

ATTACHMENT 1

1999
RATIONALE FOR REVISIONS

PART T
TRANSPORTATION OF RADIOACTIVE MATERIAL

Introduction

Any person who transports radioactive material or delivers radioactive material to a carrier for transport is subject to the requirements for packaging, preparation for shipment and care during shipment which are found in this Part T of the *Suggested State Regulations for Control of Radiation* (SSRCR) of the Conference of Radiation Control Program Directors (CRCPD). Since 1988 the requirements for transportation have been located separate from Part C (Licensing of Radioactive Material) in this Part T.

This 1999 revision of Part T incorporates provisions of the US Department of Transportation and US Nuclear Regulatory Commission which were published September 28, 1995 and became effective April 1, 1996. This revision of Part T also includes corrections published by the US Department of Transportation on May 8, 1996. These revisions made United States regulations compatible with the domestic regulations of most of the international community by bringing United States regulations into accord with relevant portions of the International Atomic Energy Agency design and performance requirements to the extent considered feasible. The US Department of Transportation revisions to Title 49 of the Code of Federal Regulations (CFR) Part 171 begin at 60 Federal Register (FR) 50292. The Nuclear Regulatory Commission changes to 10 CFR Part 71 begin at 60 FR 50248. The May 1996 corrections are at 61 Federal Register 20747-20753.

The Nuclear Regulatory Commission considers the adoption of a regulation equivalent to 10 CFR Part 71 a matter of compatibility for an Agreement State. The various provisions of the 10 CFR Part 71 regulation are assigned different compatibility and health and safety categories. Definitions of each category and the specific category assigned to each provision of 10 CFR Part 71 are set out in US Nuclear Regulatory Commission, Office of State Programs Internal Procedure B.7, Compatibility Categories and Health and Safety Identification for NRC Regulations and Other Program Elements. They reflect the new adequacy and compatibility policy statement approved by the Commission by Staff Requirements Memorandum dated June 30, 1997 (see also 62 FR46517). CRCPD considers regulation of transport of radioactive material essential to a Naturally Occurring and Accelerator Produced Radioactive Material (NARM) Licensing State.

Changes in the federal regulations to achieve compatibility with International Atomic Energy Agency regulations include revisions to the table that establishes the quantities of radioactive material that can be transported in packages not designed to withstand a severe transportation accident. The adopted International Atomic Energy Agency changes increase the number of radionuclides listed in the table from 284 to 378 (so that packaging requirements are more easily determined) and revise the allowable quantities

of certain radionuclides already listed (some allowable quantities were decreased and others were increased).

The International Atomic Energy Agency-related changes simplify the rules for shipment of fissile material (radioactive material that could sustain a chain reaction) by combining the three existing fissile classes into one. The revisions also affect the transportation of "low specific activity" radioactive materials such as uranium ores. Unlimited quantities of these materials can be transported in a Type A package (the radiation level permitted outside the transportation package has been and will continue to be limited). The revised regulations limit the quantity of certain of these materials that can be transported in a Type A package. The restrictions apply, for example, to contaminated resin beads that have been used in nuclear reactors to clean up water that cooled the reactor fuel.

The federal changes involving packages that may be used to transport plutonium by air, added approval criteria previously developed. Public Law 94-79 (also known as the Scheuer Amendment, August 9, 1975) prohibited the Nuclear Regulatory Commission from licensing the air shipment of plutonium in any form until the Nuclear Regulatory Commission certified to Congress that a safe container had been developed. The Nuclear Regulatory Commission subsequently developed and published the criteria in January 1978 and certified the criteria to Congress. Part T mirrors these provisions in T.16.

Key definitions are added to Sec. T.2, or modified, including exclusive use, fissile material, fissile material package, low specific activity material, low toxicity alpha emitters, natural thorium, nuclear waste, surface contaminated object, transport index, Type A package, and uranium-natural, depleted, enriched. A surface contaminated object is not itself classed as radioactive material, but has non-fixed (removable) or fixed radioactive material, or both, on accessible surfaces or possibly on inaccessible surfaces.

The exemption previously in Sec. T.4.c. of the 1988 Part T (brought into Part T from 10 CFR 71.10(b) based on a federal US Department of Transportation-Nuclear Regulatory Commission memorandum of understanding is deleted. An Agreement State or Licensing State would thus retain the full and appropriate authority to oversee shipment or carriage of all packages, including those containing no more than Type A quantities such as low specific activity material or surface contaminated objects.

Sec. T.5 makes more explicit within Part T the parts of the US Department of Transportation requirements which a radiation control program will oversee.

Editorial improvements are made in the general licenses found in Sec. T.6 through Sec. T.12.

International system units are incorporated into Sec. T.15 and TABLE III.

A narrative explanation of the revised A_1 and A_2 values and the values themselves are found in TABLE IV, which refers to TABLES V and VI.

Specific Provisions

Sec. T.1 - Purpose and Scope. The Purpose and Scope was not narrowed by language such as from 10 CFR §71.0(c), since the requirement for a license is in Sec. T.3. This provides broader coverage, recognizes that some states are required to remove the purpose section of the Suggested State Regulations, and avoids putting prohibitions in a statement of scope or purpose.

Part T uses "delivers radioactive material to a carrier for transport," which varies slightly from US Department of Transportation's "offering to," then signing for and "accepting for" transport.

Sec. T.2 - Definitions. Definitions which are not unique or integral to Part T and are already included in Part A (12/95) were not included in Part T. Examples are:

- a. A₁;
- b. A₂ (which will be modified slightly in Part A);
- c. licensed material; and
- d. package.

One definition is in Part A (12/95) but is added to Part T because it is commonly used and needed for comparison to normal form radioactive material: "special form radioactive material," which now includes the second continued use clause: "A special form encapsulation designed in accordance with the Nuclear Regulatory Commission requirements in effect on March 31, 1996, and constructed prior to April 1, 1998, may continue to be used." The definition of normal form is modified by adding "and other form" in accord with 49 CFR 173.425 Table 7 usage.

One definition present in Part A is expanded in Part T: "uranium - natural, depleted, enriched" (only depleted uranium is defined in Part A).

Former footnote 2 becomes footnote 1 and is slightly modified. This is pursuant to §51 of the Atomic Energy Act, as reflected in the 1983 model state radiation control statute. Part A contains definitions of "special nuclear material" and "special nuclear material in quantities not sufficient to form a critical mass."

Definitions which were present in the 1988 Part T and which were not changed by Part 71 remain in 1998 Part T. For example:

- a. carrier;
- b. closed transport vehicle;
- c. specific activity;
- d. Type A quantity;

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- e. Type B quantity;
- f. Type B package. The 10 CFR 71 definition is complex, referring to §71.13 (previously approved packages), Subpart E, and §71.73. Renumber Type B package footnote 2 and leave as is, since this fits the 71.4 definition (found under package); and
- g. Type B packaging.

Some definitions which were present in the 1988 Part T and were modified by the US Department of Transportation or the Nuclear Regulatory Commission remain in 1998 Part T:

- a. Exclusive use--note slight editorial change from the federal word order to read "by a consignor of a conveyance" so that the referent is "conveyance for which...";
- b. Fissile material (delete "Fissile Class I" and "II" and note that Fissile Class III was not put in Part T previously, based on jurisdiction);
- c. Low specific activity--note slight condensation of first sentence, inclusion of the May 1996 (61 FR 20750) change (from the September 1995 wording) to "distributed throughout" in LSA-II(ii) and LSA-III(i), and that the US Department of Transportation examples are included as foot notes.
- d. Packaging, adding explicit reference to 49 CFR 173, Subpart I;
- e. Regulations of the US Department of Transportation, with the added reference to 49 CFR Parts 390-397; and
- f. Transport index (TI), in which "first decimal place" is replaced with "next tenth"; this makes it clear that the TI has only a tenth place in it.

Some definitions are added to 1998 Part T:

- a. Low toxicity alpha emitters;
- b. Fissile material package, found in 71.4 under package;
- c. Natural thorium, since this definition isn't in Part A;
- d. Normal form radioactive material (not in Part A), for comparison to special form radioactive material definition (in Part A);
- e. Nuclear waste, based on the definition provided by Committee E-26;

- f. Surface contaminated object (SCO). Note addition of a comma after beta instead of "and" in a.i., a.ii., a.iii., b.i., b.ii., b.iii; and
- g. Type A package, including an explicit reference to the appropriate tests.

Some definitions in 10 CFR Part 71 were not included in Part T:

- a. Certificate holder;
- b. Close reflection by water, since this relates to criticality, which is the Nuclear Regulatory Commission's jurisdiction;
- c. Containment system, since this relates to evaluation of a package, not to the use of the package;
- d. Conveyance;
- e. Consignee, consignment, consignor;
- f. Hypothetical accident conditions, since a definition would require paraphrasing 10 CFR §71.73. The phrase is only used in Part T in the definition of "Type B packaging";
- g. Industrial packaging, because a word search of Part T yielded no use of the 49 CFR term;
- h. Maximum normal operating pressure;
- i. Normal conditions of transport, since a definition would require paraphrasing 10 CFR §71.71. The phrase is only used in Part T in the definitions of "Type A package" and "Type B packaging"; and
- j. Optimum interspersed hydrogenous moderation.

Part T does not include from §71.4 "certain exclusions from fissile material controls are provided in §71.53" (see definition of special nuclear material), or from §173.403 "Certain additional exceptions are provided in §173.453."

Sec. T.4 - Exemptions. Sec. T.4.a. is retained in the 1998 Part T, with the term "warehousemen" changed to "warehouse workers."

In the Sec. T.4.b., exemption for low-level materials, "70" Bq/g is used. Note that the obsolete US unit for specific activity is retained in parentheses as 0.002 microcurie per gram, which is widely known as 2 nanocuries per gram.

Sec. T.4.c. and Sec. T.4.d. are omitted. CRCPD Committees SR-1 and E-26 (Radioactive Materials Transportation) agreed with Department of Transportation reviewers of Part T that Sec. T.4.c. is not

needed. The Department of Transportation encourages states to implement all of 49 CFR. To not include this exemption preserves a state radiation control program's ability to inspect Type A quantity transport.

The 1988 Part T exemption language could be retained at a state's option. Committee SR-1 consciously choose not to include it in brackets. Note that this would require the addition of low specific activity and surface contaminated object wording from the federal rules. If it can be obtained, the redline-strikeout version provided to the CRCPD Board of Directors shows the appropriate phrasing.

Part T does not include in Sec. T.4 language paraphrasing old 10 CFR §71.9 entitled "Exemption of Physicians."

- a. The Nuclear Regulatory Commission has had this provision for many years.
- b. Many states haven't been sure about the advisability of having it.
- c. Physicians in earlier days needed to take material between hospitals.
- d. New types of material are being transported by doctors now.
- e. The exemption applied to direct possession by the physician.
- f. Health and safety considerations (communication in case of an accident) mitigate against adding this exemption.
- g. Little need exists for the exemption, which is likely to apply or be needed in very few situations.
- h. This is better handled as an authorized user on a specific radioactive material license.
- i. Physicians need to comply with the same transportation regulations as anyone else.

Sec. T.5 - Transportation of Licensed Material. Sec. T.5 incorporates slightly revised wording from 10 CFR §71.5, adding "particularly" to T.5.a.i, reference to 49 CFR 172 Subpart H regarding hazardous material employee training, and citing D.906e in T.5.a.iii.

For Sec. T.5.b, the Department of Transportation authority under the federal hazardous materials transportation law is limited to transportation of hazardous materials in commerce. Transport by government agencies, in their own vehicles, using government agency drivers and not involved in commercial activities, is not subject to the 49 CFR. Also, at present, intrastate and non-placardable loads are exempt from 49 CFR. By citing 49 CFR 170-189, Committee SR-1 makes explicit the Nuclear Regulatory Commission's reference to §71.5(a) and limits the appearance of saying "if the regulations don't apply, they do apply." The E-26 Committee agreed that this provision be retained to regulate (in accord with 49 CFR Parts 170 through 189) the DOE shipments not subject to all of 49 CFR.

Sec. T.6 - General Licenses for Carriers. Regarding footnote 3, Committee SR-1 concurs with the wording recommended by Committee E-26: "Notification of incidents shall be filed with, or made to, the Agency as prescribed in 49 CFR, regardless of and in addition to notification made to the US Department of Transportation or other agencies."

Sec. T.7 - General License: Nuclear Commission-Approved Packages. T.7 is modified by adding "Nuclear Regulatory Commission-" to the title, deleting "of the Agency," retaining the former Part T lead-in phrase "Has a copy of the specific license, ...", and replacing the 1988 T.7.d. with §71.12(e) language, including the April 1, 1996 date.

Sec. T.8 - General License. Sec. T.8 is modified by changing the title, because T.8.b. is about low specific activity, inserting "identification number of the Nuclear Regulatory Commission" before "Certificate," explicitly citing §71.85(c), changing T.8.a.ii. to match §71.13(a)(2), adding §71.13(a)(3), with commas around "and legibly and durably marked on," and adding §71.13(b) as T.8.b.

Sec. T.9 - General License: US Department of Transportation Specification Container. Sec. T.9 is modified by adding "US Department of Transportation" to the title and "for fissile material" after "specification container."

Sec. T.10 - General License: Use of Foreign Approved Package. Sec. T.10 is modified by deleting from T.10.a. "of the Agency," deleting "which has been" and adding "and," adding a comma after word "revalidation" in T.10.c.ii., adding "Has a quality assurance program approved by the Nuclear Regulatory Commission." as §71.10c.iii.

Sec. T.11 - General License: Fissile Material, Limited Quantity Per Package. The title of Sec. T.11 is modified, "in accordance with this Section" is added to Sec. T.11.a., ".4x" is revised to .40x" and in Sec. T.11.c.i., the equation is corrected to " $15/(x+y+z)$ "--the published equation was incorrect (60 FR 50269), and T.11.c.i., ii., and iii. are reformatted.

Sec. T.12 - General License: Fissile Material, Limited Moderator Per Package. The title of Sec. T.12 is changed to match §71.20, and "in accordance with this Section" is added to Sec. T.12.a. In Sec. T.12.b.iii., "150" is corrected to "7.7", and "for example certain hydrocarbon oils" is added to Sec. T.12.b.iv. Phrases conforming to §71.20(c)(6) & (7) were added to Sec. T.12.b.vi. & vii.

Sec. T.13 - Assumptions as to Unknown Properties of Fissile Material. Minor editorial changes are made in Sec. T.13. "Fissile Material" is retained in the title for clarity. The "Applicability" section of 10 CFR 71 Subpart G "Operating Controls and Procedures" is omitted from Sec. T.13, since some states cannot have such a section.

Sec. T.14 - Preliminary Determinations. In Sec. T.14.b., "34.3" is changed to "35" and "psi" is changed to "foot pounds per square inch," not "lbf/in²" as is found in the federal rule. In T.14.d., "serial number" is added.

Sec. T.15 - Routine Determinations. SR-1 explicitly decided not to add §71.87(g). This was in the former Part 71 and left out on purpose from the former Part T. Sec. T.15.g. cites §71.45 explicitly. In Sec. T.15.h., the previous Table 3 was modified by adding a Bq/cm² column, retained instead of citing US Department of Transportation 49 CFR §173.443. Sec. T.15.h.i. is reformatted. In Sec. T.15.j.ii., "is in place" is added to the footnote and the last "the" was replaced by "any accessible." The term "non-fixed" has replaced the older term, "removable".

Sec. T.16 - Air Transport of Plutonium. In T.16.b., "74 Bq/g" is changed to "70" as in §71.88(a)(2), with the English units in parentheses. A phrase from §71.88(c) is added to T.16.d.

Sec. T.17 - Shipment Records. Sec. T17 is changed in accord with §71.91(a) by revising "two" years to "3." In T.17.a. "serial number" is added. T.17.b. is edited in accord with §71.91(a)(2), modified to reflect the past tense.

Part T does not include in Sec.T.17 the language from §71.91(a)(5) & (7), nor is the §71.91(b) language about maintaining records available for inspection needed in Part T. §71.91(c) isn't applicable.

Sec. T.18 - Reports. The title to Sec. T.18 does not include "-shipper." In Sec. T.18.a., "approved Type B or fissile" is added before "packaging." "Type B or fissile" is added to Sec.T.18.b. All of §71.95(c) is added to T.18.c.

Sec. T.19 - Advance Notification of Transport of Nuclear Waste. In T.19, the title "Advance Notification of Transport of Nuclear Waste" is retained. The wording of footnote 4 is modified slightly. The wording of T.19.b.ii. is modified to read "into, within or through a state en route." The 1988 Sec. T.19.b.iii. is replaced with §71.97(b)(3). In T.19.f., "identifying the advance notification that is being canceled" is added after "notice."

Sec. T.20 - Quality Assurance Requirements. In Sec. T.20.a., CRCPD Committees E-26 and SR-1 decided to add the phrase "Unless otherwise authorized by the Agency" to give flexibility to states with regard to the requirements for quality assurance. Sec. T.20.e. now requires that quality assurance records be kept three years.

Appendix A The tables are renumbered TABLE IV, TABLE V, and TABLE VI and so referenced in the initial narrative explanation and in the citation to T.6 in TABLE IV related to uranium.

Table IV The May 1996 editorial corrections published by the US Department of Transportation changes in A₁ and A₂ values are included.

Table V Only two significant figures are appropriate in Table V.

Matters for Future Consideration

1. In Sec. T.2 some additional definitions may warrant inclusion in Part T:

- a. conveyance
 - b. consignee, consignment, consignor
 - c. highway route controlled quantity
 - d. hypothetical accident
 - e. normal conditions of transport
 - f. personnel barrier, in relation to the footnote in Sec. T.15.j.ii.
2. Revision of the definition of nuclear waste in Sec. T.2, as it is intended to be used in Sec. T.19.b.i. Part A contains no definition of nuclear waste or nuclear materials (DOE Order 5660.1B itemizes nuclear materials). Spent Nuclear Fuel is not classified as waste. Two alternatives to the definition included in this Part T for consideration are 'radioactive waste in a Type B package' or 'radioactive material in a Type B package'.
 3. Also in Sec. T.2. the part of the definition of surface contaminated object regarding total (fixed plus non-fixed) contamination on an inaccessible surface begs for an answer to the question of how such activity is to be determined.
 4. Sec. T.4.a. may warrant modification depending on changes to Part C. Even though the Nuclear Regulatory Commission defers to the US Department of Transportation within the framework of their existing Memorandum of Understanding, the states are not so obligated.
 5. A few instances are known in which agency emergency response personnel have needed to transport a radiological hazard into suitable storage. The US Department of Transportation is on record that federal hazardous material transportation law is limited to transportation of hazardous material in commerce (February 22, 1988 letter from D. Billings to C.R. Meyer, Texas Dep. of Health). "It is our opinion that transportation of hazardous materials by government agencies, in their own vehicles, using government agency drivers and not involved in commercial activities, is not subject to the US Department of Transportation's Hazardous Materials Regulations." Committee SR-1 rejected inclusion of a special exemption for agency personnel in this revision of Part T, in part because so few instances are known to have occurred and in part believing that state agency staff should adhere to the same requirements that any other transporter must adhere to. If enough instances warrant, such an exemption could be a matter for future consideration.
 6. A provision, for example, a specific exemption from placarding requirements for transport, could be added to Sec. T.4 related to ^3H and ^{14}C quantities, since 10 CFR 20.2005 and Part D.1005 treat <0.005 microcuries as if not radioactive.

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7. More specific time frames for notification of incidents from 49 CFR could be added to footnote 3.
8. Consider adding text to Sec. T.11.c.i which provides a narrative version of the equation and states what relation is intended.
9. Consider Li and Be as well as Be and ^2H to Sec. T.12.
10. Consider explicitly providing the alternative for a state to apply Sec. T.19 to all highway route controlled quantities, not just highway route controlled quantities of radioactive waste.
11. Part T could include more specific provision from 10 CFR 71 Subpart H reflecting quality assurance requirements in Sec. T.20.

PART T**TRANSPORTATION OF RADIOACTIVE MATERIAL**

Sec. T.1 - Purpose and Scope. The regulations in this Part establish requirements for packaging, preparation for shipment, and transportation of radioactive material and apply to any person who transports radioactive material or delivers radioactive material to a carrier for transport.

Sec. T.2 - Definitions. As used in this Part, the following definitions apply:

"Carrier" means a person engaged in the transportation of passengers or property by land or water as a common, contract, or private carrier, or by civil aircraft.

"Closed transport vehicle" means a transport vehicle equipped with a securely attached exterior enclosure that during normal transportation restricts the access of unauthorized persons to the cargo space containing the radioactive material. The enclosure may be either temporary or permanent but shall limit access from top, sides, and ends. In the case of packaged materials, it may be of the "see-through" type.

"Exclusive use" means the 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 issue specific instructions, in writing, for maintenance of exclusive use shipment controls, and include them with the shipping paper information provided to the carrier by the consignor.

"Fissile material" means plutonium-238, plutonium-239, plutonium-241, uranium-233, uranium-235, or any combination of these radionuclides. Unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that has been irradiated in thermal reactors only are not included in this definition.^{1/}

"Fissile material package" means a fissile material packaging together with its fissile material contents.

"Low specific activity (LSA) material" means radioactive material that satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of three groups:

- (1) LSA-I
 - (i) Ores containing only naturally occurring radionuclides^{2/} and uranium or thorium concentrates of such ores; or

^{1/} Agency jurisdiction extends only to "special nuclear material in quantities not sufficient to form a critical mass" as defined in Part A of these regulations

^{2/} For example, uranium or thorium decay series radionuclides

- (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) Mill tailings, contaminated earth, concrete, rubble, other bulk debris, and activated material in which the radioactive material is essentially uniformly distributed, and the average specific activity does not exceed $10^{-6} A_2/g$.

(2) LSA-II

- (i) Water with tritium concentration up to 0.8 terabecquerel per liter (20.0 Ci/L); or
- (ii) Material in which the radioactive material 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 in which ^{**/}

- (i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent;^{***/} and
- (ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that, even under loss of packaging, the loss of radioactive material per package by leaching, when placed in water for 7 days, would not exceed $0.1 A_2$; and
- (iii) The average specific activity of the solid does not exceed $2 \times 10^{-3} A_2/g$.

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

"Natural thorium" means thorium isotopes with a naturally occurring distribution, which is essentially 100 weight percent thorium-232.

"Normal form radioactive material" means radioactive material which has not been demonstrated to qualify as special form or other form radioactive material.

^{**/} For example, consolidated wastes, or activated materials.

^{***/} For example, concrete, bitumen, or ceramic.

"Nuclear waste" means a quantity of source, byproduct or special nuclear material^{2/} required to be in US Nuclear Regulatory Commission-approved specification packaging while transported to, through or across a state boundary to a disposal site, or to a collection point for transport to a disposal site.

"Packaging" means the assembly of components necessary to ensure compliance with the packaging requirements of 49 CFR Part 173, Subpart I. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging.

"Regulations of the US Department of Transportation" means the regulations in 49 CFR Parts 100-189 and Parts 390-397.

"Regulations of the US Nuclear Regulatory Commission" means the regulations in 10 CFR 71 for purposes of this Part T.

"Special form radioactive material" means radioactive material that satisfies the following conditions:

- (1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
- (2) The piece or capsule has at least one dimension not less than 5 millimeters (0.2 in.); and
- (3) It satisfies the test requirements specified by the Nuclear Regulatory Commission. A special form encapsulation designed in accordance with the Nuclear Regulatory Commission requirements in effect on June 30, 1983, and constructed prior to July 1, 1985, may continue to be used. A special form encapsulation designed in accordance with the Nuclear Regulatory Commission requirements in effect on March 31, 1996, and constructed prior to April 1, 1998, may continue to be used. A special form encapsulation either designed or constructed after April 1, 1998, must meet requirements of this definition applicable at the time of its design or construction.

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

"Surface contaminated object" (SCO) means a solid object that is not itself classed as radioactive material, but which has radioactive material distributed on any of its surfaces. An SCO must be in one of two groups with surface activity not exceeding the following limits:

- (1) SCO-I: A solid object on which:

^{2/} The definition of nuclear waste in this Part is used in the same way as in 49 CFR 173.403.

- (i) The non-fixed contamination on the accessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed 4 becquerel per cm² (10⁻⁴ μCi/cm²) for beta and gamma and low toxicity alpha emitters, or 0.4 becquerel per cm² (10⁻⁵ μCi/cm²) for all other alpha emitters;
 - (ii) The fixed contamination on the accessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed 4x10⁴ becquerel per cm² (1.0 μCi/cm²) for beta and gamma and low toxicity alpha emitters, or 4x10³ becquerel per cm² (0.1 μCi/cm²) for all other alpha emitters; and
 - (iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed 4x10⁴ becquerel per cm² (1 μCi/cm²) for beta and gamma and low toxicity alpha emitters, or 4x10³ Becquerel per cm² (0.1 μCi/cm²) for all other alpha emitters.
- (2) SCO-II: A solid object on which the limits for SCO-I are exceeded and on which:
- (i) The non-fixed contamination on the accessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed 400 becquerel per cm² (10⁻² μCi/cm²) for beta and gamma and low toxicity alpha emitters or 40 becquerel per cm² (10⁻³ μCi/cm²) for all other alpha emitters;
 - (ii) The fixed contamination on the accessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed 8x10⁵ becquerel per cm² (20 μCi/cm²) for beta and gamma and low toxicity alpha emitters, or 8x10⁴ becquerel per cm² (2 μCi/cm²) for all other alpha emitters; and
 - (iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed 8x10⁵ becquerel per cm² (20 μCi/cm²) for beta and gamma and low toxicity alpha emitters, or 8x10⁴ becquerel per cm² (2 μCi/cm²) for all other alpha emitters.

"Transport index" 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 the number expressing the maximum radiation level at 1 meter (3.3 feet) from the external surface of the package in millisievert (mSv) per hour multiplied by 100, which is thus equivalent to the maximum radiation level in millirem per hour at 1 meter.

"Type A quantity" means a quantity of radioactive material, the aggregate radioactivity of which does not exceed A₁ for special form radioactive material or A₂ for normal form radioactive material, where A₁ and A₂ are given in Appendix A or may be determined by procedures described in Appendix A.

"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 49 CFR 173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this Part T under normal conditions of transport as demonstrated by the tests set forth in 49 CFR 173.465 or 173.466, as appropriate.

"Type B package" means a Type B packaging together with its radioactive contents.^{3/}

"Type B packaging" means a packaging designed to retain the integrity of containment and shielding when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR Part 71.

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

"Uranium - natural, depleted, enriched"

- (1) "Natural uranium" means uranium isotopes with the naturally occurring distribution of uranium, which is approximately 0.711 weight percent uranium-235, and the remainder by weight essentially uranium-238.
- (2) "Depleted uranium" means uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.
- (3) "Enriched uranium" means uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

General Regulatory Provisions

Sec. T.3 - Requirement for License. No person shall transport radioactive material or deliver radioactive material to a carrier for transport except as authorized in a general or specific license issued by the Agency or as exempted in T.4.

Sec. T.4 - Exemptions.

- a. Common and contract carriers, freight forwarders, and warehouse workers which are subject to the requirements of the US Department of Transportation in 49 CFR 170 through 189 or the US Postal Service in the US Postal Service Domestic Mail Manual (DMM), Section C-023.9.0, and the US Postal Service, are exempt from the requirements of this Part to the extent that they transport or store radioactive material in the regular course of their carriage for others or storage incident

^{3/} A Type B package design is designated as B(U) or B(M). B(U) refers to the need for unilateral approval of international shipments. B(M) refers to the need for multilateral approval. No distinction is made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, refer to 49 CFR Part 173. A Type B package approved prior to September 6, 1983 was designated only as Type B. Limitations on its use are specified in Section T.8.

thereto. Common and contract carriers who are not subject to the requirements of the US Department of Transportation or US Postal Service are subject to T.3 and other applicable requirements of these regulations.

- b. Any licensee is exempt from the requirements of this Part to the extent that the licensee delivers to a carrier for transport a package containing radioactive material having a specific activity not greater than 70 becquerel per gram (0.002 $\mu\text{Ci/g}$).

Sec. T.5 - Transportation of Licensed Material.

- a. Each licensee who transports licensed material outside the site of usage, as specified in the Agency license, or where transport is on public highways, or who delivers licensed material to a carrier for transport, shall:
 - i. comply with the applicable requirements, appropriate to the mode of transport, of the regulations of the US Department of Transportation; particularly the regulations of the US Department of Transportation in the following areas:
 - (1) Packaging - 49 CFR Part 173: Subparts A and B and I.
 - (2) Marking and labeling - 49 CFR Part 172: Subpart D, §§ 172.400 through 172.407, §§ 172.436 through 172.440, and Subpart E.
 - (3) Placarding - 49 CFR Part 172: Subpart F, especially §§ 172.500 through 172.519, 172.556, and Appendices B and C.
 - (4) Accident reporting - 49 CFR Part 171: §§ 171.15 and 171.16.
 - (5) Shipping papers and emergency information - 49 CFR Part 172: Subpart C and Subpart G.
 - (6) Hazardous material employee training - 49 CFR Part 172: Subpart H.
 - (7) Hazardous material shipper/carrier registration - 49 CFR Part 107: Subpart G.
 - ii. The licensee shall also comply with applicable US Department of Transportation regulations pertaining to the following modes of transportation:
 - (1) Rail - 49 CFR Part 174: Subparts A through D and K.
 - (2) Air - 49 CFR Part 175.
 - (3) Vessel - 49 CFR Part 176: Subparts A through F and M.

- (4) Public Highway - 49 CFR Part 177 and Parts 390 through 397.
- iii. Assure that any special instructions needed to safely open the package are sent to or have been made available to the consignee in accordance with D.906.e.
- b. If, for any reason, the regulations of the US Department of Transportation are not applicable to a shipment of licensed material, the licensee shall conform to the standards and requirements of 49 CFR Parts 170 through 189 appropriate to the mode of transport to the same extent as if the shipment was subject to the regulations.

General Licenses

Sec. T.6 - General Licenses for Carriers.

- a. A general license is hereby issued to any common or contract carrier not exempt under T.4 to receive, possess, transport, and store radioactive material in the regular course of their carriage for others or storage incident thereto, provided the transportation and storage is in accordance with the applicable requirements, appropriate to the mode of transport, of the US Department of Transportation insofar as such requirements relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.^{4/}
- b. A general license is hereby issued to any private carrier to transport radioactive material, provided the transportation is in accordance with the applicable requirements, appropriate to the mode of transport, of the US Department of Transportation insofar as such requirements relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.^{4/}
- c. Persons who transport radioactive material pursuant to the general licenses in T.6a. or T.6b. are exempt from the requirements of Parts D and J of these regulations to the extent that they transport radioactive material.

Sec. T.7 - General License: Nuclear Regulatory Commission-Approved Packages.

- a. A general license is hereby issued to any licensee to transport, or to deliver to a carrier for transport, licensed material in a package for which a license, certificate of compliance, or other approval has been issued by the Nuclear Regulatory Commission.
- b. This general license applies only to a licensee who:

^{4/} Notification of an incident shall be filed with, or made to, the Agency as prescribed in 49 CFR, regardless of and in addition to notification made to the US Department of Transportation or other agencies

- i. Has a copy of the specific license, certificate of compliance, or other approval by the Nuclear Regulatory Commission of the package and has the drawings and other documents referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken prior to shipment;
 - ii. Complies with the terms and conditions of the license, certificate, or other approval by the Nuclear Regulatory Commission, as applicable, and the applicable requirements of this Part T;
 - iii. Prior to the licensee's first use of the package, has registered with the Nuclear Regulatory Commission; and
 - iv. Has a quality assurance program required by T.20.
- c. The general license in T.7a. applies only when the package approval authorizes use of the package under this general license.
 - d. For a Type B or fissile material package, the design of which was approved by the Nuclear Regulatory Commission before April 1, 1996, the general license is subject to the additional restrictions of T.8.

Sec. T.8 - General License: Previously Approved Package. ^{71.13}

- a. A Type B package previously approved by the Nuclear Regulatory Commission, but not designated as B(U) or B(M) in the identification number of the Nuclear Regulatory Commission certificate of compliance, may be used under the general license of T.7 with the following additional conditions:
 - i. Fabrication of the packaging was satisfactorily completed before August 31, 1986, as demonstrated by application of its model number in accordance with Nuclear Regulatory Commission regulations at 10 CFR 71.85(c);
 - ii. A package used for a shipment to a location outside the United States is subject to multilateral approval, as defined in US Department of Transportation regulations at 49 CFR 173.403; and
 - iii. A serial number that uniquely identifies each packaging which conforms to the approved design is assigned to, and legibly and durably marked on, the outside of each packaging.
- b. A Type B(U) package, a Type B(M) package, a low specific activity (LSA) material package or a fissile material package, previously approved by the Nuclear Regulatory Commission but without the designation "-85" in the identification number of the Nuclear Regulatory Commission certificate of compliance, may be used under the general license of T.7 with the following additional conditions:

- i. Fabrication of the package is satisfactorily completed by April 1, 1999, as demonstrated by application of its model number in accordance with Nuclear Regulatory Commission regulations at 10 CFR 71.85(c);
- ii. A package used for a shipment to a location outside the United States is subject to multilateral approval except approved under special arrangement in accordance with US Department of Transportation regulations at 49 CFR 173.403; and
- iii. A serial number which uniquely identifies each packaging which conforms to the approved design is assigned to and legibly and durably marked on the outside of each packaging.

Sec. T.9 - General License: US Department of Transportation Specification Container.

m 71.14

- a. A general license is issued to any licensee to transport, or to deliver to a carrier for transport, licensed material in a specification container for fissile material or for a Type B quantity of radioactive material as specified in 49 CFR Parts 173 and 178.
- b. This general license applies only to a licensee who:
 - i. Has a copy of the specification;
 - ii. Complies with the terms and conditions of the specification and the applicable requirements of this Part; and
 - iii. Has a quality assurance program required by T.20.
- c. The general license in T.9a. is subject to the limitation that the specification container may not be used for a shipment to a location outside the United States except by multilateral approval as defined in 49 CFR 173.403.

Sec. T.10 - General License: Use of Foreign Approved Package.

m 71.16

- a. A general license is issued to any licensee to transport, or to deliver to a carrier for transport, licensed material in a package the design of which has been approved in a foreign national competent authority certificate which has been revalidated by the US Department of Transportation as meeting the applicable requirements of 49 CFR 171.12.
- b. This general license applies only to international shipments.
- c. This general license applies only to a licensee who:
 - i. Has a copy of the applicable certificate, the revalidation, and the drawings and other documents referenced in the certificate relating to the use and maintenance of the packaging and to the actions to be taken prior to shipment;

- ii. Complies with the terms and conditions of the certificate and revalidation, and with the applicable requirements of this Part; and
- iii. The licensee has a quality assurance program approved by the Nuclear Regulatory Commission.

Sec. T.11 - General License: Fissile Material, Limited Quantity Per Package. *M 7/1/8*

- a. A general license is hereby issued to any licensee to transport fissile material, or to deliver fissile material to a carrier for transport, if the material is shipped in accordance with this Section.
- b. This general license applies only when a package contains no more than a Type A quantity of radioactive material, including only one of the following:
 - i. Up to 40 grams of uranium-235;
 - ii. Up to 30 grams of uranium-233;
 - iii. Up to 25 grams of the fissile radionuclides of plutonium, except that for encapsulated plutonium-beryllium neutron sources in special form, an A₁ quantity of plutonium may be present; or
 - iv. A combination of fissile radionuclides in which the sum of the ratios of the amount of each radionuclide to the corresponding maximum amounts in T.11b.i., ii., and iii. does not exceed unity.
- c. Except as specified in T.11c.ii., this general license applies only when all of the following requirements are met:
 - i. A package containing more than 15 grams of fissile radionuclides is labeled with a transport index not less than the number given by the following equation:

$$\text{Minimum Transport Index} = (0.40x + 0.67y + z) (1 - 15/(x+y+z))$$

where the package contains x grams of uranium-235, y grams of uranium-233, and z grams of the fissile radionuclides of plutonium;

- ii. For a package in which the only fissile material is in the form of encapsulated plutonium-beryllium neutron sources in special form, the transport index based on criticality considerations may be taken as 0.026 times the number of grams of the fissile radionuclides of plutonium in excess of 15 grams.

- iii. In all cases, the transport index must be rounded up to one decimal place and shall not exceed 10.0.
- iv. The licensee has a quality assurance program as required by T.20.

Sec. T.12 - General License: Fissile Material, Limited Moderator Per Package.

71.20

- a. A general license is hereby issued to any licensee to transport fissile material, or to deliver fissile material to a carrier for transport, if the material is shipped in accordance with this Section.
- b. This general license applies only when all of the following requirements are met:
 - i. The package contains no more than a Type A quantity of radioactive material;
 - ii. Neither beryllium nor hydrogenous material enriched in deuterium is present;
 - iii. The total mass of graphite present does not exceed 7.7 times the total mass of uranium-235 plus plutonium;
 - iv. Substances having a higher hydrogen density than water, for example certain hydrocarbon oils, are not present, except that polyethylene may be used for packing or wrapping;
 - v. Uranium-233 is not present, and the amount of plutonium does not exceed 1 percent of the amount of uranium-235;
 - vi. The amount of uranium-235 is limited as follows:
 - (1) If the fissile radionuclides are not uniformly distributed, the maximum amount of uranium-235 per package may not exceed the value given in TABLE I; or
 - (2) If the fissile radionuclides are distributed uniformly, for example, cannot form a lattice arrangement within the packaging, the maximum amount of uranium-235 per package may not exceed the value given in TABLE II; and
 - vii. The transport index of each package based on criticality considerations is taken as 10 times the number of grams of uranium-235 in the package divided by the maximum allowable number of grams per package in accordance with TABLE I or TABLE II as applicable.

TABLE I
PERMISSIBLE MASS OF URANIUM-235 PER FISSILE MATERIAL PACKAGE
[NONUNIFORM DISTRIBUTION]

Uranium Enrichment in Weight Percent of Uranium-235 Not Exceeding	Permissible Maximum Grams of Uranium-235 Per Package
24	40
20	42
15	45
11	48
10	51
9.5	52
9	54
8.5	55
8	57
7.5	59
7	60
6.5	62
6	65
5.5	68
5	72
4.5	76
4	80
3.5	88
3	100
2.5	120
2	164
1.5	272
1.35	320
1	680*
0.92	1,200*

**Pursuant to the Agency's agreement with the Nuclear Regulatory Commission, jurisdiction extends only to 350 grams of uranium-235.*

TABLE II
PERMISSIBLE MASS OF URANIUM-235 PER FISSILE MATERIAL PACKAGE
[UNIFORM DISTRIBUTION]

Uranium Enrichment in Weight Percent of Uranium-235 Not Exceeding	Permissible Maximum Grams of Uranium-235 Per Package
4	84
3.5	92
3	112
2.5	148
2	240
1.5	560*
1.35	800*

** Pursuant to the Agency's agreement with the Nuclear Regulatory Commission, jurisdiction extends only to 350 grams of uranium-235.*

- c. The licensee has a quality assurance program as required by T.20.

Operating Controls and Procedures = 71.83

Sec. T.13 - Assumptions as to Unknown Properties of Fissile Material When the isotopic abundance, mass, concentration, degree of irradiation, degree of moderation, or other pertinent property of fissile material in any package is not known, the licensee shall package the fissile material as if the unknown properties have credible values that will cause the maximum neutron multiplication.

Sec. T.14 - Preliminary Determinations ^{=β} Prior to the first use of any packaging for the shipment of radioactive material:

- a. The licensee shall ascertain that there are no defects which could significantly reduce the effectiveness of the packaging;
- b. Where the maximum normal operating pressure will exceed 35 kilopascal (5 lb/in²) gauge, the licensee shall test the containment system at an internal pressure at least 50 percent higher than the maximum normal operating pressure to verify the capability of that system to maintain its structural integrity at that pressure;

- c. The licensee shall determine that the packaging has been fabricated in accordance with the design approved by the Nuclear Regulatory Commission; and
- d. The licensee shall conspicuously and durably mark the packaging with its model number, serial number, gross weight, and a package identification number as assigned by the Nuclear Regulatory Commission.

Sec. T.15 - Routine Determinations. Prior to each shipment of licensed material, the licensee shall determine that:

- a. The package is proper for the contents to be shipped;
- b. The package is in unimpaired physical condition except for superficial defects such as marks or dents;
- c. Each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects;
- d. Any system for containing liquid is adequately sealed and has adequate space or other specified provision for expansion of the liquid;
- e. Any pressure relief device is operable and set in accordance with written procedures;
- f. The package has been loaded and closed in accordance with written procedures;
- g. Any structural part of the package which could be used to lift or tie down the package during transport is rendered inoperable for that purpose unless it satisfies design requirements specified in 10 CFR 71.45;
- h. The level of non-fixed radioactive contamination on the external surfaces of each package offered for shipment is as low as reasonably achievable.
- i. The level of non-fixed radioactive contamination may be determined by wiping an area of 300 square centimeters 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 removable contamination levels. Except as provided in T.15h.ii., the amount of radioactivity measured on any single wiping material, when averaged over the surface wiped, must not exceed the limits given in TABLE III at any time during transport. Other methods of assessment of equal or greater efficiency may be used. When other methods are used, the detection efficiency of the method used must be taken into account and in no case may the removable contamination on the external surfaces of the package exceed 10 times the limits listed in TABLE III.

- ii. In the case of packages transported as exclusive use shipments by rail or highway only, the non-fixed radioactive contamination at any time during transport must not exceed 10times the levels prescribed in T.15h.i. The levels at the beginning of transport must not exceed the levels in T.15h.i.;

TABLE III
NON-FIXED (REMOVABLE) EXTERNAL RADIOACTIVE CONTAMINATION - WIPE LIMITS

<u>Contaminant</u>	<u>Maximum Permissible Limit</u>		
	Bq/cm ²	Ci/cm ²	dpm/cm ²
Beta and gamma emitters and low toxicity alpha emitters	0.4	10 ⁻⁵	22
All other alpha emitting radionuclides	0.04	10 ⁻⁶	2.2

- i. External radiation levels around the package and around the vehicle, if applicable, will not exceed 2 millisievert per hour (200 mrem/hr) at any point on the external surface of the package at any time during transportation. The transport index shall not exceed 10.0;
- j. For a package transported in exclusive use by rail, highway or water, radiation levels external to the package may exceed the limits specified in T.15i. but shall not exceed any of the following:
 - i. 2 millisievert per hour (200 mrem/hr) on the accessible external surface of the package unless the following conditions are met, in which case the limit is 10 millisievert per hour (1000 mrem/hr);
 - (1) The shipment is made in a closed transport vehicle;
 - (2) Provisions are made to secure the package so that its position within the vehicle remains fixed during transportation; and
 - (3) There are no loading or unloading operations between the beginning and end of the transportation.

- ii. 2 millisievert per hour (200 mrem/hr) at any point on the outer surface of the vehicle, including the top and underside of the vehicle, or, in the case of a flat-bed style vehicle, with a personnel barrier,^{****/} at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load (or enclosure, if used), and on the lower external surface of the vehicle;
- iii. 0.1 millisievert per hour (10 mrem/hr) at any point 2 meters from the vertical planes represented by the outer lateral surfaces of the vehicle, or, in the case of a flat-bed style vehicle, at any point 2 meters from the vertical planes projected from the outer edges of the vehicle; and
- iv. 0.02 millisievert per hour (2 mrem/hr) in any normally occupied positions of the vehicle, except that this provision does not apply to private motor carriers when persons occupying these positions are provided with special health supervision, personnel radiation exposure monitoring devices, and training in accordance with Part J.12 of these regulations; and
- k. A package must be prepared for transport so that in still air at 38°Celsius (100°F) and in the shade, no accessible surface of a package would have a temperature exceeding 50°Celsius (122°F) in a nonexclusive use shipment or 85°Celsius (185°F) in an exclusive use shipment. Accessible package surface temperatures shall not exceed these limits at any time during transportation.
- l. A package may not incorporate a feature intended to allow continuous venting during transport.

Sec. T.16 - Air Transport of Plutonium. Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this Part or included indirectly by citation of the US Department of Transportation regulations, as may be applicable, the licensee shall assure that plutonium in any form is not transported by air, or delivered to a carrier for air transport, unless:

- a. The plutonium is contained in a medical device designed for individual human application;
- b. The plutonium is contained in a material in which the specific activity is not greater than 70 becquerel per gram (0.002 $\mu\text{Ci/g}$) of material and in which the radioactivity is essentially uniformly distributed;
- c. The plutonium is shipped in a single package containing no more than an A_2 quantity of plutonium in any isotope or form and is shipped in accordance with T.5;
- d. The plutonium is shipped in a package specifically authorized, in the certificate of compliance, issued by the Nuclear Regulatory Commission, for the shipment of plutonium by air and the licensee requires, through special arrangement with the carrier, compliance with 49 CFR 175.704, the US Department of Transportation regulations applicable to the air transport of plutonium.

^{****/} A flat-bed style vehicle with a personnel barrier shall have radiation levels determined at vertical planes. If no personnel barrier is in place, the package cannot exceed 2 millisievert per hour (200 mrem/hr) at any accessible surface

Sec. T.17 - Shipment Records. Each licensee shall maintain for a period of 3 years after shipment a record of each shipment of licensed material not exempt under T.4, showing, where applicable:

- a. Identification of the packaging by model number and serial number;
- b. Verification that the packaging, as shipped, had no significant defect;
- c. Volume and identification of coolant;
- d. Type and quantity of licensed material in each package, and the total quantity of each shipment;
- e. Date of the shipment;
- f. Name and address of the transferee;
- g. Address to which the shipment was made; and
- h. Results of the determinations required by T.15 and by the conditions of the package approval.

Sec. T.18 - Reports. The licensee shall report to the Agency within 30 days:

- a. Any instance in which there is significant reduction in the effectiveness of any packaging during use;
- b. Details of any defects with safety significance in the packaging after first use, with the means employed to repair the defects and prevent their recurrence; or
- c. Instances in which the conditions of approval in the certificate of compliance were not observed in making a shipment.

Sec. T.19 - Advance Notification of Transport of Nuclear Waste.

- a. Prior to the transport of any nuclear waste outside of the confines of the licensee's facility or other place of use or storage, or prior to the delivery of any nuclear waste to a carrier for transport, each licensee shall provide advance notification of such transport to the governor, or governor's designee,^{2/} of each state within or through which the waste will be transported.
- b. Advance notification is required only when:
 - i. The nuclear waste is required to be in Type B packaging for transportation;

^{2/} A list of the mailing addresses of the governors and governors' designees is available upon request from the Director, Office of State Programs, Nuclear Regulatory Commission, Washington, DC 20555. The list will be published annually in the Federal Register on or about June 30 to reflect any changes in information.

- ii. The nuclear waste is being transported into, within, or through a state enroute to a disposal facility or to a collection point for transport to a disposal facility; and
- iii. The quantity of licensed material in a single package exceeds:
 - (1) 3000 times the A_1 value of the radionuclides as specified in Appendix A, Table I for special form radioactive material;
 - (2) 3000 times the A_2 value of the radionuclides as specified in Appendix A, Table I for normal form radioactive material; or
 - (3) 1000 terabecquerel (27,000 Ci).
- c. Each advance notification required by T.19a. shall contain the following information:
 - i. The name, address, and telephone number of the shipper, carrier, and receiver of the shipment;
 - ii. A description of the nuclear waste contained in the shipment as required by 49 CFR 172.202 and 172.203(d);
 - iii. The point of origin of the shipment and the 7-day period during which departure of the shipment is estimated to occur;
 - iv. The 7-day period during which arrival of the shipment at state boundaries is estimated to occur;
 - v. The destination of the shipment, and the 7-day period during which arrival of the shipment is estimated to occur; and
 - vi. A point of contact with a telephone number for current shipment information.
- d. The notification required by T.19a. shall be made in writing to the office of each appropriate governor, or governor's designee, and to the Agency. A notification delivered by mail must be postmarked at least 7 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur. A notification delivered by messenger must reach the office of the governor, or governor's designee, at least 4 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur. A copy of the notification shall be retained by the licensee for 3 years.
- e. The licensee shall notify each appropriate governor, or governor's designee, and the Agency of any changes to schedule information provided pursuant to T.19a. Such notification shall be by telephone to a responsible individual in the office of the governor, or governor's designee, of the

appropriate state or states. The licensee shall maintain for 3 years a record of the name of the individual contacted.

- f. Each licensee who cancels a nuclear waste shipment, for which advance notification has been sent, shall send a cancellation notice, identifying the advance notification that is being canceled, to the governor, or governor's designee, of each appropriate state and to the Agency. A copy of the notice shall be retained by the licensee for 3 years.

Quality Assurance

Sec. T.20 - Quality Assurance Requirements.

- a. Unless otherwise authorized by the Agency, each licensee shall establish, maintain, and execute a quality assurance program to verify by procedures such as checking, auditing, and inspection that deficiencies, deviations, and defective material and equipment relating to the shipment of packages containing radioactive material are promptly identified and corrected.
- b. The licensee shall identify the material and components to be covered by the quality assurance program.
- c. Each licensee shall document the quality assurance program by written procedures or instructions and shall carry out the program in accordance with those procedures throughout the period during which packaging is used.
- d. Prior to the use of any package for the shipment of radioactive material, each licensee shall obtain approval by the Agency of its quality assurance program.
- e. The licensee shall maintain sufficient written records to demonstrate compliance with the quality assurance program. Records of quality assurance pertaining to the use of a package for shipment of radioactive material shall be maintained for a period of 3 years after shipment.

PART C

APPENDIX A

DETERMINATION OF A₁ AND A₂

- I. Values of A₁ and A₂ for individual radionuclides, which are the bases for many activity limits elsewhere in these regulations, are given in TABLE IV. The curie (Ci) values specified are obtained by converting from the Terabecquerel (TBq) figure. The curie values are expressed to three significant figures to assure that the difference in the TBq and Ci quantities is one tenth of one percent or less. Where values of A₁ or A₂ are unlimited, it is for radiation control purposes only. For nuclear criticality safety, some materials are subject to controls placed on fissile material.
- II. For individual radionuclides whose identities are known, but which are not listed in TABLE IV, the determination of the values of A₁ and A₂ requires Department approval, except that the values of A₁ and A₂ in TABLE V may be used without obtaining Agency approval.
- III. In the calculations of A₁ and A₂ for a radionuclide not in TABLE IV, a single radioactive decay chain, in which 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, shall be considered as a single radionuclide, and the activity to be taken into account, and the A₁ or A₂ value to be applied shall be those corresponding to the parent nuclide of that chain. In the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days, or greater than that of the parent nuclide, the parent and those daughter nuclides shall be considered as mixtures of different nuclides.
- IV. For mixtures of radionuclides whose identities and respective activities are known, the following conditions apply:

- (a) For special form radioactive material, the maximum quantity transported in a Type A package:

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

- (b) For normal form radioactive material, the maximum quantity transported in a Type A package:

$$\sum_i \frac{B(i)}{A_2(i)} \leq 1$$

where B(i) is the activity of radionuclide i and A₁(i) and A₂(i) are the A₁ and A₂ values for radionuclide respectively.

Alternatively, an A_1 value for mixtures of special form material may be determined as follows:

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

where $f(i)$ is the fraction of activity of nuclide I in the mixture and $A_1(i)$ is the appropriate A_1 value for nuclide i.

An A_2 value for mixtures of normal form material may be determined as follows:

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

where $f(i)$ is the fraction of activity of nuclide I in the mixture and $A_2(i)$ is the appropriate A_2 value for nuclide i.

- V. When the identity of each radionuclide 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 paragraph IV. 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 and beta/gamma emitters.

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Ac-225	Actinium (89)	0.6	16.2	1x10 ⁻²	0.270	2.1x10 ³	5.8x10 ⁴
Ac-227		40	1080	2x10 ⁻⁵	5.41x10 ⁻⁴	2.7	7.2x10 ¹
Ac-228		0.6	16.2	0.4	10.8	8.4x10 ⁴	2.2x10 ⁶
Ag-105	Silver (47)	2	54.1	2	54.1	1.1x10 ³	3.0x10 ⁴
Ag-108m		0.6	16.2	0.6	16.2	9.7x10 ⁻¹	2.6x10 ¹
Ag-110m		0.4	10.8	0.4	10.8	1.8x10 ²	4.7x10 ³
Ag-111		0.6	16.2	0.5	13.5	5.8x10 ³	1.6x10 ⁵
Al-26	Aluminum (13)	0.4	10.8	0.4	10.8	7.0x10 ⁻⁴	1.9x10 ⁻²
Am-241	Americium (95)	2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	1.3x10 ⁻¹	3.4
Am-242m		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	3.6x10 ⁻¹	1.0x10 ¹
Am-243		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	7.4x10 ⁻³	2.0x10 ⁻¹
Ar-37	Argon (18)	40	1080	40	1080	3.7x10 ³	9.9x10 ⁴
Ar-39		20	541	20	541	1.3	3.4x10 ¹
Ar-41		0.6	16.2	0.6	16.2	1.5x10 ⁶	4.2x10 ⁷
Ar-42		0.2	5.41	0.2	5.41	9.6	2.6x10 ²
As-72	Arsenic (33)	0.2	5.41	0.2	5.41	6.2x10 ⁴	1.7x10 ⁶
As-73		40	1080	40	1080	8.2x10 ²	2.2x10 ⁴
As-74		1	27.0	0.5	13.5	3.7x10 ³	9.9x10 ⁴
As-76		0.2	5.41	0.2	5.41	5.8x10 ⁴	1.6x10 ⁶
As-77		20	541	0.5	13.5	3.9x10 ⁴	1.0x10 ⁶
At-211	Astatine (85)	30	811	2	54.1	7.6x10 ⁴	2.1x10 ⁶
Au-193	Gold (79)	6	162	6	162	3.4x10 ⁴	9.2x10 ⁵
Au-194		1	27.0	1	27.0	1.5x10 ⁴	4.1x10 ⁵
Au-195		10	270	10	270	1.4x10 ²	3.7x10 ³
Au-196		2	54.1	2	54.1	4.0x10 ³	1.1x10 ⁵
Au-198		3	81.1	0.5	13.5	9.0x10 ³	2.4x10 ⁵
Au-199		10	270	0.9	24.3	7.7x10 ³	2.1x10 ⁵
Ba-131	Barium (56)	2	54.1	2	54.1	3.1x10 ³	8.4x10 ⁴
Ba-133m		10	270	0.9	24.3	2.2x10 ⁴	6.1x10 ⁵
Ba-133		3	81.1	3	81.1	9.4	2.6x10 ²
Ba-140		0.4	10.8	0.4	10.8	2.7x10 ³	7.3x10 ⁴
Be-7	Beryllium (4)	20	541	20	541	1.3x10 ⁴	3.5x10 ⁵
Be-10		20	541	0.5	13.5	8.3x10 ⁻⁴	2.2x10 ⁻²
Bi-205	Bismuth (83)	0.6	16.2	0.6	16.2	1.5x10 ³	4.2x10 ⁴
Bi-206		0.3	8.11	0.3	8.11	3.8x10 ³	1.0x10 ⁵

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Bi-207		0.7	18.9	0.7	18.9	1.9	5.2x10 ¹
Bi-210m		0.3	8.11	3x10 ⁻²	0.811	2.1x10 ⁻⁵	5.7x10 ⁻⁴
Bi-210		0.6	16.2	0.5	13.5	4.6x10 ³	1.2x10 ⁵
Bi-212		0.3	8.11	0.3	8.11	5.4x10 ⁵	1.5x10 ⁷
Bk-247	Berkelium (97)	2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	3.8x10 ⁻²	1.0
Bk-249		40	1080	8x10 ⁻²	2.16	6.1x10 ¹	1.6x10 ³
Br-76	Bromine (35)	0.3	8.11	0.3	8.11	9.4x10 ⁴	2.5x10 ⁶
Br-77		3	81.1	3	81.1	2.6x10 ⁴	7.1x10 ⁵
Br-82		0.4	10.8	0.4	10.8	4.0x10 ⁴	1.1x10 ⁶
C-11	Carbon (6)	1	27	0.5	13.5	3.1x10 ⁷	8.4x10 ⁸
C-14		40	1080	2	54.1	1.6x10 ⁻¹	4.5
Ca-41	Calcium (20)	40	1080	40	1080	3.1x10 ⁻³	8.5x10 ⁻²
Ca-45		40	1080	0.9	24.3	6.6x10 ²	1.8x10 ⁴
Ca-47		0.9	24.3	0.5	13.5	2.3x10 ⁴	6.1x10 ⁵
Cd-109	Cadmium (48)	40	1080	1	27.0	9.6x10 ¹	2.6x10 ³
Cd-113m		20	541	9x10 ⁻²	2.43	8.3x10 ⁴	2.2x10 ²
Cd-115m		0.3	8.11	0.3	8.11	9.4x10 ²	2.5x10 ⁴
Cd-115		4	108	0.5	13.5	1.9x10 ⁴	5.1x10 ⁵
Ce-139	Cerium (58)	6	162	6	162	2.5x10 ²	6.8x10 ³
Ce-141		10	270	0.5	13.5	1.1x10 ³	2.8x10 ⁴
Ce-143		0.6	16.2	0.5	13.5	2.5x10 ⁴	6.6x10 ⁵
Ce-144		0.2	5.41	0.2	5.41	1.2x10 ²	3.2x10 ³
Cf-248	Californium (98)	30	811	3x10 ⁻³	8.11x10 ⁻²	5.8x10 ¹	1.6x10 ³
Cf-249		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	1.5x10 ⁻¹	4.1
Cf-250		5	135	5x10 ⁻⁴	1.35x10 ⁻²	4.0	1.1x10 ²
Cf-251		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	5.9x10 ⁻²	1.6
Cf-252		0.1	2.70	1x10 ⁻³	2.70x10 ⁻²	2.0x10 ¹	5.4x10 ²
Cf-253		40	1080	6x10 ⁻²	1.62	1.1x10 ³	2.9x10 ⁴
Cf-254		3x10 ⁻³	8.11x10 ⁻²	6x10 ⁻⁴	1.62x10 ⁻²	3.1x10 ²	8.5x10 ³
Cl-36	Chlorine (17)	20	541	0.5	13.5	1.2x10 ⁻³	3.3x10 ⁻²
Cl-38		0.2	5.41	0.2	5.41	4.9x10 ⁶	1.3x10 ⁸
Cm-240	Curium (96)	40	1080	2x10 ⁻²	0.541	7.5x10 ²	2.0x10 ⁴
Cm-241		2	54.1	0.9	24.3	6.1x10 ²	1.7x10 ⁴
Cm-242		40	1080	1x10 ⁻²	0.270	1.2x10 ²	3.3x10 ³
Cm-243		3	81.1	3x10 ⁻⁴	8.11x10 ⁻³	1.9	5.2x10 ¹

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Cm-244		4	108	4x10 ⁻⁴	1.08x10 ⁻²	3.0	8.1x10 ¹
Cm-245		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	6.4x10 ⁻³	1.7x10 ⁻¹
Cm-246		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	1.1x10 ⁻²	3.1x10 ⁻¹
Cm-247		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	3.4x10 ⁻⁶	9.3x10 ⁻⁵
Cm-248		4x10 ⁻²	1.08	5x10 ⁻⁵	1.35x10 ⁻³	1.6x10 ⁻⁴	4.2x10 ⁻³
Co-55	Cobalt (27)	0.5	13.5	0.5	13.5	1.1x10 ⁵	3.1x10 ⁶
Co-56		0.3	8.11	0.3	8.11	1.1x10 ³	3.0x10 ⁴
Co-57		8	216	8	216	3.1x10 ²	8.4x10 ³
Co-58m		40	1080	40	1080	2.2x10 ⁵	5.9x10 ⁶
Co-58		1	27.0	1	27.0	1.2x10 ³	3.2x10 ⁴
Co-60		0.4	10.8	0.4	10.8	4.2x10 ¹	1.1x10 ³
Cr-51	Chromium (24)	30	811	30	811	3.4x10 ³	9.2x10 ⁴
Cs-129	Cesium (55)	4	108	4	108	2.8x10 ⁴	7.6x10 ⁵
Cs-131		40	1080	40	1080	3.8x10 ³	1.0x10 ⁵
Cs-132		1	27.0	1	27.0	5.7x10 ³	1.5x10 ⁵
Cs-134m		40	1080	9	243	3.0x10 ⁵	8.0x10 ⁶
Cs-134		0.6	16.2	0.5	13.5	4.8x10 ¹	1.3x10 ³
Cs-135		40	1080	0.9	24.3	4.3x10 ⁻⁵	1.2x10 ⁻³
Cs-136		0.5	13.5	0.5	13.5	2.7x10 ³	7.3x10 ⁴
Cs-137		2	54.1	0.5	13.5	3.2	8.7x10 ¹
Cu-64	Copper (29)	5	135	0.9	24.3	1.4x10 ⁵	3.9x10 ⁶
Cu-67		9	243	0.9	24.3	2.8x10 ⁴	7.6x10 ⁵
Dy-159	Dysprosium (66)	20	541	20	541	2.1x10 ²	5.7x10 ³
Dy-165		0.6	16.2	0.5	13.5	3.0x10 ⁵	8.2x10 ⁶
Dy-166		0.3	8.11	0.3	8.11	8.6x10 ³	2.3x10 ⁵
Er-169	Erbium (68)	40	1080	0.9	24.3	3.1x10 ³	8.3x10 ⁴
Er-171		0.6	16.2	0.5	13.5	9.0x10 ⁴	2.4x10 ⁶
Es-253	Einsteinium (99) ^{a/}	200	5400	2.1x10 ⁻²	5.4x10 ⁻¹	---	---
Es-254		30	811	3x10 ⁻³	8.11x10 ⁻²	---	---
Es-254m		0.6	16.2	0.4	10.8	---	---
Es-255		---	---	---	---	---	---
Eu-147	Europium (63)	2	54.1	2	54.1	1.4x10 ³	3.7x10 ⁴
Eu-148		0.5	13.5	0.5	13.5	6.0x10 ²	1.6x10 ⁴
Eu-149		20	541	20	541	3.5x10 ²	9.4x10 ³
Eu-150		0.7	18.9	0.7	18.9	6.1x10 ⁴	1.6x10 ⁶

^{a/} International shipments of Einsteinium require multilateral approval of A₁ and A₂ values

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Eu-152m		0.6	16.2	0.5	13.5	8.2x10 ⁴	2.2x10 ⁶
Eu-152		0.9	24.3	0.9	24.3	6.5	1.8x10 ²
Eu-154		0.8	21.6	0.5	13.5	9.8	2.6x10 ²
Eu-155		20	541	2	54.1	1.8x10 ¹	4.9x10 ²
Eu-156		0.6	16.2	0.5	13.5	2.0x10 ³	5.5x10 ⁴
F-18	Fluorine (9)	1	27.0	0.5	13.5	3.5x10 ⁶	9.5x10 ⁷
Fe-52	Iron (26)	0.2	5.41	0.2	5.41	2.7x10 ⁵	7.3x10 ⁶
Fe-55		40	1080	40	1080	8.8x10 ¹	2.4x10 ³
Fe-59		0.8	21.6	0.8	21.6	1.8x10 ³	5.0x10 ⁴
Fe-60		40	1080	0.2	5.41	7.4x10 ⁻⁴	2.0x10 ⁻²
Fm-255	Fermium (100) ^{b/}	40	1080	0.8	21.6	---	---
Fm-257		10	270	8x10 ⁻³	21.6x10 ⁻¹	---	---
Ga-67	Gallium (31)	6	162	6	162	2.2x10 ⁴	6.0x10 ⁵
Ga-68		0.3	8.11	0.3	8.11	1.5x10 ⁶	4.1x10 ⁷
Ga-72		0.4	10.8	0.4	10.8	1.1x10 ⁵	3.1x10 ⁶
Gd-146	Gadolinium (64)	0.4	10.8	0.4	10.8	6.9x10 ²	1.9x10 ⁴
Gd-148		3	81.1	3x10 ⁻⁴	8.11x10 ⁻³	1.2	3.2x10 ¹
Gd-153		10	270	5	135	1.3x10 ²	3.5x10 ³
Gd-159		4	108	0.5	13.5	3.9x10 ⁴	1.1x10 ⁶
Ge-68	Germanium (32)	0.3	8.11	0.3	8.11	2.6x10 ²	7.1x10 ³
Ge-71		40	1080	40	1080	5.8x10 ³	1.6x10 ⁵
Ge-77		0.3	8.11	0.3	8.11	1.3x10 ⁵	3.6x10 ⁶
H-3	Hydrogen (1)	See T-Tritium					
Hf-172	Hafnium (72)	0.5	13.5	0.3	8.11	4.1x10 ¹	1.1x10 ³
Hf-175		3	81.1	3	81.1	3.9x10 ²	1.1x10 ⁴
Hf-181		2	54.1	0.9	24.3	6.3x10 ²	1.7x10 ⁴
Hf-182		4	108	3x10 ⁻²	0.811	8.1x10 ⁻⁶	2.2x10 ⁻⁴
Hg-194	Mercury (80)	1	27.0	1	27.0	1.3x10 ⁻¹	3.5
Hg-195m		5	135	5	135	1.5x10 ⁴	4.0x10 ⁵
Hg-197m		10	270	0.9	24.3	2.5x10 ⁴	6.7x10 ⁵
Hg-197		10	270	10	270	9.2x10 ³	2.5x10 ⁵
Hg-203		4	108	0.9	24.3	5.1x10 ²	1.4x10 ⁴
Ho-163	Holmium (67)	40	1080	40	1080	2.7	7.6x10 ¹
Ho-166m		0.6	16.2	0.3	8.11	6.6x10 ⁻²	1.8
Ho-166		0.3	8.11	0.3	8.11	2.6x10 ⁴	7.0x10 ⁵

^{b/}International shipments of Fermium require multilateral approval of A₁ and A₂ values.

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
I-123	Iodine (53)	6	162	6	162	7.1x10 ⁴	1.9x10 ⁶
I-124		0.9	24.3	0.9	24.3	9.3x10 ³	2.5x10 ⁵
I-125		20	541	2	54.1	6.4x10 ²	1.7x10 ⁴
I-126		2	54.1	0.9	24.3	2.9x10 ³	8.0x10 ⁴
I-129		Unlimited	Unlimited	Unlimited	Unlimited	6.5x10 ⁻⁶	1.8x10 ⁻⁴
I-131		3	81.1	0.5	13.5	4.6x10 ³	1.2x10 ⁵
I-132	0.4	10.8	0.4	10.8	3.8x10 ⁵	1.0x10 ⁷	
I-133	0.6	16.2	0.5	13.5	4.2x10 ⁴	1.1x10 ⁶	
I-134	0.3	8.11	0.3	8.11	9.9x10 ⁵	2.7x10 ⁷	
I-135	0.6	16.2	0.5	13.5	1.3x10 ⁵	3.5x10 ⁶	
In-111	Indium (49)	2	54.1	2	54.1	1.5x10 ⁴	4.2x10 ⁵
In-113m		4	108	4	108	6.2x10 ⁵	1.7x10 ⁷
In-114m		0.3	8.11	0.3	8.11	8.6x10 ²	2.3x10 ⁴
In-115m		6	162	0.9	24.3	2.2x10 ⁵	6.1x10 ⁶
Ir-189	Iridium (77)	10	270	10	270	1.9x10 ³	5.2x10 ⁴
Ir-190		0.7	18.9	0.7	18.9	2.3x10 ³	6.2x10 ⁴
Ir-192		1	27.0	0.5	13.5	3.4x10 ²	9.2x10 ³
Ir-193m		10	270	10	270	2.4x10 ³	6.4x10 ⁴
Ir-194		0.2	5.41	0.2	5.41	3.1x10 ⁴	8.4x10 ⁵
K-40		Potassium (19)	0.6	16.2	0.6	16.2	2.4x10 ⁻⁷
K-42	Krypton (36)	0.2	5.41	0.2	5.41	2.2x10 ⁵	6.0x10 ⁶
K-43		1.0	27.0	0.5	13.5	1.2x10 ⁵	3.3x10 ⁶
Kr-81		40	1080	40	1080	7.8x10 ⁻⁴	2.1x10 ⁻²
Kr-85m		6	162	6	162	3.0x10 ⁵	8.2x10 ⁶
Kr-85		20	541	10	270	1.5x10 ¹	3.9x10 ²
Kr-87		0.2	5.41	0.2	5.41	1.0x10 ⁶	2.8x10 ⁷
La-137	Lanthanum (57)	40	1080	2	54.1	1.6x10 ³	4.4x10 ⁻²
La-140		0.4	10.8	0.4	10.8	2.1x10 ⁴	5.6x10 ⁵
Lu-172	Lutetium (71)	0.5	13.5	0.5	13.5	4.2x10 ³	1.1x10 ⁵
Lu-173		8	216	8	216	5.6x10 ¹	1.5x10 ³
Lu-174m		20	541	8	216	2.0x10 ²	5.3x10 ³
Lu-174	8	216	4	108	2.3x10 ¹	6.2x10 ²	
Lu-177	30	811	0.9	24.3	4.1x10 ³	1.1x10 ⁵	
MFP	For mixed fission products, use formula for mixtures or TABLE V.						
Mg-28	Magnesium (12)	0.2	5.41	0.2	5.41	2.0x10 ⁵	5.4x10 ⁶
Mn-52	Manganese (25)	0.3	8.11	0.3	8.11	1.6x10 ⁴	4.4x10 ⁵

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Mn-53		Unlimited	Unlimited	Unlimited	Unlimited	6.8x10 ⁻⁵	1.8x10 ⁻³
Mn-54		1	27.0	1	27.0	2.9x10 ²	7.7x10 ³
Mn-56		0.2	5.41	0.2	5.41	8.0x10 ⁵	2.2x10 ⁷
Mo-93	Molybdenum (42)	40	1080	7	189	4.1x10 ⁻²	1.1
Mo-99		0.6	16.2	0.5	13.5 ^{s'}	1.8x10 ⁴	4.8x10 ⁵
N-13	Nitrogen (7)	0.6	16.2	0.5	13.5	5.4x10 ⁷	1.5x10 ⁹
Na-22	Sodium (11)	0.5	13.5	0.5	13.5	2.3x10 ²	6.3x10 ³
Na-24		0.2	5.41	0.2	5.41	3.2x10 ⁵	8.7x10 ⁶
Nb-92m	Niobium (41)	0.7	18.9	0.7	18.9	5.2x10 ³	1.4x10 ⁵
Nb-93m		40	1080	6	162	8.8	2.4x10 ²
Nb-94		0.6	16.2	0.6	16.2	6.9x10 ⁻³	1.9x10 ⁻¹
Nb-95		1	27.0	1	27.0	1.5x10 ³	3.9x10 ⁴
Nb-97		0.6	16.2	0.5	13.5	9.9x10 ⁵	2.7x10 ⁷
Nd-147	Neodymium (60)	4	108	0.5	13.5	3.0x10 ³	8.1x10 ⁴
Nd-149		0.6	16.2	0.5	13.5	4.5x10 ⁵	1.2x10 ⁷
Ni-59	Nickel (28)	40	1080	40	1080	3.0x10 ⁻³	8.0x10 ⁻²
Ni-63		40	1080	30	811	2.1	5.7x10 ¹
Ni-65		0.3	8.11	0.3	8.11	7.1x10 ⁵	1.9x10 ⁷
Np-235	Neptunium (93)	40	1080	40	1080	5.2x10 ¹	1.4x10 ³
Np-236		7	189	1x10 ⁻³	2.70x10 ⁻²	4.7x10 ⁻⁴	1.3x10 ⁻²
Np-237		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	2.6x10 ⁻⁵	7.1x10 ⁻⁴
Np-239		6	162	0.5	13.5	8.6x10 ³	2.3x10 ⁵
Os-185	Osmium (76)	1	27.0	1	27.0	2.8x10 ²	7.5x10 ³
Os-191m		40	1080	40	1080	4.6x10 ⁴	1.3x10 ⁶
Os-191		10	270	0.9	24.3	1.6x10 ³	4.4x10 ⁴
Os-193		0.6	16.2	0.5	13.5	2.0x10 ⁴	5.3x10 ⁵
Os-194		0.2	5.41	0.2	5.41	1.1x10 ¹	3.1x10 ²
P-32	Phosphorus (15)	0.3	8.11	0.3	8.11	1.1x10 ⁴	2.9x10 ⁵
P-33		40	1080	0.9	24.3	5.8x10 ³	1.6x10 ⁵
Pa-230	Protactinium (91)	2	54.1	0.1	2.70	1.2x10 ³	3.3x10 ⁴
Pa-231		0.6	16.2	6x10 ⁻⁵	1.62x10 ⁻³	1.7x10 ⁻³	4.7x10 ⁻²
Pa-233		5	135	0.9	24.3	7.7x10 ²	2.1x10 ⁴
Pb-201	Lead (82)	1	27.0	1	27.0	6.2x10 ⁴	1.7x10 ⁶
Pb-202		40	1080	2	54.1	1.2x10 ⁻⁴	3.4x10 ⁻³
Pb-203		3	81.1	3	81.1	1.1x10 ⁴	3.0x10 ⁵

^{s'} 20 Ci for Mo⁹⁹ for domestic use

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	4.5x10 ⁻⁶	1.2x10 ⁻⁴
Pb-210		0.6	16.2	9x10 ⁻³	0.243	2.8	7.6x10 ¹
Pb-212		0.3	8.11	0.3	8.11	5.1x10 ⁴	1.4x10 ⁶
Pd-103	Palladium (46)	40	1080	40	1080	2.8x10 ³	7.5x10 ⁴
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	1.9x10 ⁻⁵	5.1x10 ⁻⁴
Pd-109		0.6	16.2	0.5	13.5	7.9x10 ⁴	2.1x10 ⁶
Pm-143	Promethium (61)	3	81.1	3	81.1	1.3x10 ²	3.4x10 ³
Pm-144		0.6	16.2	0.6	16.2	9.2x10 ¹	2.5x10 ³
Pm-145		30	811	7	189	5.2	1.4x10 ²
Pm-147		40	1080	0.9	24.3	3.4x10 ¹	9.3x10 ²
Pm-148m		0.5	13.5	0.5	13.5	7.9x10 ²	2.1x10 ⁴
Pm-149		0.6	16.2	0.5	13.5	1.5x10 ⁴	4.0x10 ⁵
Pm-151		3	81.1	0.5	13.5	2.7x10 ⁴	7.3x10 ⁵
Po-208	Polonium (84)	40	1080	2x10 ⁻²	0.541	2.2x10 ¹	5.9x10 ²
Po-209		40	1080	2x10 ⁻²	0.541	6.2x10 ⁻¹	1.7x10 ¹
Po-210		40	1080	2x10 ⁻²	0.541	1.7x10 ²	4.5x10 ³
Pr-142	Praseodymium (59)	0.2	5.41	0.2	5.41	4.3x10 ⁴	1.2x10 ⁶
Pr-143		4	108	0.5	13.5	2.5x10 ³	6.7x10 ⁴
Pt-188	Platinum (78)	0.6	16.2	0.6	16.2	2.5x10 ³	6.8x10 ⁴
Pt-191		3	81.1	3	81.1	8.7x10 ³	2.4x10 ⁵
Pt-193m		40	1080	9	243	5.8x10 ³	1.6x10 ⁵
Pt-193		40	1080	40	1080	1.4	3.7x10 ¹
Pt-195m		10	270	2	54.1	6.2x10 ³	1.7x10 ⁵
Pt-197m		10	270	0.9	24.3	3.7x10 ⁵	1.0x10 ⁷
Pt-197		20	541	0.5	13.5	3.2x10 ⁴	8.7x10 ⁵
Pu-236	Plutonium (94)	7	189	7x10 ⁻⁴	1.89x10 ⁻²	2.0x10 ¹	5.3x10 ²
Pu-237		20	541	20	541	4.5x10 ²	1.2x10 ⁴
Pu-238		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	6.3x10 ⁻¹	1.7x10 ¹
Pu-239		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	2.3x10 ⁻³	6.2x10 ⁻²
Pu-240		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	8.4x10 ⁻³	2.3x10 ⁻¹
Pu-241		40	1080	1x10 ⁻²	0.270	3.8	1.0x10 ²
Pu-242		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	1.5x10 ⁻⁴	3.9x10 ⁻³
Pu-244		0.3	8.11	2x10 ⁻⁴	5.41x10 ⁻³	6.7x10 ⁻⁷	1.8x10 ⁻⁵
Ra-223	Radium (88)	0.6	16.2	3x10 ⁻²	0.811	1.9x10 ³	5.1x10 ⁴
Ra-224		0.3	8.11	6x10 ⁻²	1.62	5.9x10 ³	1.6x10 ⁵

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Ra-225		0.6	16.2	2x10 ⁻²	0.541	1.5x10 ³	3.9x10 ⁴
Ra-226		0.3	8.11	2x10 ⁻²	0.541	3.7x10 ²	1.0
Ra-228		0.6	16.2	4x10 ⁻²	1.08	1.0x10 ¹	2.7x10 ²
Rb-81	Rubidium (37)	2	54.1	0.9	24.3	3.1x10 ⁵	8.4x10 ⁶
Rb-83		2	54.1	2	54.1	6.8x10 ²	1.8x10 ⁴
Rb-84		1	27.0	0.9	24.3	1.8x10 ³	4.7x10 ⁴
Rb-86		0.3	8.11	0.3	8.11	3.0x10 ³	8.1x10 ⁴
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	3.2x10 ⁻⁹	8.6x10 ⁻⁸
Rb (natural)		Unlimited	Unlimited	Unlimited	Unlimited	6.7x10 ⁶	1.8x10 ⁸
Re-183	Rhenium (75)	5	135	5	135	3.8x10 ²	1.0x10 ⁴
Re-184m		3	81.1	3	81.1	1.6x10 ²	4.3x10 ³
Re-184		1	27.0	1	27.0	6.9x10 ²	1.9x10 ⁴
Re-186		4	108	0.5	13.5	6.9x10 ³	1.9x10 ⁵
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	1.4x10 ⁻⁹	3.8x10 ⁻⁸
Re-188		0.2	5.41	0.2	5.41	3.6x10 ⁴	9.8x10 ⁵
Re-189		4	108	0.5	13.5	2.5x10 ⁴	6.8x10 ⁵
Re (natural)		Unlimited	Unlimited	Unlimited	Unlimited	-- 2.4x10 ⁻⁸	
Rh-99	Rhodium (45)	2	54.1	2	54.1	3.0x10 ³	8.2x10 ⁴
Rh-101		4	108	4	108	4.1x10 ¹	1.1x10 ³
Rh-102m		2	54.1	0.9	24.3	2.3x10 ²	6.2x10 ³
Rh-102		0.5	13.5	0.5	13.5	4.5x10 ¹	1.2x10 ³
Rh-103m		40	1080	40	1080	1.2x10 ⁶	3.3x10 ⁷
Rh-105		10	270	0.9	24.3	3.1x10 ⁴	8.4x10 ⁵
Rn-222	Radon (86)	0.2	5.41	4x10 ⁻³	0.108	5.7x10 ³	1.5x10 ⁵
Ru-97	Ruthenium (44)	4	108	4	108	1.7x10 ⁴	4.6x10 ⁵
Ru-103		2	54.1	0.9	24.3	1.2x10 ³	3.2x10 ⁴
Ru-105		0.6	16.2	0.5	13.5	2.5x10 ⁵	6.7x10 ⁶
Ru-106		0.2	5.41	0.2	5.41	1.2x10 ²	3.3x10 ³
S-35	Sulfur (16)	40	1080	2	54.1	1.6x10 ³	4.3x10 ⁴
Sb-122	Antimony (51)	0.3	8.11	0.3	8.11	1.5x10 ⁴	4.0x10 ⁵
Sb-124		0.6	16.2	0.5	13.5	6.5x10 ²	1.7x10 ⁴
Sb-125		2	54.1	0.9	24.3	3.9x10 ¹	1.0x10 ³
Sb-126		0.4	10.8	0.4	10.8	3.1x10 ³	8.4x10 ⁴
Sc-44	Scandium (21)	0.5	13.5	0.5	13.5	6.7x10 ⁵	1.8x10 ⁷
Sc-46		0.5	13.5	0.5	13.5	1.3x10 ³	3.4x10 ⁴

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Sc-47		9	243	0.9	24.3	3.1x10 ⁴	8.3x10 ⁵
Sc-48		0.3	8.11	0.3	8.11	5.5x10 ⁴	1.5x10 ⁶
Se-75	Selenium (34)	3	81.1	3	81.1	5.4x10 ²	1.5x10 ⁴
Se-79		40	1080	2	54.1	2.6x10 ⁻³	7.0x10 ⁻²
Si-31	Silicon (14)	0.6	16.2	0.5	13.5	1.4x10 ⁶	3.9x10 ⁷
Si-32		40	1080	0.2	5.41	3.9	1.1x10 ²
Sm-145	Samarium (62)	20	541	20	541	9.8x10 ¹	2.6x10 ³
Sm-147		Unlimited	Unlimited	Unlimited	Unlimited	8.5x10 ⁻¹⁰	2.3x10 ⁻⁸
Sm-151		40	1080	4	108	9.7x10 ⁻¹	2.6x10 ¹
Sm-153		4	108	0.5	13.5	1.6x10 ⁴	4.4x10 ⁵
Sn-113	Tin (50)	4	108	4	108	3.7x10 ²	1.0x10 ⁴
Sn-117m		6	162	2	54.1	3.0x10 ³	8.2x10 ⁴
Sn-119m		40	1080	40	1080	1.4x10 ²	3.7x10 ³
Sn-121m		40	1080	0.9	24.3	2.0	5.4x10 ¹
Sn-123		0.6	16.2	0.5	13.5	3.0x10 ²	8.2x10 ³
Sn-125		0.2	5.41	0.2	5.41	4.0x10 ³	1.1x10 ⁵
Sn-126		0.3	8.11	0.3	8.11	1.0x10 ⁻³	2.8x10 ⁻²
Sr-82	Strontium (38)	0.2	5.41	0.2	5.41	2.3x10 ³	6.2x10 ⁴
Sr-85m		5	135	5	135	1.2x10 ⁶	3.3x10 ⁷
Sr-85		2	54.1	2	54.1	8.8x10 ²	2.4x10 ⁴
Sr-87m		3	81.1	3	81.1	4.8x10 ⁵	1.3x10 ⁷
Sr-89		0.6	16.2	0.5	13.5	1.1x10 ³	2.9x10 ⁴
Sr-90		0.2	5.41	0.1	2.70	5.1	1.4x10 ²
Sr-91		0.3	8.11	0.3	8.11	1.3x10 ⁵	3.6x10 ⁶
Sr-92		0.8	21.6	0.5	13.5	4.7x10 ⁵	1.3x10 ⁷
T	Tritium (1)	40	1080	40	1080	3.6x10 ²	9.7x10 ³
Ta-178	Tantalum (73)	1	27.0	1	27.0	4.2x10 ⁶	1.1x10 ⁸
Ta-179		30	811	30	811	4.1x10 ¹	1.1x10 ³
Ta-182		0.8	21.6	0.5	13.5	2.3x10 ²	6.2x10 ³
Tb-157	Terbium (65)	40	1080	10	270	5.6x10 ⁻¹	1.5x10 ¹
Tb-158		1	27.0	0.7	18.9	5.6x10 ⁻¹	1.5x10 ¹
Tb-160		0.9	24.3	0.5	13.5	4.2x10 ²	1.1x10 ⁴
Tc-95m	Technetium (43)	2	54.1	2	54.1	8.3x10 ²	2.2x10 ⁴
Tc-96m		0.4	10.8	0.4	10.8	1.4x10 ⁶	3.8x10 ⁷
Tc-96		0.4	10.8	0.4	10.8	1.2x10 ⁴	3.2x10 ⁵

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Tc-97m		40	1080	40	1080	5.6x10 ²	1.5x10 ⁴
Tc-97		Unlimited	Unlimited	Unlimited	Unlimited	5.2x10 ⁻⁵	1.4x10 ⁻³
Tc-98		0.7	18.9	0.7	18.9	3.2x10 ⁻⁵	8.7x10 ⁻⁴
Tc-99m		8	216	8	216	1.9x10 ⁵	5.3x10 ⁶
Tc-99		40	1080	0.9	24.3	6.3x10 ⁻⁴	1.7x10 ⁻²
Te-118	Tellurium (52)	0.2	5.41	0.2	5.41	6.8x10 ³	1.8x10 ⁵
Te-121m		5	135	5	135	2.6x10 ²	7.0x10 ³
Te-121		2	54.1	2	54.1	2.4x10 ³	6.4x10 ⁴
Te-123m		7	189	7	189	3.3x10 ²	8.9x10 ³
Te-125m		30	811	9	243	6.7x10 ²	1.8x10 ⁴
Te-127m		20	541	0.5	13.5	3.5x10 ²	9.4x10 ³
Te-127		20	541	0.5	13.5	9.8x10 ⁴	2.6x10 ⁶
Te-129m		0.6	16.2	0.5	13.5	1.1x10 ³	3.0x10 ⁴
Te-129		0.6	16.2	0.5	13.5	7.7x10 ⁵	2.1x10 ⁷
Te-131m		0.7	18.9	0.5	13.5	3.0x10 ⁴	8.0x10 ⁵
Te-132		0.4	10.8	0.4	10.8	1.1x10 ⁴	3.0x10 ⁵
Th-227	Thorium (90)	9	243	1x10 ⁻²	0.270	1.1x10 ³	3.1x10 ⁴
Th-228		0.3	8.11	4x10 ⁻⁴	1.08x10 ⁻²	3.0x10 ¹	8.2x10 ²
Th-229		0.3	8.11	3x10 ⁻⁵	8.11x10 ⁻⁴	7.9x10 ⁻³	2.1x10 ⁻¹
Th-230		2	54.1	2x10 ⁻⁴	5.41x10 ⁻³	7.6x10 ⁻⁴	2.1x10 ⁻²
Th-231		40	1080	0.9	24.3	2.0x10 ⁴	5.3x10 ⁵
Th-232		Unlimited	Unlimited	Unlimited	Unlimited	4.0x10 ⁻⁹	1.1x10 ⁻⁷
Th-234		0.2	5.41	0.2	5.41	8.6x10 ²	2.3x10 ⁴
Th (natural)		Unlimited	Unlimited	Unlimited	Unlimited	8.1x10 ⁻⁹	2.2x10 ⁻⁷
Ti-44	Titanium (22)	0.5	13.5	0.2	5.41	6.4	1.7x10 ²
Tl-200	Thallium (81.1)	0.8	21.6	0.8	21.6	2.2x10 ⁴	6.0x10 ⁵
Tl-201		10	270	10	270	7.9x10 ³	2.1x10 ⁵
Tl-202		2	54.1	2	54.1	2.0x10 ³	5.3x10 ⁴
Tl-204		4	108	0.5	13.5	1.7x10 ¹	4.6x10 ²
Tm-167	Thulium (69)	7	189	7	189	3.1x10 ³	8.5x10 ⁴
Tm-168		0.8	21.6	0.8	21.6	3.1x10 ²	8.3x10 ³
Tm-170		4	108	0.5	13.5	2.2x10 ²	6.0x10 ³
Tm-171		40	1080	10	270	4.0x10 ¹	1.1x10 ³
U-230	Uranium (92)	40	1080	1x10 ⁻²	0.270	1.0x10 ³	2.7x10 ⁴
U-232		3	81.1	3x10 ⁻⁴	8.11x10 ⁻³	8.3x10 ⁻¹	2.2x10 ¹

TABLE IV
A₁ AND A₂ VALUES FOR RADIONUCLIDES (Continued)

Symbol of Radionuclide	Element and Atomic No.	A ₁ (TBq)	A ₁ (Ci)	A ₂ (TBq)	A ₂ (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
U-233		10	270	1x10 ⁻³	2.70x10 ⁻²	3.6x10 ⁻⁴	9.7x10 ⁻³
U-234		10	270	1x10 ⁻³	2.70x10 ⁻²	2.3x10 ⁻⁴	6.2x10 ⁻³
U-235		Unlimited	Unlimited	Unlimited	Unlimited	8.0x10 ⁻⁸	2.2x10 ⁻⁶
U-236		10	270	1x10 ⁻³	2.70x10 ⁻²	2.4x10 ⁻⁶	6.5x10 ⁻⁵
U-238		Unlimited	Unlimited	Unlimited	Unlimited	1.2x10 ⁻⁸	3.4x10 ⁻⁷
U (natural)		Unlimited	Unlimited	Unlimited	Unlimited	2.6x10 ⁻⁸	7.1x10 ⁻⁷
U (enriched 5% or less)		Unlimited	Unlimited	Unlimited	Unlimited	-- (TABLE VI)	
U (enriched > 5%)		10	270	1x10 ⁻³	2.70x10 ⁻²	-- (TABLE VI)	
U (depleted)		Unlimited	Unlimited	Unlimited	Unlimited	-- (TABLE VI)	
V-48	Vanadium (23)	0.3	8.11	0.3	8.11	6.3x10 ³	1.7x10 ⁵
V-49		40	1080	40	1080	3.0x10 ²	8.1x10 ³
W-178	Tungsten (74)	1	27.0	1	27.0	1.3x10 ³	3.4x10 ⁴
W-181		30	811	30	811	2.2x10 ²	6.0x10 ³
W-185		40	1080	0.9	24.3	3.5x10 ²	9.4x10 ³
W-187		2	54.1	0.5	13.5	2.6x10 ⁴	7.0x10 ⁵
W-188		0.2	5.41	0.2	5.41	3.7x10 ²	1.0x10 ⁴
Xe-122	Xenon (54)	0.2	5.41	0.2	5.41	4.8x10 ⁴	1.3x10 ⁶
Xe-123		0.2	5.41	0.2	5.41	4.4x10 ⁵	1.2x10 ⁷
Xe-127		4	108	4	108	1.0x10 ³	2.8x10 ⁴
Xe-131m		40	1080	40	1080	3.1x10 ³	8.4x10 ⁴
Xe-133		20	541	20	541	6.9x10 ³	1.9x10 ⁵
Xe-135		4	108	4	108	9.5x10 ⁴	2.6x10 ⁶
Y-87	Yttrium (39)	2	54.1	2	54.1	1.7x10 ⁴	4.5x10 ⁵
Y-88		0.4	10.8	0.4	10.8	5.2x10 ²	1.4x10 ⁴
Y-90		0.2	5.41	0.2	5.41	2.0x10 ⁴	5.4x10 ⁵
Y-91m		2	54.1	2	54.1	1.5x10 ⁶	4.2x10 ⁷
Y-91		0.3	8.11	0.3	8.11	9.1x10 ²	2.5x10 ⁴
Y-92		0.2	5.41	0.2	5.41	3.6x10 ⁵	9.6x10 ⁶
Y-93		0.2	5.41	0.2	5.41	1.2x10 ⁵	3.3x10 ⁶
Yb-169	Ytterbium (70)	3	81.1	3	81.1	8.9x10 ²	2.4x10 ⁴
Yb-175		30	811	0.9	24.3	6.6x10 ³	1.8x10 ⁵
Zn-65	Zinc (30)	2	54.1	2	54.1	3.0x10 ²	8.2x10 ³
Zn-69m		2	54.1	0.5	13.5	1.2x10 ⁵	3.3x10 ⁶
Zn-69		4	108	0.5	13.5	1.8x10 ⁶	4.9x10 ⁷
Zr-88	Zirconium (40)	3	81.1	3	81.1	6.6x10 ²	1.8x10 ⁴
Zr-93		40	1080	0.2	5.41	9.3x10 ⁻⁵	2.5x10 ⁻³
Zr-95		1	27.0	0.9	24.3	7.9x10 ²	2.1x10 ⁴
Zr-97		0.3	8.11	0.3	8.11	7.1x10 ⁴	1.9x10 ⁶

TABLE V
GENERAL VALUES FOR A₁ AND A₂

Contents	A ₁		A ₂	
	TBq	Ci	TBq	Ci
Onl beta- or gamma-emitting nuclides are known to be present.	0.2	5	0.02	0.5
Alpha-emitting nuclides are known to be present, or no relevant data are available.	0.10	2.70	2x10 ⁻⁵	5.4x10 ⁻⁴

TABLE VI
ACTIVITY-MASS RELATIONSHIPS FOR URANIUM

Uranium Enrichment ^{2/} weight % U-235 present	Specific Activity	
	Ci/g	TBq/g
0.45	1.8x10 ⁻⁸	5.0x10 ⁻⁷
0.72	2.6x10 ⁻⁸	7.1x10 ⁻⁷
1.0	2.8x10 ⁻⁸	7.6x10 ⁻⁷
1.5	3.7x10 ⁻⁸	1.0x10 ⁻⁶
5.0	1.0x10 ⁻⁷	2.7x10 ⁻⁶
10.0	1.8x10 ⁻⁷	4.8x10 ⁻⁶
20.0	3.7x10 ⁻⁷	1.0x10 ⁻⁵
35.0	7.4x10 ⁻⁷	2.0x10 ⁻⁵
50.0	9.3x10 ⁻⁷	2.5x10 ⁻⁵
90.0	2.2x10 ⁻⁶	5.8x10 ⁻⁵
93.0	2.6x10 ⁻⁶	7.0x10 ⁻⁵
95.0	3.4x10 ⁻⁶	9.1x10 ⁻⁵

^{2/} The figures for uranium include representative values for the activity of the uranium-235 which is concentrated during the enrichment process

ATTACHMENT 2

MEMORANDA OF UNDERSTANDING

terminated in accordance with the terms of the agreement.

Participation in this agreement may be terminated by any of the parties following 30 days advance written notice by that party to all of the other parties.

Supplementary agreements may be temporary and terminate on a certain date or upon completion, as provided.

The termination of any party's participation in this Memorandum of Understanding or any supplementary agreement does not render such agreements void to the other parties.

Implementing Agency Components

The following is a list of agency components with responsibilities for implementing the provisions of this Memorandum of Understanding. Each organizational component will designate specific personnel to be contacted on matters related to implementing this MOU. EPA shall provide each implementing component with an up-to-date list of these personnel semiannually or more frequently if EPA is notified of changes in personnel.

Department of the Air Force, Deputy Chief of Staff, Operations, Plans and Readiness, Directorate of operations and Readiness, Reconnaissance Division.

Department of Energy, Office of Assistant Secretary for Environment, Division of Operational and Environmental Safety.

Environmental Protection Agency, Office of Radiation Programs, Environmental Analysis Division.

Department of Health, Education, and Welfare, Food and Drug Administration, FDA Recall and Emergency Staff.

Department of Commerce, National Oceanic and Atmospheric Administration, Air Resources Laboratory.

Nuclear Regulatory Commission, Office of Inspection and Enforcement.

Department of Transportation, Federal Aviation Administration, Office of Environmental Quality.

Agreement Authority

This agreement is entered into under various provisions for interagency cooperation appearing in the legislative authorities of the signatory agencies.

For the Department of the Air Force,
Brig. Gen. Walter B. Ratliff,
Acting Director of Operations and Readiness.

For the Department of Energy,

Ruth C. Clusen,

Assistant Secretary for Environment.

For the Environmental Protection Agency,

Paul Stolpman,

Acting Assistant Administrator for Air, Noise, and Radiation.

For the Federal Aviation Administration,

Charles R. Foster,
Associate Administrator for Aviation Standards.

For the Food and Drug Administration,

Joseph P. Hile,

Associate Commissioner for Regulatory Affairs.

For the National Oceanic and Atmospheric Administration,

George S. Benton,

Associate Administrator.

For the Nuclear Regulatory Commission,

Lee V. Gossick,

Executive Director for Operations.

44 FR 38690

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DEPARTMENT OF TRANSPORTATION

Nuclear Regulatory Commission

Transportation of Radioactive Materials; Memorandum of Understanding

The roles of the Department of Transportation and the Nuclear Regulatory Commission in the regulation of the transportation of radioactive materials were described in a memorandum of understanding signed on June 8, 1979. The present memorandum supersedes a 1973 agreement between the Atomic Energy Commission and the Department of Transportation. A text of the memorandum is set forth below.

Radioactive Materials

Abstract. This agreement delineates the respective responsibilities of the Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC) for the regulation of safety in transportation of radioactive materials. It supersedes the existing agreement executed on March 22, 1973, between the DOT and the Atomic Energy Commission. Generally, the DOT is responsible for regulating safety in transportation of all hazardous materials, including radioactive materials, and the NRC is responsible for regulating safety in receipt, possession, use, and transfer of byproducts, source, and special nuclear materials. The NRC reviews and approves or denies approval of package designs for fissile materials and for other radioactive materials (other than low specific activity materials) in quantities exceeding Type A limits, as defined in 10 CFR Part 71.

Agreement between the DOT and the NRC. The Department of Transportation (DOT), under the Transportation of

Explosives Act (18 U.S.C. 831-835), the Dangerous Cargo Act (R. S. 4472, as amended, 46 U.S.C. 170), Title VI and 902(h) of the Federal Aviation Act of 1958 (49 U.S.C. 1421-1430 and 1472(h)), the Department of Transportation Act (49 U.S.C. 1855), and the Hazardous Materials Transportation Act (49 U.S.C. 1801-1812), is required to regulate safety in the transportation of hazardous materials, including radioactive materials.

The Nuclear Regulatory Commission (NRC), under the Atomic Energy Act of 1954, as amended (42 U.S.C. Chapter 23), and Section 201 of the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5841), is authorized to license and regulate the receipt, possession, use, and transfer of "by product material," "source material," and "special nuclear material" (as defined in 42 U.S.C. 2014). The NRC authority to license air shipment of plutonium is further governed by Pub. L. 94-79.

For the purpose of developing, establishing, and implementing consistent and comprehensive regulations and requirements for the safe transportation of radioactive materials, and avoiding duplication of effort, the DOT and the NRC agree, subject to their respective statutory authorities, as follows. Terms used in this agreement are defined in 49 CFR Parts 100-199 and 10 CFR part 71.

I. Development of Safety Standards

A. The DOT (in consultation with the NRC) will develop safety standards for the classification of radioactive materials; for the design specifications and performance requirements of packages for quantities of radioactive materials (other than fissile materials) not exceeding Type A limits and for low specific activity (LSA) radioactive materials; for the external radiation fields, labeling, and marking of all radioactive materials packages and vehicles; for the mechanical conditions, construction requirements, and tie-down requirements of carrier equipment; for the qualifications of carrier personnel; for the procedures for loading, unloading, handling, and storage in transit; for any special transport controls (excluding safeguards) necessary for radiation safety during carriage; and for all other safety requirements except those specified in the next paragraph.

B. The NRC (in consultation with the DOT) will develop safety standards for design and performance of packages for fissile materials and for quantities of other radioactive materials (other than LSA materials) exceeding Type A limits in the following areas:

MEMORANDA OF UNDERSTANDING

1. Structural materials of fabrication;
2. Closure devices;
3. Structural integrity;
4. Criticality control;
5. Containment of radioactive material;
6. Shielding;
7. Generation of internal pressure;
8. Internal contamination of packages;
9. Protection against internal overheating; and
10. Quality assurance of packaging design, fabrication, testing, maintenance, and use.

II. Adoption of Safety Standards and Regulations

A. The DOT will adopt regulations imposing on shippers and carriers subject to its jurisdiction those standards developed by the DOT and the NRC pursuant to Section I of this Memorandum of Understanding and any additional requirements necessary to protect the public health and safety. The DOT will require NRC approval of designs of packages for shipment of fissile materials and other radioactive materials in quantities exceeding Type A limits (except LSA materials) by all persons subject to the jurisdiction of the DOT. The DOT will issue complete and comprehensive Federal regulations for the packaging and transportation of all radioactive materials as a part of its overall body of Federal regulations (49 CFR Parts 100-199) for the packaging and transportation of all hazardous materials.

B. The NRC will adopt packaging standards for fissile materials and for quantities of other radioactive materials (other than LSA materials) exceeding Type A limits and will adopt regulations imposing on its licensees administrative, procedural, and technical requirements necessary to protect the public health and safety and to assure the common defense and security.

C. The NRC will adopt procedures, standards, and criteria for approval of package designs and for approval of special transport controls proposed by the applicant for a given package design. The NRC will require its licensees to comply with the DOT regulations when those persons are not otherwise subject to the DOT regulations.

III. Package Review

A. The DOT will submit to the NRC for review the following package designs:

1. Specification containers. Approval by the NRC of package designs for fissile materials and for radioactive materials (other than LSA materials) in quantities exceeding Type A limits will be obtained before publication of such

designs in the DOT regulations.

2. Packages with foreign certification. Approval by the NRC will be obtained before revalidation of the foreign certificates required in the DOT regulations for packages shipped between origins and destinations within the United States, except for import and export shipments. Approval by the NRC is not required if a package is used solely for export or import or if a package is authorized by the DOT regulations solely for transportation through or over the United States between origins and destinations outside the United States. The DOT has the responsibility for exercising discretion as to whether it requests NRC review of such packages.

3. Any package for which NRC evaluation is warranted in DOT opinion.

B. The NRC will evaluate package designs for fissile materials and for other radioactive materials (other than LSA materials) in quantities exceeding Type A limits and will, if satisfactory, issue approvals therefor (viz., a license, Certificate of Compliance, or other package approval) directly to the person requesting the approval.

IV. Inspection and Enforcement

A. Each agency will conduct an inspection and enforcement program within its jurisdiction to assure compliance with its requirements. The NRC will assist the DOT, as appropriate, in inspecting shippers of fissile materials and of other radioactive materials in quantities exceeding Type A limits.

B. The DOT and the NRC will consult each other on the results of their respective inspections in the areas where the results are related to the other agency's requirements, and each will take enforcement action as it deems appropriate within the limits of its authority.

V. Accidents and Incidents

A. The DOT will require of all carriers subject to its jurisdiction the notification and reporting to the DOT of accidents, incidents, and instances of actual or suspected leakage involving radioactive material packages if such an event occurs in transit and the DOT will promptly notify the NRC of such events.

B. The NRC will require of its licensees the notification and reporting to the NRC of accidents, incidents, and instances of actual or suspected leakage involving radioactive material packages if such an event occurs prior to delivery to a carrier for transport or after delivery to a receiver. The NRC will

encourage the Agreement States¹ and the DOT will encourage the non-Agreement States to impose incident reporting requirements on shippers and receivers subject to the States' jurisdiction.

C. In all accidents, incidents, and instances of actual or suspected leakage involving packages of radioactive material regulated by the NRC, the NRC will normally be the lead agency for investigating the occurrence and preparing the report of the investigation. The DOT may either participate, as appropriate, in the investigation with the NRC as the lead agency or conduct a separate investigation. Subsequent to each investigation involving radioactive material regulated by the NRC, the NRC and the DOT will jointly define the scope of the enforcement actions to be taken by each agency to assure that shippers and carriers are subject to concurrent and equivalent enforcement actions but not unduly subject to duplicate enforcement actions.

D. This section V does not affect the authority of the National Transportation Safety Board, which is independent of the DOT and the NRC, to receive accident reports and to investigate transportation accidents.

VI. National Competent Authority

A. The DOT will be the national competent authority with respect to the administrative requirements set forth in the regulations for the Safe Transport of Radioactive Materials of the International Atomic Energy Agency (IAEA). In issuing certificates of competent authority for the United States under those regulations, the DOT will require for certain packages other than DOT specification containers an NRC approval in accordance with Section III.A of this Memorandum of Understanding. The NRC will provide to the national competent authority (DOT) technical support and advice pertaining to the transportation of radioactive materials.

B. The DOT will act as the representative of the United States to the IAEA and other international groups on matters pertaining to the administrative and safety regulatory aspects of transportation of radioactive materials. The NRC will provide technical support and advice to the DOT in this capacity.

¹ States which have entered into an Agreement with the Atomic Energy Commission or the NRC pursuant to Section 274 of the Atomic Energy Act of 1954, as amended, under which the NRC has relinquished to such States the majority of its regulatory authority over source, byproduct and special nuclear material in quantities not sufficient to form a critical mass.

VII. Exchange of Information

A. Prior to issuance of any regulations by either the DOT or the NRC involving transportation of radioactive materials, each agency will advise and consult with the other to avoid possible conflict in regulations and to assure that: (1) the regulations will afford adequate protection of the health and safety of the public; (2) the effect of these regulations will not be inimical to the common defense and security of the United States; and (3) the regulations are in the public interest.

B. The DOT and the NRC will exchange information, consult and assist each other within the areas of their special competence in the development and enforcement of regulations and procedures. Each agency will make available to the other, subject to security requirements and statutory provisions affecting the release of information, summaries of inspection records, investigations of serious accidents, and other matters relating to safety in the transportation of radioactive materials.

VIII. Working Arrangements

The NRC and the DOT will designate appropriate staff representatives and will establish joint working arrangements from time to time for the purpose of administering this Memorandum of Understanding.

IX. Effect

A. Nothing herein is intended to affect the statutory exemption of shipments of radioactive materials made by or under the direction or supervision of the Department of Energy or the Department of Defense in accordance with the provisions of 18 U.S.C. 832(c).

B. This agreement shall take effect upon the signing by authorized representatives of the respective agencies, and shall supersede in its entirety the March 22, 1973, Memorandum of Understanding between the DOT and the Atomic Energy Commission.

C. Nothing in this Memorandum of Understanding is intended to restrict the statutory authority of either the DOT or the NRC.

Done at Washington, D.C., in triplicate, this 8th day of June 1979.

For the United States Department of Transportation.

James D. Palmer,
Administrator, Research and Special Programs Administration, Department of Transportation.

For the United States Nuclear Regulatory Commission.

Joseph M. Hendrie,
Chairman, Nuclear Regulatory Commission

March 31, 1999

ATTACHMENT 3



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 29, 2001

ALL AGREEMENT AND NON-AGREEMENT STATES

PROGRAM MANAGEMENT INFORMATION: ADOPTION OF CERTAIN TRANSPORTATION REGULATIONS BY REFERENCE (STP-01- 029)

Several States have asked whether adopting appropriate sections of 49 CFR and 10 CFR 71, by reference, would allow them to maintain compatibility with respect to transportation regulations.

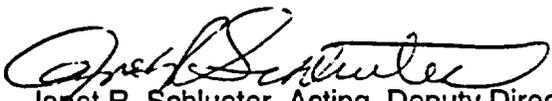
We were also asked, by Mr. Steven Collins from the Illinois Department of Nuclear Safety, to provide a list of transportation requirements in 10 CFR Part 71 which are not also addressed in 49 CFR Parts 170 - 189. This would help to avoid duplication of requirements when adopting transportation regulations by reference. Enclosed is our response to Mr. Collins advising him that adoption by reference is acceptable and providing the requested list.

If you have any questions regarding this correspondence, please contact me or the individual named below.

POINT OF CONTACT:
TELEPHONE:

Lloyd A. Bolling
301-415-2327

INTERNET: LAB@NRC.GOV
FAX: 301-415-3502


Janet R. Schlueter, Acting Deputy Director
Office of State and Tribal Programs

Enclosure:
As stated

ATTACHMENT 3



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 27, 2001

Mr. Steven C. Collins
Assistant Manager
Office of Radiation Safety
Illinois Department of Nuclear Safety
1035 Outer Park Drive
Springfield, IL 62704

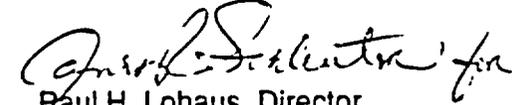
Dear Mr. Collins:

This is in response to your February 7, 2001, letter on adopting the appropriate sections of 49 CFR by reference.

We believe that the Illinois Department of Nuclear Safety can adopt 49 CFR Parts 170 - 189 by reference, along with the appropriate sections of 10 CFR Part 71 that are not specifically included in 49 CFR, in order to maintain compatibility. We have enclosed the 10 CFR Part 71 portion of the Office of State and Tribal Programs Procedure SA-200, entitled, "Compatibility Categories and Health and Safety Identification for NRC Regulations and Other Program Elements" issued on February 6, 2001. This complete procedure is located at the Office of State and Tribal Programs website, listed under "Procedures." The sections of 10 CFR Part 71 that are not specifically included in 49 CFR Parts 170 - 189 are identified by an asterisk in this enclosure. Please note that some of these sections are identified as Compatibility Category D.

Please feel free to contact me or Lloyd Bolling at 301-415-2327 should you have any further questions.

Sincerely,


Paul H. Lohaus, Director
Office of State and Tribal Programs

Enclosure:
Compatibility List - Current Part 71

Current Part 71 - PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIAL From SA-200 dated 2/6/01

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
§71.0	Purpose and Scope	D	
§71.1	Communications and Records	D	
§71.2	Interpretations	D	
§71.3.	Requirements for license	D	
§71.4	Definitions		
	A ₁	B	
	A ₂	B	
	Carrier	B	
	Certificate holder	D	This term is not used in any section requiring Agreement State adoption.
	Close reflection by water	D	This definition is not required for compatibility since it defines a term which pertains to an area reserved to NRC. A State may adopt this definition for purposes of clarity or communication. This definition can be adopted by Agreement States since it in and of itself does not convey any authority whereby a State can regulate in an exclusive NRC jurisdiction. However, if a State chooses to define the term then the definition should be essentially identical.
	Containment System	D	This term is not used in any section requiring Agreement State adoption.
	Conveyance	D	This term is not used in any section requiring Agreement State adoption.
	Exclusive use	B	
	Fissile material	B	
	Licensed material	[D]	This definition also appears in 10 CFR 20.1003. For purposes of compatibility, the language of the Part 20 definition should be used and is assigned to Compatibility Category D.
	Low Specific Activity (LSA) material	B	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
	Low toxicity alpha emitters	B	
	*Maximum normal operating pressure	B	The definition of the term "maximum normal operating pressure" was changed from a compatibility category "B" to a category "D." This term is not used in any section requiring Agreement State adoption; it relates to the heat conditions in §71.71(c)(1), which is designated a category "NRC." This definition is not required for compatibility since it defines a term which pertains to an area reserved to the NRC. A State may adopt this definition for purposes of clarity or communication. This definition can be adopted by Agreement States since it is and of itself does not convey any authority whereby a State can regulate in an exclusive NRC jurisdiction. However, if a State chooses to define this term then the definition should be essentially identical.
	Natural thorium	B	
	Normal form radioactive material	B	
	*Optimum interspersed hydrogenous moderation	D	This definition is not required for compatibility since it defines a term which pertains to an area reserved to NRC. A State may adopt this definition for purposes of clarity or communication. This definition can be adopted by Agreement States since it in and of itself does not convey any authority whereby a State can regulate in an exclusive NRC jurisdiction. However, if a State chooses to define the term then the definition should be essentially identical.
	Package	B	
	Fissile material package	B	
	Type B package	B	
	Packaging	B	
	Special form radioactive material	B	
	Specific activity	B	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
	*State	D	
	Surface Contaminated Object (SCO)	B	
	Transport Index	B	
	Type A quantity	B	
	Type B quantity	B	
	Natural Uranium	B	
	Depleted Uranium	B	
	Enriched Uranium	B	
*§71.5	Transportation of Licensed Material	B	
*§71.6	Information collection requirements; OMB approval	D	
*§71.7	Completeness and accuracy of Information	D	
*§71.8	Specific exemptions	D	
*§71.9	Exemption for physicians	D	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
*§71.16	General license: Use of foreign approved package	B	
§71.18	General license: Fissile material, limited quantity of package	D	This provision is not required for purposes of compatibility because the transportation of these packages in Agreement States is already covered under existing Department of Transportation (DOT) regulations.
§71.20	General license: Fissile material, limited moderator per package	D	This provision is not required for purposes of compatibility because the transportation of these packages in Agreement States is already covered under existing (DOT) regulations.
§71.22	General license: Fissile material, limited quantity, Controlled Shipment	D	This provision is not required for purposes of compatibility because the transportation of these packages in Agreement States is already covered under existing (DOT) regulations.
§71.24	General license: Fissile material, limited moderator, controlled shipment	NRC	
§71.31	Contents of Application	NRC	
§71.33.	Package description	NRC	
§71.35	Package evaluation	NRC	
§71.37	Quality Assurance	NRC	
§71.38	Renewal of a certificate of compliance or quality assurance program approval	NRC	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
§71.39	Requirements for additional information	NRC	
§71.41	Demonstration of Compliance	NRC	
§71.43	General Standards for all packages	NRC	
§71.45	Lifting and tie-down Standards for all packages	NRC	
§71.47	External radiation Standards for all packages	[B]	This requirement was changed from a compatibility category "NRC" to "[B]." This provision was changed because it establishes the external radiation standards for all transportation packages. It is essential that the Agreement States adopt this provision in an essentially identical manner because they have direct and significant transboundary affects. The bracket, indicates that a State should adopt this provision in an essentially identical manner because of its direct and significant transboundary effects; however, if a State has adopted this provision as a part of its DOT regulations, then the adoption of this section is not necessary.
§71.51	Additional Requirements for Type B packages	NRC	
§71.52	Exemption for low-specific-activity (LSA) packages	NRC	
§71.53	Fissile material exemptions	NRC	
§71.55	General Requirements for fissile material packages	NRC	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
§71.57	Reserved		
§71.59	Standards for arrays of fissile material packages	NRC	
§71.61	Special requirements for irradiated nuclear fuel shipments	NRC	
§71.63	Special requirements for plutonium shipments	NRC	
§71.64	Special requirements for plutonium air shipments	NRC	
§71.65	Additional Requirements	NRC	
§71.71	Normal conditions of transport	NRC	
§71.73	Hypothetical accident conditions	NRC	
§71.74	Accident conditions for air transport of plutonium	NRC	
§71.75	Qualification of special form radioactive material	NRC	
§71.77	Qualification of LSA-III material	NRC	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
*§71.81	Applicability of operating controls	D	This requirement was changed from a compatibility category "B" to "D." This designation was changed because it does not meet any of the criteria for designation as Category A, B, C or Health and Safety and is not required for the purposes of compatibility.
*§71.83	Assumptions as to unknown properties	[B]	This requirement was changed from a compatibility category "NRC" to "[B]." Agreement States can regulate fissile material below 350gms. This provision is needed to address fissile material regulated by the States and to assure a regulatory gap in the regulations of these materials is not created. The bracket, indicates that a State should adopt this provision in an essentially identical manner because of its direct and significant transboundary effects; however, if a State has adopted this provision as a p of its DOT regulations, then the adoption of this section is not necessary.
*§71.85	Preliminary determinations	B	
§71.87	Routine determinations	B	
§71.88	Air Transportation of plutonium	B	
*§71.89	Opening instructions	B	
*§71.91	Records	D	
*§71.93.	Inspection and tests	D	
*§71.95	Reports	D	
*§71.97	Advance notification of shipment of irradiated reactor fuel and nuclear waste	B	
*§71.99	Violations	D	
*§71.100	Criminal penalties	D	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
*§71.101	Quality assurance requirements	D	
*§71.103	Quality assurance organization	D	
*§71.105	Quality assurance program	D	
*§71.107	Package design control	D	
*§71.109	Procurement document control	D	
*§71.111	Instructions, procedures, and drawings	D	
*§71.113	Document control	D	
*§71.115	Control of purchased material, equipment, and services	D	
*§71.117	Identification and control of materials, parts, and components	D	
*§71.119	Control of special processes	D	
*§71.121	Internal Inspection	D	
*§71.123	Test control	D	
*§71.125	Control of measuring and test equipment	D	

REGULATION SECTION	SECTION TITLE	COMPATIBILITY CATEGORY	COMMENTS
*§71.127	Handling, storage, and shipping control	D	
*§71.129	Inspection, test, and operating status	D	
*§71.131	Nonconforming materials, parts, or components	D	
*§71.133	Corrective action	D	
*§71.135	Quality assurance records	D	
*§71.137	Audits	D	
Appendix A	Determination of A1 and A2	B	