts of naturally occurring radioactive material, the types of radioactive material which may be present are relatively well known, and it will usually be possible to set up a standard procedure for determining whether the product is subject to the HMR. It should be kept in mind that with the current 70 Bq/g threshold such determinations are also necessary.

Because some proposed exemption concentrations are greater than the current value of 70 Bq/g, it might be argued that in these cases we are proposing to ''lower the level of safety.'' However, the increase in risk in these cases is in a range where the risk is very small. For P–32, for example, the increase in exemption level from 70 Bq/g to the BSS threshold of 1,000 Bq/g results in an increase of the risk for a worker transporting this material without being subject to the HMR from a value corresponding to 0.58 mrem/y up to a value corresponding to 8.3 mrem/y. For comparison purposes, it was mentioned earlier in this section that for the 20 nuclides to which the transport and fixed facility scenarios were first applied, the original threshold of 70 Bq/g corresponds to an average annual dose of about 50 mrem, while use of the BSS exemption activity concentrations adopted in TS–R–1 corresponds to an average annual dose of about 23 mrem. Thus, use of the proposed exemption values will reduce the overall risk by about 50%.

We prefer not to adopt a combination approach to defining radioactive materials in which different exemption values would apply to international and domestic shipments, since doing so would tend to make the proposed system still more complex, and lead us away from the goal of harmonization.

Accordingly, we propose to adopt the nuclide-specific exemption activity concentrations and the nuclide-specific exemption consignment activities listed in TS–R–1. These would be listed in a new section (§ 173.436). The purpose of adopting the TS–R–1 exemption values would be to assure continued consistency between domestic and international regulations for the basic definition of radioactive material. In addition, adoption of the TS–R–1 exemption values would reduce and make more uniform the risk to transport workers and members of the public when radioactive material is transported at levels below the exemption values, where these materials would not be regulated as radioactive. Adoption of these values would provide a consistent level of protection for all radionuclides and would result in a single regulatory structure valid for both domestic and international shipments, thus reducing the potential for error in classifying the material for shipment, reducing costs for those entities that ship domestically and internationally, and increasing regulatory efficiency. Since shippers who have materials with radioactivity near the exemption levels currently need to know what radionuclides and activity levels are present in order to determine compliance with the 70 Bq/g threshold, the primary changes that would be needed when using the nuclide-specific exemption values would be those introduced to apply the sum rules for mixtures, and possible changes in computer software, recordkeeping, training, and other mostly administrative requirements. We believe that the cost savings associated with the enhanced regulatory efficiency due to having common domestic and international criteria for classifying material for shipment, and with thus facilitating the goal of consistency between countries with respect to future modifications of the regulations, outweigh the additional costs resulting from applying the new procedures.

As described under Issue 2, certain naturally occurring radioactive materials with activity concentrations or activities up to 10 times the exemption values, which are not extracted for their radioactive properties, would be excluded from these regulations in order to avoid regulating large amounts of these materials which have not heretofore been subject to radioactive material transport regulations. Since, however, for some radionuclides 10 times the exemption activity concentrations will not be the same as the present 70 Bq/g threshold, some currently unregulated naturally occurring radioactive materials will fall under the scope of the regulations, and some materials which were formerly regulated because they had a specific activity slightly greater than 70 Bq/g, may no longer be regulated. The former situation would lead to some additional costs for the companies involved; however, that would be at least partially offset by reduced costs for shipping those materials in the latter category. Commenters did not provide details or numbers to aid in estimating the magnitude of the projected costs or cost savings, or who would be affected.

Issue 2: Naturally Occurring Radioactive Materials

An important addition to the list of circumstances in TS–R–1 under which the regulations do not apply is found in paragraph 107(e) of that document. That paragraph excludes certain naturally occurring radioactive materials from being regulated during transportation. The purpose of the exclusion is to take into account practical difficulties that result from reducing the exemption concentrations for several alpha emitters from the present level of 70 Bq/g (0.002 μCi/g) in conjunction with the adoption of nuclide-specific exemption values (see the discussion under Issue 1).

Certain of these radionuclides, such as natural uranium and natural thorium, are widespread in nature and found in almost all ores, such as coal, phosphate, gypsum, or a large variety of metals or other minerals. Application of the new exemption values to the radioactive material in these ores would result in bringing under the scope of the regulations enormous amounts of material that have until now not been subject to those regulations, and whose specific activity level presents a very low hazard.

On the other hand, there are ores in nature where the specific activity concentration is much higher than the exemption values, and the regular transport of these ores may require the use of the radiation protection measures inherent in applying the regulations. Thus, for low specific activity ores not intended to be processed for use of those radionuclides, a threshold of 10 times the exemption values provides an appropriate balance between the need for radiological controls at higher concentrations and the practical problems associated with over-regulation which would arise for large quantities of material with low specific activity concentrations of naturally occurring radionuclides.

Discussion. Commenters to the ANPRM generally agree that the HMR should be revised to incorporate the scope limitations of TS–R–1.

Commenters state that this would remove HMR controls from consumer commodities, such as smoke detectors, and radioactive material that is an integral part of the packaging, such as casks with depleted uranium shielding. (We note that this is not necessarily a valid argument for incorporating the cited scope limitation since, for example, materials used in smoke detectors are not usually naturally occurring, and uranium in depleted uranium shielding would have been originally mined for its radioactive properties. In addition, such materials are usually found to be in quantities above ten times the proposed exemption values.) Commenters further state that, since these items are inherently safe, they should be removed from the scope of the HMR. Several commenters state that any change to the scope should ensure that materials regulated as ''radioactive'' for transportation purposes does not extend to ores and natural materials, including products made from those ores and materials, that are outside the nuclear fuel cycle and do not exceed an appropriate regulatory threshold and, thus, present a very low hazard.

Several commenters suggest that a provision to allow radiation protection personnel to carry excepted quantities of solid radioactive material on passenger aircraft as checked baggage should be added to allow radiation protection personnel to travel to a site with appropriate radiation detection equipment without the worry that they are in violation of the HMR. These commenters assert that this provision would have a very direct benefit to public health protection and since the quantities involved are far below the A_1 or A_2 limits, the risk would not be significant. We note that the HMR currently permit carriage aboard an aircraft of a limited quantity of radioactive material, or an instrument or article containing radioactive material, meeting the requirements of § 173.421 or § 173.424, in checked baggage. This was formally stated in a letter issued on March 19, 1991, from the Federal Aviation Administration Director of the Office of Civil Aviation Security Operations to the Director of State Programs of the U.S. Nuclear Regulatory Commission. Therefore, we do not agree that a specific regulatory provision is necessary.

One commenter asserts that there is no significant safety or economic impact from the application of the graded approach to performance standards described in paragraph 106 of TS–R–1. The commenter expresses support for the incorporation of the three severity levels (routine, normal and accident conditions of transport) to determine the level of regulation required by the HMR. The HMR are designed as to assure that the severity of regulatory requirements is proportional to the hazard of the materials to be transported. TS–R–1 and several previous revisions of the IAEA regulations refer to the industrial and Type A package performance requirements, found in 49 CFR 173.465, as ''tests for demonstrating ability to withstand normal conditions of transport,'' and the additional performance requirements for Type B and fissile material packages, found in 10 CFR 71, as ''tests for demonstrating ability to withstand accident conditions of transport.'' We believe that the distinction made in TS–R–1 between routine (incident free) and normal (minor mishaps) is artificial, and does not enhance the use of the graded approach.

Finally, one commenter suggests that language in the regulations should be simplified and clarified, rather than further complicated, to ensure understanding by various segments of the distribution network with a wide range of educational levels. This commenter states that TS–R–1 uses several terms, the definition and application of which are unclear and vulnerable to subjective interpretation. Examples include ''worker,'' ''appropriate training,'' ''unlikely to exceed,'' ''appropriate records,'' and ''regularly occupied working areas.'' This commenter suggests that, due to the extensive interface between transport of radioactive materials and sites subject to NRC, Agreement State, and other nuclear regulatory agency jurisdiction, the definition and application of terms should be clarified and consistent between TS–R–1 and the regulations of these other agencies, and should be consistent with international regulations. We agree. In this NPRM we have attempted to reduce the number of undefined terms, and to add or modify definitions where appropriate.

Accordingly, in this NPRM we are proposing to provide an exception in the HMR, in § 173.401, that naturally occurring radioactive materials not intended to be processed for their radioactive components and with activity concentration not to exceed ten times the exemption activity concentrations would not be subject to the requirements of the HMR.

Issue 3: Changes in A_1 and A_2 Values

Background.

The international and domestic transportation regulations use calculated activity values for each radionuclide to specify the amount of radioactive material that is permitted to be transported in particular packaging and for other purposes. These numbers, known as the A_1 and A_2 values, indicate the maximum activity that is permitted to be transported in a Type A package. For example, A_1 is the maximum activity of radioactive material in special form, and A_2 is the maximum activity in non-special form that may be transported in a Type A package. A_1 and A_2 values for the most commonly transported radionuclides are listed in 49 CFR 173.435, 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.

To determine whether a given amount of radioactive material may be shipped in a Type A package, or if a Type B package must be used instead, the total activity to be shipped is compared directly with the appropriate A_1 or A_2 value. Fractions or multiples of the A_1 and A_2 values are also used for several other purposes, such as specifying Type B package activity leakage limits, low specific activity and excepted package limits, and determining whether a given amount of radioactive material constitutes a Highway Route Controlled Quantity.

Based on the results from the updated Q-system (see TS–G–1.1, Appendix I), 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.

While the dosimetric models and dose pathways within the Q-system were thoroughly reviewed and updated, the reference doses that the model uses were unchanged. The reference doses are the dose values that are used to define a ''not unacceptable'' dose in the event of an accident. Consequently, while some revised A_1 and A_2 values are higher and some are lower, the potential dose following an accident is the same. 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. In other words, where an A_1 or A_2 value has increased, the potential dose is still the same—the use of the revised dosimetric models merely illustrates that a higher activity of that radionuclide is actually required to produce the same reference dose. Conversely, where an A_1 or A_2 value has decreased, the revised models show that less activity of that nuclide is needed to produce the reference dose. Many A_1 and A_2 values have been adjusted to reflect more recent dosimetric data; in general, the adjustments are not large.

Some radionuclides for which A_1 and A_2 values are presently listed in 49 CFR 173.435 and Appendix A of 10 CFR 71 do not appear in Table I of TS-R–1. These are Ar-42, Au-196, 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).

Discussion. Several commenters to the ANPRM support the new A_1 and A_2 values in general, but request 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. We note that the A_2 value for Mo-99 in TS–R–1 is 0.6 TBq (16.2 Ci), compared to 0.5 TBq (13.5 Ci) in Safety Series No. 6, 1985 Edition. Upon further review of these comments, and of similar comments received and analyzed during the incorporation of Safety Series No. 6, 1985 Edition changes into the HMR (60 FR 50292), we are proposing to continue to allow this domestic exception of 0.74 TBq (20 Ci) for the A_2 value of Mo-99.

A major manufacturer and a major user of californium-252 (Cf-252) neutron sources oppose any proposal that would reduce the A_1 quantity for Cf-252 from its present value of 0.1 TBq (2.7 Ci) to 0.05 TBq (1.35 Ci). One commenter states that reducing the A_1 limit for Cf-252 is not justifiable based on potential radiation exposure rates, and emphasizes that the physical and chemical forms of the californium sources are such that this material, if released, is insoluble in water and will not burn in air, and that this was not taken into account in the Q-system calculations. This commenter asserts that Cf-252 is shipped in Type A packages, and that the costs of designing, qualifying and using Type B packages for sources that will continue to have an activity no greater than 0.1 TBq (2.7 Ci) are much higher and not necessary. This commenter additionally states that using a special form Type A limit which is one half the previous value would double the number of shipments, thereby increasing the risk of transport damage and increasing the potential of exposure of transport workers to radiation. The commenter further states that the company has a substantial investment in the design and construction of Type A packages for transporting Cf-252 in the 0.05 to 0.1 TBq range, and that a general purpose unit for shipping 5 mg (0.1 TBq) of Cf-252 weighs several tons. Changing to the TS–R–1 A_1 value would render these packages unusable. The company estimates that its costs for dismantling and disposing of these packages, which may contain activated metallic parts and would have to be treated as potentially radioactive material, to be on the order of $500,000, not counting the high additional costs required to design, construct, test, and obtain certification for new Type B containers.

During analysis of these comments, RSPA and NRC staff members 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. For this reason we decided to include in this rulemaking a domestic exception to the TS–R–1 Cf-252 A_1 and A_2 values, retaining the present Title 49 A_1 and A_2 values for domestic shipments. Import and export shipments, however, would be subject to the TS–R–1 A_1 and A_2 values.

Other commenters are supportive of the proposed adoption of the new A_2 activity limits. One commenter, who will be moving large quantities of radioactive waste (especially LSA and SCO) as result of environmental cleanup, sites (or facilities) closures, and waste repository operations, states that adopting the new A_2 values will increase the waste shipping volume per conveyance. As a result, the transportation costs will decrease and the number of packagings required will be reduced.

In this NPRM, we propose to incorporate the TS-R–1 A_1 and A_2 values into the HMR, in § 173.435, with the exceptions noted above for Mo-99 and Cf-252. There are two principal arguments for adopting the new values: One is the need to continue to assure the safety of workers and the public, taking into account the latest scientific analyses. The other is the need for harmonization with the international regulations in this area. This harmonization would eliminate the complexities resulting from having to move back and forth between two already complex A_1 and A_2 systems, and the resultant increased probability of inadvertent errors from doing so. In addition, retaining the current values, which are essentially those from Safety Series No. 6, 1985 Edition, would in most cases not be scientifically justifiable, since the new values were introduced in TS–R–1 precisely in order to take into account advancements in scientific knowledge.

In this NPRM, we propose to not include A_1 and A_2 values for the 16 isotopes described above which are listed in our present domestic regulations, but which do not appear in TS–R–1. This means that the default A_1 and A_2 values in TS-R–1 would have to be used for these isotopes. However, DOT regulations at § 173.433(b) provide a mechanism for obtaining approval from the Associate Administrator for Hazardous Materials Safety to use convincingly documented values of A_1

and A_2 for radionuclides not listed in the table in § 173.435. We propose in this NPRM to include a similar mechanism to obtain approval for use of non-default exemption values for these radionuclides.

Issue 4: Communication Changes

Background. The TS–R–1 revisions in hazard communication includes the following:

- Proper shipping names and UN identification numbers are changed (Table VIII in TS-R–1);
- UN identification numbers now must be marked on excepted packages (paragraph 535), and package type, international vehicle registration code (the letters USA in the case of the U.S.) and packaging manufacturer now must be marked on all industrial and Type A packages (paragraph 537);
- Radionuclide activities must be expressed in SI units (paragraphs 543 and 549);
- The former criticality transport index (criticality TI) for fissile material has been abolished, and replaced with the CSI (paragraph 218); TI is now derived exclusively from the maximum radiation dose rate at one meter from the package (paragraphs 243, 526, 527); and
- For fissile material, a fissile label is introduced, upon which the CSI must be displayed (Figure 5, paragraphs 544, 545). Industrial packagings are to carry the markings TYPE IP–1, TYPE IP–2 or TYPE IP–3 as appropriate (paragraph 537).

Discussion. Several commenters note that changing proper shipping names will require all shipments to be re-labeled. One commenter states that the majority of labels that would be affected are metal and pop-riveted directly onto the container, requiring major work to replace these labels with no net safety benefit. These commenters further assert that many preprinted shipping papers will be affected and request a grandfathering or transition period to update the paperwork to reflect the new names.

We agree that there would be definite and sometimes appreciable costs associated with the change to the use of new proper shipping names and UN identification numbers. However, those who import or export radioactive material, as well as those who offer for transportation such material domestically to air carriers operating under the Technical Instructions for the Safe Transport of Dangerous Goods by Air of the International Civil Aviation Organization (ICAO), must necessarily use the new shipping names and UN numbers as of ICAO's implementation of the TS–R–1 requirements effective July 1, 2001. In addition, in order to accommodate domestic and international air transport of radioactive material in accordance with the ICAO Technical Instructions as well as domestic transport by other modes in accordance with the present requirements of Title 49, and to permit the use in transport by those other modes of packages which had been marked with the new names and numbers for air transport, the final rule adopted under docket HM–215D authorizes the use for all modes of either the previous proper shipping names and UN numbers or the new ones. Thus, many shippers are already required to use the new names and numbers or are doing so voluntarily. Morever, since these transition arrangements are likely to remain in place until the effective date of the final rule that is expected to result from this NPRM, there should be ample time to implement the proposed changes.

Several commenters supported the adoption of the new package labeling requirements to provide information on the CSI. Commenters state that the CSI provides essential information relevant for proper separation of packages with fissile material contents during their storage and stowage. Commenters further state that there would be a one-time operational impact and cost of incorporating the new FISSILE label. One commenter estimates this one-time cost to their operation to be a few million dollars that would include personnel training; procedure revisions; and package, overpack and container labeling. Commenters request a five-year transition period to allow for the use and depletion of existing label inventories and to develop, manufacture and obtain new labels prior to the implementation date. We agree that there will be an appreciable but not major one-time impact and a minor ongoing impact of using the new FISSILE labels for shippers of fissile material, but that the simplicity and improvement in safety that will result from distinguishing the CSI from the TI fully justifies this proposal. The use of existing label inventories should not be a problem, since we are proposing no change to existing labeling requirements. There should be sufficient time between the publication date and the effective date of a final rule to obtain the new FISSILE labels, particularly since these labels are already required for most international fissile material shipments.

Several commenters oppose the new excepted package marking requirements in TS–R–1. They assert that current HMR do not require exterior marking of excepted packages, and suggest that the addition of the UN identification number with the letters ''UN'' would do little to enhance the understanding of the contents of excepted packages or the safety of individuals responding to excepted package incidents. They further state that the addition would more likely confuse carriers and end users.

We are aware of the sometimes appreciable initial costs, and the change of culture that placing the UN identification numbers on excepted packages would entail. However, we do not agree that this addition will confuse carriers and end users, nor that it would do little to enhance the understanding of package contents. Possible confusion should be minimal, since carrier personnel are required to receive appropriate training in accordance with subpart H of Part 172. The addition of the UN identification numbers would indicate to first responders in an accident that packages containing small quantities of radioactive material are present. By referring to the DOT Emergency Response Guidebook, in the use of which all first responders are required to be trained, appropriate remedial measures can be taken. Also, as in the case of other TS–R–1 requirements, those who import or export commercial items in excepted packages, as well as those who offer for transportation such items domestically using air carriers who operate under the ICAO Technical Instructions, are currently required to mark the UN identification numbers on those packages, so that the harmonization of our requirements with those of TS–R–1 in this respect seems indicated. On balance, the benefits of adopting this requirement outweigh the disadvantages.

Commenters to the ANPRM generally oppose adoption of any new requirements that would require the placarding of all vehicles engaged in the transportation of radioactive materials labeled RADIOACTIVE WHITE–I, RADIOACTIVE YELLOW–II, or RADIOACTIVE YELLOW–III. Currently, the HMR require the placarding of vehicles transporting YELLOW–III labeled packages of radioactive materials, or certain exclusive use shipments of LSA materials or SCO. Commenters representing radiopharmaceutical shippers and carriers state that requiring all radioactive material shipments to be placarded would result in adverse operational and financial impacts on nuclear pharmacies and radiopharmaceutical distribution in the United States by requiring these

facilities to employ only driver personnel with commercial driver's licenses, who generally command higher salaries. These commenters assert that the established safety record for transporting RADIOACTIVE WHITE–I and RADIOACTIVE YELLOW–II labeled packages in the United States does not justify a tightening of the regulations for local transportation of these packages to hospitals and clinics. These commenters suggest that the increased cost of running a program encompassing some 500 nuclear pharmacies throughout the United States would be immense without any improvement in safety.

We agree with these comments, which can be extended to the transport of other relatively low levels of radioactive material; therefore, we propose no change to the current policy of requiring RADIOACTIVE placards only on vehicles carrying packages with RADIOACTIVE YELLOW–III labels, or on certain exclusive use vehicles transporting LSA or SCO, as described in proposed § 173.427.

Accordingly, in this NPRM we are proposing to adopt, in § 172.101, the new proper shipping names and UN identification numbers, except for those referring to Type C packages, or to fissile LSA or SCO materials. They are not needed, since we do not propose to adopt the concept of Type C packages for domestic use (see Issue 7), and fissile material (above the level considered fissile-excepted) may not be transported domestically as LSA material or SCO.

We do not propose to make any substantial change with respect to the use of SI units to describe activity or radiation levels. Part 172 currently requires the use of SI units or SI units followed by the appropriate quantity in ''customary'' units; it is our position that this does not violate the TS–R–1 requirement, facilitates communication and reduces the possibility of errors for domestic shipments, while promoting familiarity with the use of the SI system. We do propose to require in §§ 172.203(d) and 172.403(g), 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 SI units.

We also propose to adopt the use of the CSI to refer to what was formerly the criticality control transport index, and to restrict the use of the concept of TI to a number derived purely from the maximum radiation level at one meter from the package. In conjunction with this, we propose that the new fissile label be placed on each fissile material package, and that the CSI for that package be noted on the FISSILE label. This would make it obvious that the package is carrying fissile material, and would reduce the complexity of the system presently in use, in which for packages of fissile materials the transport index is determined through a comparison between a number related to radiation levels and another determined on the basis of a criticality analysis. It would also simplify decisions as to how many packages can be grouped together, since under the proposed system the description of radiation and criticality hazards would be uncoupled, and during transport each hazard can be considered separately.

We propose to adopt the requirement that excepted packages be marked with the UN identification number, that industrial packagings be marked with the package type, and that industrial and Type A packages be marked with the international vehicle registration code of the country of origin of packaging design.

We propose to 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.

Because the isotope plutonium-238 has been removed from the TS–R–1 definition of fissile material (see the discussion for Issue 9), we propose to remove it from our definition of fissile material in § 173.403, and to remove 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.

We propose to improve readability and clarity of the HMR by moving the labeling requirements for overpacks to subpart E of part 172, and by stating explicitly that the Class 7 label category for an overpack is to be determined using the maximum surface radiation level on the interior package(s) unless the overpack is the appropriate package type for its contents.

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 attempted to refine the existing LSA and 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 all the provisions, such as the Safety Series No. 6 definition of contamination.

IAEA TS–R–1 proposed a new class of LSA–I material (paragraph 226), 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 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.

Discussion. In response to the ANPRM, commenters agreed that we should adopt a definition of contamination that is consistent with the one used in TS–R–1. Due to the insufficient availability of industrial packages, significant volumes of material that would have to be repackaged and the lack of a significant safety benefit, many commenters support continued use of strong, tight packages for transport of LSA and SCO material. Commenters also suggest that due to minimal risk but large size or volume of many shipments of LSA and SCO, provisions for unpackaged material are appropriate and necessary.

One commenter requests that we retain the present LSA–I classification in § 173.403 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. We do not agree. We propose to replace this classification with the new TS–R–1 classification of other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the activity concentration values. The present LSA–I classification does not provide an equivalent level of safety to the exemption-based classification from TS–R–1 which we are proposing to adopt.

In this NPRM, we are proposing to simplify the HMR by bringing them into closer harmony with the TS–R–1 by adopting a definition of contamination, an authorization to transport unpackaged LSA and SCO, and an

authorization to use qualified tank containers, freight containers and metal intermediate bulk containers as industrial packagings, types 2 and 3 (IP–2 and IP–3). We also propose to adopt a new class of LSA–I material (paragraph 226), 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 value. We believe that incorporating these changes will greatly simplify LSA and SCO regulations by bringing them into closer harmony with the TS–R–1. Specifically, we believe that the addition of a contamination definition and the authority to transport unpackaged LSA and SCO will better focus the regulations on radioactive material that truly poses a hazard to persons, property and the environment. We also believe 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 would greatly simplify the HMR with no increase in risk.

We also propose to eliminate present paragraph § 173.427(d), which when offered for transportation for disposal or recovery by means other than aircraft, excepts from all requirements of the HMR for Class 7 materials LSA material and SCO that conform to the provisions of 10 CFR 20.2005. 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 would no longer be needed if the TS–R–1 exemption values are adopted, since the TS–R–1 exemption activity concentrations 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. Note, however, that this does not necessarily mean that these materials would be exempt from the provisions of the HMR relating to other hazard classes.

Issue 6: Uranium Hexafluoride (UF^6)

Background. Current regulation for uranium hexafluoride (UF_6) packaging and transportation is a combination of NRC and HMR requirements. The HMR contain provisions that govern many aspects of UF^6 packaging and shipment preparation, including a requirement that the UF_6 material be packaged in cylinders that meet the ANSI N14.1 standard. NRC regulates fissile materials and Type B packaging designs for all materials. Since UF_6 is a fissile material, it is also regulated by NRC.

Previous editions of the IAEA regulations did not specifically address UF_6, but TS–R–1 contains detailed requirements for UF6 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, 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 must 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 competent national 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.

There are specific performance and design requirements for packages containing uranium hexafluoride (paragraphs 629–632), including conformance with ISO Standard 7195, ''Packaging of Uranium Hexafluoride (UF_6) for Transport.'' Competent Authority package design certificates are required for international shipments of uranium hexafluoride (paragraph 828).

Discussion. Although many commenters to the ANPRM do not agree with the need or basis of the changes, most of the commenters do agree that we should adopt them to facilitate international transportation of UF_6. Commenters 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 agree with the need for additional information and are proposing to include all of what was requested. We also 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.

Accordingly, in this NPRM we are proposing to incorporate the TS–R–1 changes for packagings containing more than 0.1 kg of UF_6. RSPA also proposes to authorize the use of the 2001 edition of ISO Standard 7195 as an alternative to ANSI N14.1, to require the packagings to meet the pressure, drop and thermal test requirements found in paragraphs 629–632; to prohibit the use of pressure relief devices; and to certify the packagings in accordance with paragraph 828.

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 exemption 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.

Discussion. A commenter to the 1999 ANPRM asserts that the testing criteria for Type C packages is inadequate. For example, the commenter questions 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 state 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 support the addition of the term LDM and recommend its incorporation into the HMR. Finally, one commenter suggests that the new concept of LDM was introduced to offset the problems encountered in developing a Type C package. The commenter further asserts that the nuclear industry would attempt to certify reprocessed fuel known as MOX as LDM. The commenter believes there are significant safety implications regarding the movement of these substances via transportation by air and very strongly opposes any adoption of requirements in this area.

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

Issue 8: Fissile Material Package and Transport Requirements

Background. Under the MOU between DOT and NRC, NRC establishes the packaging requirements for the transport of fissile radioactive material. In February 1997, NRC published an emergency final rule (62 FR 5913, February 10, 1997) to amend Part 71 of Title 10 of the Code of Federal Regulations (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, 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 notice of proposed rulemaking to harmonize 10 CFR 71 with TS–R–1, is proposing several changes to its requirements for fissile exemptions.

In addition, the NRC is proposing in its NPRM 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.

Discussion. Several commenters assert that the TS–R–1 requirements for conducting criticality analyses for fissile materials being shipped by air require 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. RSPA has no authority to make unilateral changes in IAEA documents. RSPA, in coordination with the NRC, will analyze problems in performing criticality analyses for the shipment of fissile materials by air as they arise; the possibility of issuing a guidance document will be considered if it appears to be an appropriate means to address any problems encountered.

These commenters further stated that RSPA 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. As indicated in Issue 7, the NRC and RSPA do not propose to adopt TS–R–1 provisions for Type C packages or LDM. 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 LDM. Other Certificates of Competent Authority for the international transport of fissile materials by air will be issued following normal procedures described in §§ 173.471 and 173.473.

Accordingly, in this NPRM we propose to adopt the NRC fissile material exemption provisions in § 173.453, and to introduce the Type B(DP) package proposed by the NRC in its NPRM. We propose 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, since we feel that this would considerably simplify the transport of fissile material packages, while maintaining appropriate criticality safeguards.

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. 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 restrictive TS–R–1 transitional provisions will have several impacts. The primary impact of these two paragraphs is that Safety Series No. 6 (1967) approved packagings are no longer authorized. The second impact is that fabrication of packagings designed and approved under Safety Series No. 6 (1985/1985A) 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; (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) can 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. 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 packagings will be required to meet TS–R–1 packaging approval requirements.

Discussion. Commenters to the ANPRM generally state 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 suggests 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 state that for domestic shipments, we should provide a one-year transition period for complete implementation of the TS–R–1 regulations. Other commenters suggest 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 do not agree that the HMR should adopt the above suggestions. Radioactive material transport regulations in the HMR apply only to domestic transport and to the domestic portion of import and export shipments. Because the international modal organizations IMO and ICAO have adopted TS–R–1, international shipments must follow TS–R–1 requirements.

Accordingly, in this NPRM, we propose to accept the IAEA transitional requirements and will begin the phase out of its Type B specification packages. We propose that manufacture of all Type B specification packages conforming to Safety Series 6 for radioactive material 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.

Issue 10: Other TS–R–1 Changes

We propose to 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. 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.

III. Section-by-Section Review

Part 171

Section 171.7

In the table of material incorporated by reference, we are proposing to remove the DOE Uranium Hexafluoride Good Practices manual, the1985 IAEA Regulations for the Safe Transport of Radioactive Material, Safety Series No. 6. and an ISO standard entry, revise the IAEA Regulations for the Safe Transport of Radioactive Material, No. TS–R–1, 1996 Edition and two ISO standard entries, and add three new entries consisting of two ISO standards and a United States Enrichment Corporation Good Handling Practices for Uranium Hexafluoride.

Section 171.11

In HM–215D, [66 FR 33336], we added a paragraph 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 proposing to remove paragraph (d)(6)(vi) that limits the Class 7 (radioactive) material to the current definition in § 173.403. This would allow for the proposed adoption of the current edition of the IAEA regulations for both domestic and international shipments. 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 proposing to change the phrase ''limited quantities'' in § 171.11(d)(6)(ii) and (iv) to ''excepted packages.''

Section 171.12

In § 171.12, we propose to revise 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 propose to remove paragraph (d)(7) that limits the Class 7 (radioactive) material definition to the current definition in § 173.403. This would allow for the proposed adoption of the current edition of the IAEA regulations for both domestic and international shipments.

Part 172

Section 172.101

In the Hazardous Materials Table, we propose to revise 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'' to allow for both domestic and international shipment. In addition, we propose to remove those radioactive material entries that currently allow for domestic shipment only.

Section 172.203

In paragraph (d) we propose to remove two requirements that would become redundant upon adoption of the new proper shipping names: (1) Paragraph (d)(1) requiring that the words ''Radioactive Material'' be entered on the shipping paper unless already contained in the proper shipping name, and

(2) paragraph (d)(11) requiring 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 proposing to revise paragraph (d)(4) 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 propose to revise paragraph (d)(4) 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. Paragraphs (d)(7)(ii) and (d)(7)(iii) would be redesignated (d)(7)(iii) and (d)(7)(iv), and a new paragraph (d)(7)(ii) would be added to require inclusion of the criticality safety index in the shipping description for fissile material packages. Paragraphs (d)(2) through (d)(10) would be redesignated (d)(1) through (d)(9). A new paragraph (d)(10) would be added to require the words ''Highway route controlled quantity'' on a package containing a highway route controlled quantity of Class 7 (radioactive) materials.

Section 172.301

We propose to revise paragraph (a)(1) to include the UN identification number marking requirement for excepted packages of Class 7 (radioactive) materials.

Section 172.310

We are proposing to revise paragraph (b) to require industrial packagings to be marked Type IP–1,'' ''Type IP–2,'' or ''Type IP–3,'' as appropriate. We propose to revise 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 further propose to redesignate paragraphs (c) and (d) as (d) and (e), and to add 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,'' in use until now, and decoupled it from the determination of the TI for such a package. The CSI must be displayed on shipments 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 propose to revise the table in § 172.400 to add the new ''FISSILE'' label.

Section 172.402

Paragraph (d) would be 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 propose to add a new paragraph (e) to require each FISSILE label to be completed with the CSI. (See discussion under § 172.400 above.) Paragraph (g)(2) would be 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 proposing to revise 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 propose to add a new paragraph (h) to incorporate the requirements presently in § 173.448(g) pertaining to the labeling of overpacks, and to add a clarification that the label category for the overpack must be determined using the maximum surface radiation level of the interior package(s) unless the overpack qualifies as an appropriate package type for its contents.

Section 172.441

We are proposing to add 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 proposing to revise paragraphs (b)(2) and (b)(3) for clarity. In addition, we propose to add new paragraph (b)(4) to expand upon those areas when the HMR would not apply by including under specific conditions Class 7 (radioactive) material in natural material and ores containing naturally occurring radionuclides, respectively. In regard to paragraph (b)(2), the proposed language accurately and more succinctly reflects the present contents of § 173.401(b)(2) and (b)(3). In regard to paragraph (b)(3) the proposed language is intended to codify actual practice. In regard to paragraph (b)(4), the proposed language 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 propose to revise this section by removing the definitions for ''Non-fixed radioactive contamination,'' and ''Fissile material, controlled shipment,'' and revising the definitions for ''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),'' ''Exemption value'', and ''Quality assurance'' would be added.

The following definitions would be removed:

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

Fissile material, controlled shipment. We propose to remove 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 would be revised:

Exclusive use. We propose to clarify that a vehicle survey is required under certain circumstances after use.

Fissile material. We propose to revise 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. Plutonium-238 would be removed 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 propose to revise 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. This definition would be revised 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 propose to revise this definition to align the HMR with the wording in TS–R–1 and 10 CFR 71.4.

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

Package. We propose to revise 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 proposing to include the caveat that if the contents are fissile, additional requirements must be satisfied. In addition, the definitions of types of packages would be 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. Finally, the revision of the definition of Package would include the addition of the definition for the proposed NRC Type B(DP) package.

Radioactive contents. We propose to revise this definition to be consistent with TS–R–1.

Radioactive material. We propose to revise 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 notice under Issue No. 1.)

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

Surface Contaminated Object (SCO). We propose to revise this definition for clarity.

Transport Index. We propose to revise this definition 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 propose to revise this definition by adding the word ''design.'' The Competent Authority approval for a package is actually for the package design.

Unirradiated uranium. We propose to revise this definition to be consistent with TS–R–1.

Uranium—natural, depleted, or enriched. We propose to revise 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 propose to add the following definitions:

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

Contamination. We propose to add this definition for consistency with TS–R–1. The proposed 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 would be added to be consistent with TS–R–1. The introduction of the CSI is intended to simplify the representation on labels, and in 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.

Exemption value. This definition would be 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 if from a DOT exemption, defined in § 171.8.

Fissile material package. This definition would be 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 would be added to be consistent with TS–R–1. (See discussion under the definition for ''contamination'' above.)

Quality assurance (QA). This definition would be 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 USNRC 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 would 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 propose to revise 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 propose to revise paragraph (a) to clarify that after April 1, 1997, the use of Specification 7A packagings designed in accordance with the requirements of § 178.350 in effect on October 1, 1996 would continue to be authorized.

Section 173.416

We propose to remove paragraphs (d), (e) and (f) to discontinue the use of DOT Specification 20WC and 21WC as authorized Type B packaging. We also propose to revise paragraph (c) to discontinue the use of DOT Specification 6M as an authorized Type B package, and to specify that 2 years after the effective date of the final rule, these DOT Specification packages may no longer be used.

Section 173.417

We propose to remove 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 also propose to add a new paragraph (c) to specify that 2 years after the effective date of the final rule, these packages may no longer be used. Tables 2, 4, and 5 would be removed. Tables 3 and 6 would be redesignated as Tables 2 and 3, respectively. Paragraphs (a)(3), (a)(4), (a)(5), (a)(7) and (a)(8) would be redesignated as (a)(1) through (a)(5), respectively, and (b)(3), (b)(4), and (b)(5) as (b)(1) through (b)(3). The new paragraphs (a)(3) and (b)(2) would have the references to Safety Series No. 6 changed to No. TS–R–1. The new paragraph (a)(4) would be revised to include the greater than 0.1 kg of uranium hexafluoride provision. The proposed NRC Type B(DP) packaging would be added to new paragraph (b)(1), and Type B packagings would be removed from the new paragraphs (a)(2), (a)(3), (b)(1) and (b)(2).

Section 173.420

We propose to revise § 173.420 to introduce new performance packaging requirements for packagings containing more than 0.1 kg of UF_6 to include ISO Standard 7195 as an alternative to American National Standard N14.1.

Section 173.421

We propose to revise 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 propose to eliminate the requirement in § 173.422(a) for a certification statement for such packages. In addition, we are proposing to add the requirement that excepted packages be marked with the UN identification number, and to remove 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.

Section 173.424

We propose to revise § 173.424 to indicate that an excepted package containing a radioactive instrument or article is not excepted from all marking requirements. In addition, we propose to require each instrument or article, except radio luminescent time-pieces or devices, to be transported in an excepted package bearing the marking ''RADIOACTIVE,'' and that the active material in an instrument or article containing radioactive material be completely enclosed by the non-active components.

Section 173.426

We propose to revise § 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 propose to revise § 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 proposing to revise this section to authorize the transportation of unpackaged LSA–I and SCO–I material, and to remove the present exception for LSA material and SCO conforming to the provisions specified in 10 CFR 20.2005.

Section 173.428

We propose to revise § 173.428 to include a requirement for marking an empty package with the UN identification number. We propose to redesignate paragraphs (c), (d) and (e) as (d), (e) and (f). In addition, we propose to add 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 propose to revise paragraph (b) to remove the reference to a Type B package.

Section 173.433

We propose to revise § 173.433 to reference the nuclide-specific exemption values, and clarify how these may be calculated for mixtures. We also propose to revise 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 propose to replace 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 would be retained. In addition, the Safety Series No. 6 values of A_1 and A_2 would be retained for Cf–252.

Section 173.436

In accordance with our proposal to adopt the nuclide-specific exemption values found in TS–R–1, we propose to add a new § 173.436 to contain a table entitled ''Exempt material activity concentrations and exempt consignment activity limits for radionuclides.'' This table, along withaccompanying footnotes, would be taken from Table I of TS–R–1.

Section 173.441

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

Section 173.443

We propose to revise Table 11, in § 173.443 to list the true non-fixed contamination limits for the outer surfaces of packages. In addition, we propose to revise 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 173.448

We propose to revise § 173.448 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 propose to revise § 173.453 to be consistent with the new fissile material exceptions included in NRC rulemaking.

Section 173.457

We propose to simplify 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 propose to revise § 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 propose to remove § 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 173.469

To allow for the substitution of the Class 4 impact test from ISO 2919–1980(E) for the basic impact and percussion tests, we propose to revise paragraph (d)(1) to include the TS–R–1 restriction that the sealed capsule and contents have a mass less than 200 g. In addition, we propose to revise the reference for the alternate leak test methods in paragraph (a)(4)(ii) from ISO/TR 4826–1979(E) to ISO 9978–1992(E), and other minor revisions of syntax would be incorporated in this section to reflect more accurately the wording of TS–R–1.

Section 173.471

We propose to revise 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 propose to revise 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 propose to revise paragraph (c)(4) to specify what the required quality assurance program should cover. In addition, we propose to add 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 propose to add 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 propose to revise paragraph 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 propose to add a new paragraph (d) to emphasize that the appropriate transport restrictions for fissile material packages apply to transport by rail.

Part 175

Section 175.700

We propose to revise 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 propose to add a new paragraph (e) to ensure that on a passenger aircraft neither the total TI nor the total CSI exceeds 50.

Section 175.702

We propose to revise § 175.702 to include the requirements for non-exclusive use cargo aircraft only, based on the separate TS–R–1 limits on total transport index and total criticality safety index.

Section 175.703

We propose to add a new paragraph (c) to emphasize that the appropriate transport restrictions for fissile material packages also apply to transport by air. Current paragraphs (c), (d), and (e) would be redesignated paragraphs (d), (e), and (f) respectively, and the redesignated paragraph (d) would be revised to replace the reference to fissile material, controlled shipment with requirements for exclusive use shipments by air.

Part 176

Section 176.700

We propose to remove paragraph (c) due to the proposed elimination of the term ''fissile material, controlled shipment. Paragraphs (d) and (e) would be 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 would be moved to § 176.704.

Section 176.704

We propose to revise § 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 indexes and criticality safety indexes. We also propose to replace Table III with Table IIIA to list ''Transport Index Limits'' and Table IIIB for the ''Criticality Safety Index Limits.'' In addition, we propose to add 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 propose to revise § 176.708 to provide a 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 also propose to restrict the use of this alternate method to the case of exclusive use shipments, for which the proposed § 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, in paragraph (g), a reference to transport index for fissile material packages would be replaced by one to criticality safety index.

Part 178

Section 178.350

In § 178.350, paragraph (b) would be revised to remove the wording ''and Radioactive Material'' from the marking requirement. It is duplicative since all proposed proper shipping names include the words ''Radioactive Material.'' In addition, we propose to add a new paragraph (c) to require that each Specification 7A package be marked with the manufacturer's or offeror's name.

Section 178.352

As a result of our proposal to discontinue the use of DOT Specification 6L metal packagings as an authorized fissile material packaging, we propose to remove in its entirety § 178.352.

Section 178.354

As a result of our proposal to discontinue the use of DOT Specification 6M metal packagings as an authorized Type B and fissile material packaging, we propose to remove in its entirety § 178.354.

Section 178.362

As a result of our proposal to discontinue the use of DOT Specification 20WC wooden protective jacket as an authorized Type B packaging, we propose to remove in its entirety § 178.362.

Section 178.364

As a result of our proposal to discontinue the use of DOT Specification 21WC wooden-steel protective overpack as an authorized Type B packaging, we propose to remove in its entirety § 178.364.

IV. Regulatory Analyses and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

This proposed 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 proposed 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 proposed changes in this notice, we looked to the ''Draft 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 notice of proposed rulemaking. A copy of that document is available for review in this docket (RSPA–99–6283).

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

The NUREG/CR–6713 analysis of regulatory proposals 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, then it is likely that the current packagings will not meet the standards proposed in this NPRM. 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, we do not think these potential costs should weigh heavily in our determination to propose 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.

Numerical data for most of the proposed changes are difficult to obtain. Therefore, we invite all commenters to address the issues discussed in this NPRM. For persons required to comply with the HMR, can you quantify any increases or decreases in costs resulting from the proposals in this NPRM? Can you quantify any benefits that may result?

B. Executive Order 13132

This proposed rule has been analyzed in accordance with the principles and criteria contained in Executive Order 13132 (''Federalism''). This proposed rule would preempt State, local and Indian tribe requirements but does not propose 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 proposed rule concerns the classification, packaging, marking, labeling, and handling of hazardous material, among other covered subjects and would preempt any State, local, or Indian tribe requirements not meeting the ''substantively the same'' standard. This proposed rule is necessary to incorporate changes already adopted in international standards. If the changes proposed in this NPRM are not adopted in the HMR, 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 proposed changes 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. We propose that the effective date of Federal preemption will be 180 days from publication of a final rule in the **Federal Register**.

C. Executive Order 13175

This proposed 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 proposed 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

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. This proposed rule would incorporate changes introduced in the 1996 edition (revised) of the IAEA Regulations For The Safe Transport of Radioactive Material, TS–R–1. It would apply to offerors and carriers of radioactive materials and would facilitate the transportation of hazardous materials in international commerce by providing consistency with international requirements. Alternatively, if we do not so revise the HMR, U.S. companies will be forced to comply with a dual system of regulation, to their economic disadvantage, and to the cause of decreased safety in transportation attributed to the complexity of having to comply with multiple sets of regulations. The proposed changes are intended to avoid this result.

Many of the persons subject to revisions of the HMR proposed in this NPRM are small businesses. They comprise a wide variety of shippers and carriers, including nuclear pharmacies, as well as packaging manufacturers, and manufacturers of measuring instruments and other articles that contain radioactive materials. To a large extent the greatest impact on these small entities concerns proposed requirements for hazard communication, e.g., 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 (radioactive) material, and a new labeling requirement to communicate the criticality safety index of packages containing fissile materials. These proposed revisions to the HMR obviously affect the administrative procedures of shippers, carriers, and the like, and it will require retraining of hazmat employees, but none are expected to have an adverse effect on core business operations.

In addition to revisions to hazard communication requirements, currently authorized packagings conforming to specification DOT 6L, 6M, and UN standard packaging 1A2 used for the transportation of fissile radioactive materials would be prohibited under the proposed rule, thereby requiring the manufacturers of these packaging designs to requalify their packagings to conform to NRC requirements for fissile materials or to utilize other packages which conform to those requirements. The NRC approval process requires the packaging manufacturer to pay a fee to the NRC for its technical review of the design and test results, but again we believe that fee is not so great as to cause manufacturers to discontinue a line of packagings, much less adversely affect the manufacturer's ability to continue to exist as a going concern. The proposed phase-in period of 2 years following the effective date of a final rule for continued use of currently authorized packagings should provide for a smooth transition to the NRC approval process.

Several commenters to the advance notice of proposed rulemaking noted that one of the requirements in TS–R–1 would require placarding of each transport vehicle containing any quantity of a Class 7 (radioactive) material. Incorporating that requirement into the HMR would impose numerous, potentially costly, requirements on shippers and carriers. That includes a requirement that all operators of motor vehicles have a commercial driver's license, and the carrier would be required to file a registration statement with RSPA and pay an annual fee. Over the years, we examined the need for placarding of transport vehicles carrying any quantity of radioactive material and in each instance we determined that is unnecessary. As background materials used in the development of TS–R–1 provide no new justification for placarding for any quantity of radioactive material, we find ourself in agreement with commenters to the docket and we are not now proposing such a requirement for domestic shipments.

In consideration of the above, and on the basis of the NUREG/CR–6713 analysis of regulatory proposals prepared for the NRC in support of its associated notice of proposed rulemaking, I hereby certify that this proposal will not, if promulgated, have a significant economic impact on a substantial number of small entities. This certification is subject to modification as a result of a review of comments received in response to this proposal. A copy of NUREG/CR–6713 is available for review in this docket (RSPA–99–6283).

E. Paperwork Reduction Act

RSPA has a current information collection approval under OMB No. 2137–0510, Radioactive (RAM) Transportation Requirements, with 14,480 burden hours and $117,270.60 annual cost for burden. RSPA believes that this proposed rule may result in an increase in annual burden hours and costs. If these proposals are finalized, the current approval would be required to be revised and resubmitted to OMB for extension and re-approval.

Section 1320.8(d), Title 5, Code of Federal Regulations requires that RSPA provide interested members of the public and affected agencies an opportunity to comment on information collection and recordkeeping requests. This notice identifies information collection that RSPA is submitting to OMB for extension and re-approval based on the requirements in this proposed rule. RSPA has revised burden estimates, where appropriate, to reflect current reporting levels or adjustments based on changes in this proposed rule since the information collection was last approved. RSPA estimates that the total information collection and recordkeeping burden as proposed in this rule would be revised as follows:

OMB No. 2137–0510: 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.

RSPA specifically requests comments on the information collection and recordkeeping burdens associated with developing, implementing, and maintaining these requirements for approval under this proposed rule.

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.

Written comments should be addressed to the Dockets Unit as identified in the **ADDRESSES** section of this rulemaking. Comments should be received prior to the close of comment period identified in the **DATES** section of this rulemaking. Under the Paperwork Reduction Act of 1995, no person is required to respond to an information collection unless it displays a valid OMB control number. If these proposed requirements are adopted in a final rule, RSPA will submit the revised information collection and recordkeeping requirements to the Office of Management and Budget for approval.

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 proposed 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, February 2000, 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 proposed rule. A copy of the environmental assessment prepared by the NRC is available for review in the docket.

List of Subjects

49 CFR Part 171

Exports, Hazardous materials transportation, Hazardous waste, Imports, 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, 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 proposed to be amended as follows:

PART 171—GENERAL INFORMATION, REGULATIONS, AND DEFINITIONS

1. The authority citation for part 171 would continue to read as follows:

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

2. In § 171.7, in the paragraph (a)(3) table make the following amendments:

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'' would be 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'' would be removed and a new entry would be 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'', ''ISO 1496–3 Series 1 freight containers-Specification and testing, Part 3: Tank containers for liquids, gases and pressurized dry bulk, March 1, 1995, Fourth Edition'' and ''ISO 1496–3–1995(E)—Series 1 Freight Containers—Specification and Testing—Part 3: Tank Containers for Liquid, Gases and Pressurized Dry Bulk'' would be removed and two new entries added in alpha-numeric order, and the entries ''ISO–7195:1993(E)—packaging of uranium hexafluoride (UF_6) for transport, November 1, 1993, First

Edition'' and ''ISO 9978:1992 (E)—Radiation protection—Sealed radioactive sources—Leakage test methods, February 15, 1992, First Edition'' would be added in alpha-numeric order; and

d. A new entry for ''United States Enrichment Corporation, Inc. (USEC) would be 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	49 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, 173.473
* * * * * * *	
International Organization for Standardization * * *	
* * * * * * *	
ISO 1496–1: 1990(E)—Series 1 freight containers—Specification and testing, Part 1: General cargo containers, August 15, 1990, Fifth Edition.	173.411
ISO 1496–3: 1995(E)—Series 1 freight containers—Specification and testing, Part 3: Tank containers for liquids, gases and pressurized dry bulk, March 1, 1995, Fourth Edition.	178.274
* * * * * * *	
ISO–7195: 1993(E)—Packaging of uranium hexafluoride (UF_6) for transport, November 1, 1993, First Edition	173.420
* * * * * * *	
ISO 9978: 1992(E)—Radiation protection—Sealed radioactive sources—Leakage test methods, February 15, 1992, First Edition.	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) would be removed and paragraphs (d)(6)(iii) and (d)(6)(iv) would be 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 or 173.426 of this subchapter, as appropriate.

* * * * *

4. In § 171.12, paragraphs (d) introductory text and (d)(4) would be revised, the semi-colon at the end of paragraph (d)(5) would be removed and ''; and'' would be added in its place, ''; and'' at the end of paragraph (d)(6) would be removed and a period would be added in its place, and paragraph (d)(7) would be removed 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 (see § 171.7), if—

* * * * *

(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;

* * * * *

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

5. The authority citation for part 172 would continue to read as follows:

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

6. In § 172.101, the Hazardous Materials Table would be 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 numbers	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				A	
		*	*		* *	*	*		*				
	Radioactive material, excepted package—empty packaging.	7	UN2908		Empty		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	W7	421, 422, 428.	427				A	95
	Radioactive material, low specific activity (LSA–II) *non fissile or fissile-excepted*.	7	UN3321		7	W7	421, 422, 428.	427				A	95
	Radioactive material, low specific activity (LSA–III) *non fissile or fissile-excepted*.	7	UN3322		7	W7	421, 422, 428.	427				A	95
		*	*		* *	*	*		*				
	Radioactive material, surface contaminated objects (SCO–I *or* SCO–II) *non fissile or fissile-excepted*.	7	UN2913		7		421, 422, 428.	427				A	95
	Radioactive material, transported under special arrangement, *non fissile or fissile excepted*.	7	UN2919		7	139							
	Radioactive material, transported under special arrangement, fissile.	7	UN3331		7	139							
	Radioactive material, Type A package, fissile *non-special form*.	7	UN3327		7	W7, W8	453	417				A	95
	Radioactive material, Type A package *non-special form, non fissile or fissile-excepted*.	7	UN2915		7	W7, W8		415				A	95
	Radioactive material, Type A package, special form *non fissile or fissile-excepted*.	7	UN3332		7	W7, W8		415, 476				A	95
	Radioactive material, Type A package, special form, fissile.	7	UN3333		7	W7, W8	453	417, 476				A	
	Radioactive material, Type B(M) package, fissile.	7	UN3329		7		453	417				A	
	Radioactive material, Type B(M) package *non fissile or fissile-excepted*.	7	UN2917		7			416				A	95
	Radioactive material, Type B(U) package, fissile.	7	UN3328		7		453	417				A	
	Radioactive material, Type B(U) package *non fissile or fissile excepted*.	7	UN2916		7			416				A	95
	Radioactive material, uranium hexafluoride *non fissile or fissile-excepted*.	7	UN2978		7, 8		423	420				A	95
	Radioactive material, uranium hexafluoride, fissile.	7	UN2977		7, 8		453	417, 420				A	
		*	*		* *	*	*		*				
	[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		453	417	417			A	40, 95
D	Radioactive material, low specific activity, n.o.s. *or* Radioactive material, LSA, n.o.s..	7	UN22912		7		421, 428	427	427			A	95
D	Radioactive material, n.o.s	7	UN2982		7		421, 428	415, 416	415, 416			A	40, 95
D	Radioactive material, special form, n.o.s	7	UN2974		7		421, 424	415, 416	415, 416			A	95
D	Radioactive material, surface contaminated object *or* Radioactive material SCO.	7	UN2913		7		421, 424, 426.	427	427			A	95
D	Thorium metal, pyrophoric	7	UN2975		7, 4.2		None	418	None	Forbidden	Forbidden	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				
D	Uranium, hexafluoride, fissile (*with more than 1 percent U–235*).	7	UN2977		7, 8		453	417, 420	417, 420			A	95
D	Uranium metal, pyrophoric	7	UN2979		7, 4.2		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) would be 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 fissile package:

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

(ii) For a fissile material package, the criticality safety index.

(7) For a package approved by the U.S. Department of Energy (DOE) or U.S. Nuclear Regulatory Commission (USNRC), a notation of the package identification marking as prescribed in the applicable DOE or USNRC 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'' must be entered in association with the basic description when all or a portion of the shipment is by highway.

* * * * *

8. In § 172.301, paragraph (a)(1) would be revised to read as follows:

§ 172.301 General marking requirements for non-bulk packages.

(a) *Proper shipping name and identification number.* (1) Except as otherwise provided by this subchapter, each person who offers for transportation a hazardous material in a non-bulk packaging shall mark the package with the proper shipping name and identification number (preceded by ''UN'' or ''NA'', as appropriate) for the material as shown in the § 172.101 Table. Except for Class 7 (radioactive) material, identification numbers are not required on packages which contain only limited quantities, as defined in § 171.8 of this subchapter, or ORM–D materials. Excepted packages of Class 7 (radioactive) material (see §§ 173.421, 173.422, 173.424, 173.426 and 173.428 of this subchapter) must be marked with the identification number but are excepted from the proper shipping name marking requirement.

* * * * *

9. Section 172.310 would be 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 Industrial Package Type 1, Industrial Package Type 2, Industrial Package Type 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 to part 172.

(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.)

10. In § 172.400, in paragraph (b), the table would be 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 material; see § 172.402).	FISSILE	172.441
* * * *		

* * * * *

11. In § 172.402, paragraph (d) would be revised to read as follows:

§ 172.402 Additional labeling requirements.

* * * * *

(d) *Class 7 (Radioactive) Materials.* Except as otherwise provided in this paragraph (d), 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, overpack, or freight container containing fissile material, other than fissile-excepted material, described in § 173.453 of this subchapter, must bear two FISSILE labels, affixed to opposite sides of the package, which conforms to the figure shown in § 172.441; such labels, where applicable, must be affixed adjacent to the labels for radioactive materials. Overpacks or freight containers containing one or more fissile material packages must bear FISSILE labels. Labels must not cover the markings specified in §§ 172.301, 172.302, and 172.310.

* * * * *

12. In § 172.403, paragraph (e) would be added, paragraphs (g)(1) and (g)(2) would be revised, and paragraph (h) would be 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.

* * * * *

(h) When one or more packages of Class 7 (radioactive) material are placed within the same outside container or overpack, the outside container or 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 a non-rigid overpack, the transport index must be determined by adding together the transport indices of the Class 7 (radioactive) materials packages contained therein.

(4) For a rigid overpack, the transport index must be determined by:

(i) Adding together the transport indices of the Class 7 (radioactive) materials packages contained in the overpack; or

(ii) Direct measurements 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.

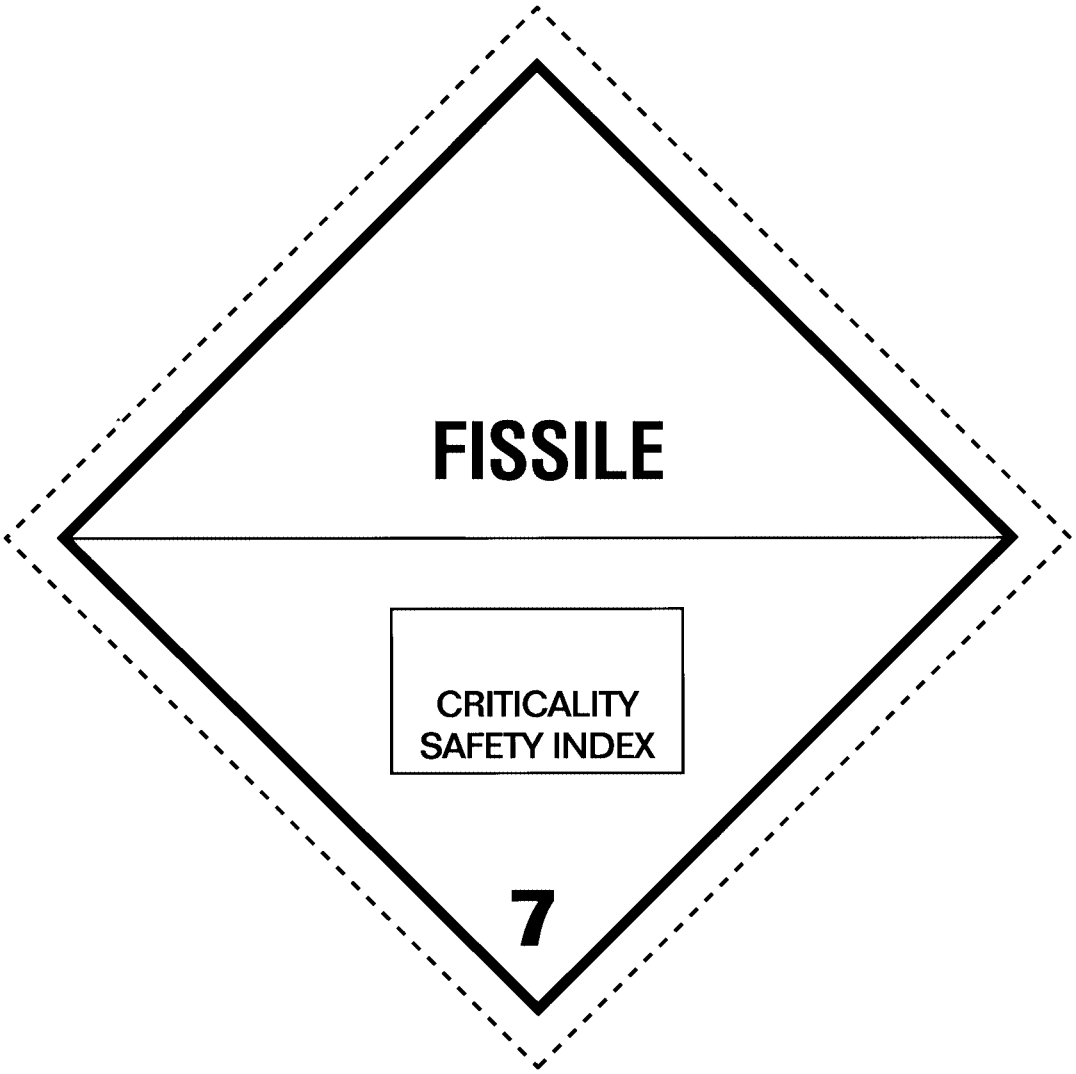
(5) The category of Class 7 label for the overpack must be determined from the table in § 172.403(c) using the TI derived according to paragraph (c)(3) or (c)(4) of this section, and the maximum surface radiation level on the interior package or packages. The maximum radiation level on the external surface of the overpack may be used for this purpose only if the overpack has been demonstrated to satisfy the packaging requirements for the package type appropriate for the totality of its contents.

(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 U.S. NRC or the U.S. Competent Authority.

13. A new § 172.441 would be 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

14. The authority citation for part 173 would continue to read as follows:

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

15. In § 173.401, paragraphs (b)(2) and (b)(3) would be revised and paragraphs (b)(4) would be added to read as follows:

§ 173.401 Scope.

* * * * *

(b) * * *

(2) Class 7 (radioactive) materials that have been implanted or incorporated into 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.

16. In § 173.403, the definitions for ''Fissile material, controlled shipment'' and ''Non-fixed radioactive contamination'' would be removed; definitions for ''Exclusive use,'' ''Fissile material,'' ''Low Specific Activity (LSA) material'' paragraphs (1), (2), and (3), ''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 (TI),'' ''Unilateral approval,'' ''Unirradiated uranium,'' and ''Uranium—natural, depleted or enriched'' would be revised; and the definitions for ''Consignment,'' ''Contamination,'' ''Criticality Safety Index (CSI),'' ''Exemption value,'' and ''Quality assurance'' would be added in appropriate alphabetical order, to read as follows:

§ 173.403 Definitions.

* * * * *

Consignment means each shipment of a package or group of packages or load of radioactive material offered by a shipper for 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. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in § 173.443.

* * * * *

Criticality Safety Index (CSI) means a number 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.

* * * * *

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 in writing, for maintenance of exclusive use shipment controls, including the vehicle survey requirement of § 173.443 (c) as applicable, and include them 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 to be distinguished 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.

* * * * *

Low Specific Activity (LSA) material

* * *

(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 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) 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 average specific activity of the solid 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.

* * * * *

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/cm^2 (100 lb/in^2) 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) ''Type B(DP) package'' means a dual purpose packaging intended for both the transport and storage of spent fuel, together with its radioactive contents. A package may be used as a Type B(DP) package only if the U.S. Nuclear Regulatory Commission has issued separate Certificates of Compliance for it approving its design as a spent fuel transportation package, in accordance with the requirements of subpart I of 10 CFR part 71, and approving its design as a spent fuel storage cask, in accordance with the requirements of subpart L of 10 CFR part 72.

(6) ''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, a Type B(M)F package, or a Type B(DP) package.

* * * * *

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.

* * * * *

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

* * * * *

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).

* * * * *

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 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 (10^{-4} microcurie/cm^2) for beta, gamma and low toxicity alpha emitters, or 0.4 Bq/cm^2 (10^{-5} microcurie/cm^2) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 (1.0 microcurie/cm^2) for beta, gamma and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 (0.1 microcurie/cm^2) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4x10^4$ Bq/cm^2 (1 microcurie/cm^2) for beta, gamma and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 (0.1 microcurie/cm^2) 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 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 400 Bq/cm^2 (10^{-2} microcurie/cm^2) for beta, gamma and low toxicity alpha emitters, or 40 Bq/cm^2 (10^{-3} microcurie/cm^2) for all other alpha emitters;

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

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

* * * * *

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

* * * * *

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 paragraph (1) of this definition, a very small mass percentage of uranium-234 is present.

17. In § 173.411, paragraph (b)(5)(ii) would be 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—Specifications and Testing—Part 1 :

General Cargo Containers,'' excluding dimensions and ratings (see § 171.7 of this subchapter);

* * * * *

18. In § 173.415, paragraphs (a), (c) and (d) would be 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'' (see § 171.7 of this subchapter) and bears the marking ''Type A'' and was used for the import of Class 7 (radioactive) materials. Such packagings may be subsequently used for domestic and export shipments of Class 7 (radioactive) materials provided the offeror obtains the applicable 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.

19. In § 173.416, paragraphs (a), (b), and (c) would be revised and paragraphs (d), (e) and (f) would be removed to read as follows:

§ 173.416 Authorized Type B packages.

* * * * *

(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'' (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 [2 Years From Effective Date of Final Rule] if it conforms in all aspects to the requirements of this subchapter in effect on October 1, 2001.

20. Section 173.417 would be revised to read as follows:

§ 173.417 Authorized fissile materials packages.

(a) Except as provided in § 173.453, fissile materials containing not more than A1 or A2 as appropriate, must be packaged in one of the following packagings: (1)(i) A Class 7 (radioactive) material specified in 10 CFR part 71, subpart C, may be packaged in any packaging listed in § 173.415;

(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 (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) Residual ''heels'' 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. Such shipments 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(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), Type B(M), or Type B(DP) 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 and ANSI N14.1 (see § 171.7 of this subchapter); 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 cylinder 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
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 Type B packaging constructed to DOT Specification 6L, 6M, or 1A2, is authorized until [2 Years From Effective Date of Final Rule] if it conforms in all respect to the requirements of this subchapter in effect on October 1, 2001.

21. Section 173.420 would be 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 (see § 171.7 of this subchapter) or International Organization for Standardization (ISO) document ISO 7195 (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) International Organization for Standardization (ISO) document 7195; or

(iv) Section VIII, Division I of the ASME Code (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 and without unacceptable stress;

(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) Packagings for uranium hexafluoride must be periodically inspected, tested, marked and otherwise conform with the American National Standard N14.1or ISO document ISO 7195.

(c) Each repair to a packaging for uranium hexafluoride must be performed in accordance with the American National Standard N14.1 or International Organization for Standardization (ISO) document ISO 7195.

(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.

22. In § 173.421, paragraph (a) introductory text would be 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 7 in § 173.425, and its packaging, are excepted from requirements in this subchapter for specification packaging, labeling, marking (except for the UN identification number), and if not a hazardous substance or hazardous waste, shipping papers, and the requirements of this subpart if:

* * * * *

23. Section 173.422 would be 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 classified in accordance with § 173.29 as Class 7, and is prepared for shipment under the provisions of § 173.421, § 173.424, § 173.426, or § 173.428 is not subject to the requirements of this subchapter, except for the following:

(a) The outside of each package must be marked with the identification number for the material as shown in § 172.101 of this subchapter, the Hazardous Materials Table;

(b) Sections 171.15, 171.16, 174.750 and 176.710 of this subchapter, pertaining to the reporting of incidents and decontamination, when transported by a mode other than air;

(c) Sections 171.15, 171.16, and 175.700(b) of this subchapter, pertaining to the reporting of incidents and decontamination, when transported by aircraft; and

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

24. Section 173.424 would be 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), 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 7 in § 173.425;

(c) The total activity per package does not exceed the relevant limit listed in Table 7 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) Each instrument or article (except radio-luminescent time-piece or devices) bears the marking ''RADIOACTIVE'';

(f) 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);

(g) 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);

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

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

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

25. In § 173.426, the introductory text would be 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 from the requirements in this subchapter for specification packaging, labeling, marking (except for the UN identification number), and if not a hazardous substance or hazardous waste, shipping papers and the requirements of this subpart if:

* * * * *

26. Section 173.427 would be 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 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 9;

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

(4) Packages 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) Packages 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, packages containing less than an A2 quantity are excepted from the marking and labeling requirements of this subchapter. However, the exterior of each package must be stenciled or otherwise marked ''RADIOACTIVE—LSA'' or ''RADIOACTIVE—SCO'', as appropriate, and packages 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 8 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 8;

(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;

(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 8 and 9 are as follows:

TABLE 8.—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

TABLE 9.—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.

27. In § 173.428, the introductory text would be revised, paragraphs (c), (d) and (e) would be redesignated as paragraphs (d), (e) and (f) respectively, and a new paragraph (c) would be 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, marking (except for the UN identification number) 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) would be 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 would be 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, the radionuclide values must be determined in one of the following ways:

(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) the radionuclide values in Tables 10A or 10B of this section may be used; or

(3) an approval issued by the Associate Administrator or, for international transport, multilateral approval.

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

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

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:

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

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:

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

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:

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

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;

$a_{(1)}$ is the activity of radionuclide i in the mixture; and

$A_{(i)}$ is the $A_1$1 or A_2 value, as appropriate for radionuclide i.

(h) Tables 10A and 10B are as follows:

TABLE 10A.—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	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}

TABLE 10A.—GENERAL VALUES FOR A_1 AND A_2—Continued

Radioactive contents	A_1		A_2	
	(TBq)	(Ci)	(TBq)	(Ci)
3. No relevant data are available.	1×10^{-3}	2.7×10^{-2}	9×10^{-5}	2.4×10^{-3}

TABLE 10B.—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 would be 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:

A_1 AND A_2 VALUES FOR RADIONUCLIDES

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}
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		2.0×10^{1}	5.4×10^{2}	4.0×10^{1}	1.1×10^{3}	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	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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
Au-195	Gold (79)	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	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}
Brn82		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		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]	1.1×10^{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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
Cf-251		7.0	1.9×10^{2}	7.0×10^{-4}	1.9×10^{-2}	5.9×10^{-2}	1.6
Cf-252		5.0×10^{-2} (h)	1.35 (h)	3.0×10^{-3} (h)	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}	1.6×101^{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	Curium (96)	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 Cm-246		9.0 9.0	2.4×10^{2} 2.4×10^{2}	9.0×10^{-4} 9.0×10^{-4}	2.4×10^{-2} 2.4×10^{-2}	6.4×10^{-3} 1.1×10^{-2}	1.7×10^{-1} 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}	$4.2\times10-3$
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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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 (63)	Europium	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)		2.0	5.4×10^{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	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	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	4.0×10^{-1}	1.1×10^{1}	4.0×10^{-1}	1.1×10^{1}	2.6×10^{4}	7.0×10^{5}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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)		6.0×101^{-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}
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		1.0 (c)	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^{2}	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	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}	44.4×10^{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)		1.0	2.7×10^{1}	6.0×10^{-1}(i)	1.6×10^{1}(i)	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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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)		2.0×10^{1}	5.4×10^{2}	2.0	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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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}
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^{-2}
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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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}
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		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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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	Thorium(90)	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}	1.0×10^{-1}	2.7	1.0×10^{3}	2.7×10^{4}
U-230 (slow lung absorption) (a)(f).		4.0×10^{1}	1.1×10^{3}	1.0×10^{-1}	2.7	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}	1.0×10^{-2}	2.7×10^{-1}	8.3×10^{-1}	2.2×10^{1}
U-232 (slow lung absorption) (f).		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-233 (fast lung absorption) (d).	Uranium (92)	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}	9.0×10^{-2}	2.4	3.6×10^{-4}	9.7×10^{-3}
U-233 (slow lung absorption) (f).		4.0×10^{1}	1.1×10^{3}	9.0×10^{-2}	2.4	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}	9.0×10^{-2}	2.4	2.3×10^{-4}	6.2×10^{-3}
U-234 (slow lung absorption) (f).		4.0×10^{1}	1.1×10^{3}	9.0×10^{-2}	2.4	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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
U-236 (fast lung absorption) (d).	.....	Unlimited	Unlimited	Unlimited	Unlimited	2.4×10^{-6}	6.5×10^{-5}
U-236 (medium lung absorption) (e).	.....	Unlimited	Unlimited	Unlimited	Unlimited	2.4×10^{-6}	6.5×10^{-5}
U-236 (slow lung absorption) (f).	.....	Unlimited	Unlimited	Unlimited	Unlimited	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	§173.434	§173.434
U (dep)	.....	Unlimited	Unlimited	Unlimited	Unlimited	§173.434	§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	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 (79)	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}

A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

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)
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 he×avalent 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 would be added to read as follows:

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

The table of exempt activity concentrations and exempt consignment activity limits for radionuclides is as follows:

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

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 (a)	Actinium (89)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Ac-227 (a)		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 (a),(b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ag-110m (a)		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 (a),(b)		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Am-243 (a),(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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
At-211 (a)	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 (a)	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 (a),(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 (a)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Bi-212 (a),(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 (a)		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 (a)		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 (a)		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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
Ce-143		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Ce-144 (a),(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 (a)		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}
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 (a)		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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
Cs-137 (a), (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 (a)		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^{3}	2.7×10^{-8}	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-152 m		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 (a)	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 (a)		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 (a)	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 (a)	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 (a)	Hafnium (72)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
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 (a)	Mercury (80)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Hg-195m(a)		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}
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 (a)		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 (a)		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 (a)	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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
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 (a)	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 (a)		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^{3}	2.7×10^{-8}	1.0×10^{7}	2.7×10^{-4}
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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
Os-193		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}
Os-194 (a)		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 (a)	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 (a),(b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Pb-212 (a),(b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Pd-103 (a)	Palladium (46)	1.0×10^{3}	2.7×10^{-8}	1.0×10^{8}	2.7×10^{-3}
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 (a)		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 (a)	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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
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 (a)		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 (a)		1.0	2.7×10^{-11}	1.0×10^{4}	2.7×10^{-7}
Ra-223 (a)	Radium (88) (b)	1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6} (b)
Ra-224 (a),(b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Ra-225 (a)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Ra-226 (a),(b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
Ra-228 (a),		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 (a)		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 (a)		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 (a),(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 (a)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{6}	2.7×10^{-5}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
Ru-105		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Ru-106 (a),(b)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
S35	Sulphur (16)	$1.0x10^{5}$	$2.7x10^{-6}$	$1.0x10^{8}$	$2.7x10^{-3}$
Sb-122	Antimony (51)	$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{4}$	$2.7x10^{-7}$
Sb-124		$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sb-125		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sb-126		$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{5}$	$2.7x10^{-6}$
Sc-44	Scandium (21)	$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{5}$	$2.7x10^{-6}$
Sc-46		$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sc-47		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sc-48		$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{5}$	$2.7x10^{-6}$
Se-75	Selenium (34)	$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Se-79		$1.0x10^{4}$	$2.7x10^{-7}$	$1.0x10^{7}$	$2.7x10^{-4}$
Si-31	Silicon (14)	$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{6}$	$2.7x10^{-5}$
Si-32		$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sm-145	Samarium (62)	$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{7}$	$2.7x10^{-4}$
Sm-147		$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{4}$	$2.7x10^{-7}$
Sm-151		$1.0x10^{4}$	$2.7x10^{-7}$	$1.0x10^{8}$	$2.7x10^{-3}$
Sm-153		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sn-113	(a)Tin (50)	$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{7}$	$2.7x10^{-4}$
Sn-117m		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sn-119m		$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{7}$	$2.7x10^{-4}$
Sn-121m (a)		$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{7}$	$2.7x10^{-4}$
Sn-123		$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sn-125		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{5}$	$2.7x10^{-6}$
Sn-126 (a)		$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{5}$	$2.7x10^{-6}$
Sr-82 (a)	Strontium (38)	$1.0x10^{1}$	$2.7x10^{-10}$	$1.0x10^{5}$	$2.7x10^{-6}$
Sr-85		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sr-85m		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{7}$	$2.7x10^{-4}$
Sr-87m		$1.0x10^{2}$	$2.7x10^{-9}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sr-89		$1.0x10^{3}$	$2.7x10^{-8}$	$1.0x10^{6}$	$2.7x10^{-5}$
Sr-90 (a),(b)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{4}	2.7×10^{-7}
Sr-91 (a)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
Sr-92 (a)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
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 (a)	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 (a)		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 (a)		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 (a)		1.0×10^{3}	2.7×10^{-8}	1.0×10^{6}	2.7×10^{-5}
Te-131m (a)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Te-132 (a)		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 (a),(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 (a),(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 (a)	Titanium (22)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
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) (a),(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) (a),(e).		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
U–230 (slow lung absorption) (a),(f)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}
U-232 (fast lung absorption) (b),(d)	Uranium (92)	1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
U-232 (medium lung absorption) (e)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
U-232 (slow lung absorption) (f)		1.0	2.7×10^{-11}	1.0×10^{3}	2.7×10^{-8}
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^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-233 (slow lung absorption) (f)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
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^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-234 (slow lung absorption) (f)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
U-235 (all lung absorption types) (a),(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)	Uranium (92)	1.0×10^{1}	2.7×10^{-10}	1.0×10^{4}	2.7×10^{-7}
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 (a)	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}

EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

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)
W-188 (a)		1.0×10^{2}	2.7×10^{-9}	1.0×10^{5}	2.7×10^{-6}
Xe-122 (a)	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 (a)	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 (79)	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 (a)		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 (a)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{6}	2.7×10^{-5}
Zr-97 (a),(b)		1.0×10^{1}	2.7×10^{-10}	1.0×10^{5}	2.7×10^{-6}

Notes:
(a) A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days
(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, Pb212, Bi-212, Tl208 (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
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 he×avalent 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 would be revised, paragraph (d) would be redesignated as paragraph (e) and revised and a new paragraph (d) would be added to read as follows:

§ 173.441 Radiation level limitations and exclusive use provisions.

* * * * *

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

(1) Except for shipments by cargo aircraft only or by seagoing vessel, the sum of transport indexes 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 indexes aboard a single conveyance.

(3) The number of packages, overpacks and freight containers containing Class 7 (radioactive) material being transported under exclusive use or stored in transit in any one storage area must be so limited that the total sum of the transport indexes in any group of packages, overpacks or freight containers does not exceed 50. Groups of packages must be situated so as to maintain a spacing of at least 6 m (20 ft) between the closest surfaces of packages, overpacks or freight containers from any two groups.

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

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

(e) Packages 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) would be revised to read as follows:

§ 173.443 Contamination control.

(a) * * *

(1) Wiping an area of 300 cm^2 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, may not exceed the limits set forth in Table 11 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 11 is as follows:

TABLE 11.—NON-FIXED EXTERNAL RADIOACTIVE CONTAMINATION LIMITS FOR PACKAGES

Contaminant	Maximum permissible limits		
	Bq/cm^2	uCi/cm^2	dpm/cm^2
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. Section 173.448 would be 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.

35. Section 173.453 would be revised to read as follows:

§ 173.453 Fissile materials-exceptions.

The requirements of §§ 173.457 and 173.459 do not apply to packages containing fissile material for which:

(a) The mass ratio of iron to fissile material is greater than 200:1 and the package contents contain less than 15 g of fissile material.

(b) The mass ratio of noncombustible, insoluble-in-water, material (including both the contents and packaging) to fissile material is greater than 2000:1 and the package contents contain less than 350 g 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 mass ratio for the package.

(c) 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 present in the package is less than 0.1 percent of the fissile mass.

(d) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 percent by weight, provided that:

(1) The total plutonium and uranium-233 content does not exceed 0.1 percent of the mass of uranium-235;

(2) The nitrogen to uranium atomic ratio (N/U) is greater than or equal to 2.0; and

(3) The material must be packaged in a DOT Type A package or other specification packaging authorized for radioactive material.

(e) Plutonium with a total mass of less than 1 kg, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 20 percent by mass of the total quantity of plutonium in the package.

36. Section 173.457 would be 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.

37. Section 173.459 would be 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.

38. In § 173.469, paragraphs (a)(4)(ii), (c)(1)(i), (c)(1)(iv), (c)(2)(i), (c)(2)(iv), and (d)(1) would be 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'' (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'' (see § 171.7 of this subchapter); and

* * * * *

39. In § 173.471, the introductory text would be 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 (USNRC) and other requirements of this subchapter, any offeror of a Type B(U), Type B(M), or Type B(DP) or other fissile material

package that has been approved by the USNRC in accordance with 10 CFR part 71 must also comply with the following requirements:

* * * * *

40. In § 173.473, the introductory text would be 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, '' (see § 171.7 of this subchapter) shall also comply with the following requirements:

* * * * *

41. In § 173.476, ''; and'' at the end of paragraph (c)(3) would be removed and a semi-colon would be added in its place, paragraph (c)(4) would be revised and a new paragraph (c)(5) would be 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 transported 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.

* * * * *

42. A new § 173.477 would be 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, to the Associate Administrator. 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

43. The authority citation for part 174 would continue to read as follows:

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

44. In § 174.700, paragraph (b) would be revised, paragraphs (d) through (f) would be redesignated as paragraphs (e) through (g), respectively, and a new paragraph (d) would be 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

45. The authority citation for part 175 would continue to read as follows:

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

46. In § 175.700, paragraph (a) would be revised and a new paragraph (e) would be added to read as follows:

§ 175.700 Special limitations and requirements for Class 7 (radioactive) materials.

(a) In addition to other requirements, no person may carry 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 indexes of all packages in the aircraft does not exceed 50; and

(6) The total sum of criticality safety indexes of all packages in the aircraft does not exceed 50.

* * * * *

(e) Any package or overpack having either a transport index greater than 10, or any consignment having a criticality safety index greater than 50, must be transported only under exclusive use.

47. In § 175.702, the section heading would be revised, and paragraph (b) would be revised to read as follows:

§ 175.702 Requirements for carriage of packages containing Class 7 (radioactive) materials in a non-exclusive use cargo aircraft only.

* * * * *

(b) No person may carry in a non-exclusive use 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 50.0; 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.

48. In § 175.703, paragraph (b) would be revised, paragraphs (c), (d), and (e) would be redesignated as paragraphs (d), (e), and (f) respectively, a new paragraph (c) would be added, and paragraphs (d) and (f) would be 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 § 173.448(g) of this subchapter.

(c) Each shipment of fissile material packages must conform to the requirements of §§ 173.457 and 173.459 of this subchapter.

(d) No person shall carry in an aircraft a fissile material package with a criticality safety index greater than 50, except—

(1) In a cargo aircraft only which has been assigned for the exclusive use of the shipper for the specific shipment of fissile Class 7 (radioactive) material. Instructions for the exclusive use must be developed by the shipper and carrier, and the instructions issued with the shipping papers.

(2) There is no upper limit to the total transport index which may be carried in an exclusive use aircraft; however, radioactive material must be segregated sufficiently from crew members such that crew members in regularly occupied work areas do not receive a dose in excess of 5.0 mSv (500 mrem) in a year.

(3) The total criticality safety index of all of the packages carried in an exclusive use aircraft shall not exceed 100.

* * * * *

(f) 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

49. The authority citation for part 176 would continue to read as follows:

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

§ 176.700 [Amended]

50. In § 176.700, paragraph (c) would be removed, and paragraphs (d) and (e) would be redesignated (c) and (d), respectively.

51. Section 176.704 would be revised to read as follows:

§ 176.704 Requirements relating to transport indexes and criticality safety indexes.

(a) The sum of the transport indexes (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 packages in freight containers, the radiation level may not exceed 2 mSv per hour (200 mrem per hour) at any point on the 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 indexes (CSI's) for all packages of Class 7 (radioactive) materials on board a vessel may not exceed the limits specified in Table IIIB of this section.

(e) Each group of Class 7 (radioactive) material packages, 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 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 indexes 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

TABLE IIIA.—TI LIMITS FOR FREIGHT CONTAINERS AND CONVEYANCES—Continued

Type of freight container or conveyance	Limit on total sum of transport indexes in a single freight container or aboard a conveyance	
	Not under exclusive use	Under exclusive use
ii. Large freight containers	No limit	No limit

[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 indexes 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	[c]200	[d]200
ii. Large freight containers	No limit [c]	No limit [d]

[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.

52. In § 176.708 the section title and paragraphs (a) through (e) would be revised and in note 6 to Table IV in paragraph (f), ''176.704(f)'' would be revised to read ''176.704(g)'' 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 over packs.

(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.

* * * * *

PART 177—CARRIAGE BY PUBLIC HIGHWAY

53. The authority citation for part 177 would continue to read as follows:

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

54. In § 177.842, paragraph (g) would be revised to read as follows:

§ 177.842 Class 7 (radioactive) material.

* * * * *

(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 indexes (CSIs) for packages containing fissile material may not exceed 100.

PART 178—SPECIFICATIONS FOR PACKAGINGS

55. The authority citation for part 178 would continue to read as follows:

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

56. In § 178.350, paragraph (b) would be revised and paragraph (c) would be 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 be marked with the name of the manufacturer, or offeror, in association with marking required by paragraph (b) of this section.

§§ 178.352 and 178.352–1—178.352–6 [Removed]

57. Sections 178.352 and 178.352–1 through 178.352–6 would be removed.

§§ 178.354 and 178.354–1—178.354–5 [Removed]

58. Sections 178.354 and 178.354–1 through 178.354–5 would be removed.

§§ 178.362 and 178.362–1—178.362–7 [Removed]

59. Sections 178.362 and 178.362–1 through 178.362–7 would be removed.

§§ 178.364 and 178.364–1—178.364–6 [Removed]

60. Sections 178.364 and 178.364–1 through 178.364–6 would be removed.

Issued in Washington, DC on March 27, 2002 under authority delegated in 49 CFR part 106.

Frits Wybenga,

Deputy Associate Administrator for Hazardous Materials Safety.

[FR Doc. 02–8143 Filed 4–29–02; 8:45 am]

BILLING CODE 4910–60–P