

Title 33
ENVIRONMENTAL QUALITY
Part XV. Radiation Protection

Chapter 15. Transportation of Radioactive Material

§1502. Scope

A. Each licensee who transports licensed material outside the site of usage, as specified in the department license, or where transport is on public highways, of the confines of his plant, or other place of use, or who delivers licensed material to a carrier for transport, shall comply with the regulations in this Chapter and the applicable requirements of the U.S. DOT regulations appropriate to the mode of transport of U.S. DOT in 49 CFR Pparts 170-189.

B. The licensee shall particularly note U.S. DOT regulations in the following areas:

A1. PpackagingC49 CFR Ppart 173, Ssubparts A, and B, and Paragraphs 173.401-173.478. I;

B2. Mmarking and labelingC49 CFR Ppart 172, subpart D, and Pparagraphs 172.400-172.407; ,172.436-172.440-, and subpart E.

C3. PplacardingC49 CFR Ppart 172, subpart F, paragraphs 172.500 -172.519, 172.556; and appendices B and C-;

D4. Sshipping papers and emergency informationC49 CFR Ppart 172, subparts C and G-;

E5. Aaccident reportingC49 CFR Pparts 171.15 and 171.16-;

F6. -hazardous material shipper/Ccarrier requirementsC49 CFR Parts 390 to 397.part 107, subpart G; and

7. hazardous material employee training—49 CFR part 172, subpart H.

C. The licensee shall also note U.S. DOT regulations pertaining to the following modes of transportation:

1. rail— 49 CFR part 174, subparts A - D and K;

2. air—49 CFR part 175;

3. vessel—49 CFR part 176, subparts A - F and M; and

4. public highway— 49 CFR part 177 and parts 390 - 397.

D. If U.S. DOT regulations are not applicable to a shipment of licensed material, the licensee shall conform to the standards and requirements of the U.S. DOT specified in Subsection A of this Section to the same extent as if the shipment or transportation were subject to U.S. DOT regulations. A request for modification, waiver, or exemption from those requirements, and any notification referred to in those requirements, must be filed with, or made to, the Director, Office of Nuclear Material Safety and Safeguards, U.S. NRC, Washington, DC 20555-0001.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113.

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1503. Definitions

A. As used in this Chapter, the following definitions apply:

A_1C the maximum activity of special form radioactive material permitted in a Type A package.

A_2C the maximum activity of radioactive material, other than special form, LSA, and SCO radioactive material, permitted in a Type A package. These values are either listed in LAC 33:XV.1517, or may be derived in accordance with the procedure prescribed in LAC 33:XV.1517

* * *

[See Prior Text]

Conveyance—for transport by public highway or rail, any transport vehicle or large freight container; for transport by water, any vessel, or any hold, compartment, or defined deck area of a vessel, including any transport vehicle on board the vessel; and for transport by aircraft, any aircraft.

Exclusive Use—(also referred to in other regulations as "sole use" or "full load") means the sole use of a conveyance by a single consignor of a conveyance and 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—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. Certain exclusions from fissile material controls are provided by the U.S. NRC in 10 CFR 71.53.

Low Specific Activity (LSA) Material ~~any of the following:~~ radioactive material with limited specific activity 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. ~~uranium or thorium ores and physical or chemical concentrates of those ores;~~
2. ~~unirradiated natural or depleted uranium or unirradiated natural thorium;~~
3. ~~tritium oxide in aqueous solutions provided the concentration does not exceed 5.0 millicuries (185 MBq) per milliliter;~~
4. ~~material in which the radioactivity is essentially uniformly distributed and in which the estimated average concentration per gram of contents does not exceed:~~
 - a. 0.0001 millicurie [3.7 kBq] of radionuclides for which the A_2 quantity in Appendix A of this Chapter is not more than 0.05 Curie [1.85 GBq];

~~_____ b. 0.005 millicurie [185 kBq] of radionuclides for which the A_2 quantity in Appendix A of this Chapter is more than 0.05 Curie [1.85 GBq], but not more than 1.0 Curie [37 GBq]; or~~

~~_____ c. 0.3 millicurie [11.1 MBq] of radionuclides for which the A_2 quantity in Appendix A of this Chapter is more than 1.0 Curie [37 GBq].~~

~~5. objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination, when averaged over an area of 1 square meter, does not exceed 0.0001 millicurie [220,000 disintegrations per minute] [3.7 kBq] per square centimeter of radionuclides for which the A_2 quantity in Appendix A of this Chapter is not more than 0.05 curie [1.85 GBq], or 0.001 millicurie [2,200,000 disintegrations per minute] [37 kBq] per square centimeter for other radionuclides.~~

a. LSA-I:

i. ores containing only naturally occurring radionuclides (e.g., uranium, thorium) and uranium or thorium concentrates of such ores;

ii. solid unirradiated natural uranium, depleted uranium, or natural thorium or their solid or liquid compounds or mixtures;

iii. radioactive material, other than fissile material, for which the A_2 value is unlimited; or

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

b. LSA-II:

i. water with tritium concentration up to 0.8 TBq/liter (20.0 Ci/liter); 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.

c. LSA-III. Solids (e.g., consolidated wastes, activated materials) 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 (e. g., concrete, bitumen, ceramic, etc.);

ii. the radioactive material is essentially uniformly distributed throughout a solid or a collection of solid objects or is essentially uniformly distributed in a solid compact binding agent (e.g., concrete, bitumen, ceramic, etc.);

iii. 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 seven days, would not exceed $0.1 A_2$; and

iv. the average specific activity of the solid does not exceed 2×10^{-3}

A_2/g .

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

Maximum Normal Operating Pressure—the maximum gauge pressure that would develop in the containment system in a period of one year under the heat condition specified by the U.S. NRC regulations in 10 CFR 71.71(c)(1), in the absence of venting, external cooling by an ancillary system, or operational controls during transport.

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

* * *

[See Prior Text]

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

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

b. Type B package means a Type B packaging together with its radioactive contents. On approval, a Type B package design is designated by the NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lb/in²) gauge or a pressure relief device that would allow the release of radioactive material to the environment under the tests specified in U.S. NRC regulations 10 CFR 71.73, in which case it will receive a designation B(M). B(U) refers to the need for unilateral approval of international shipments; B(M) refers to the need for multilateral approval of international shipments. There is no distinction made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, see U.S. DOT regulations in 49 CFR part 173. A Type B package approved before September 6, 1983, was designated only as Type B. Limitations on its use are specified in LAC 33:XV.1509.

* * *

[See Prior Text]

Special Form Radioactive Material Cradioactive material ~~which~~ that satisfies the following conditions:

a. it is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

b. the piece or capsule has at least one dimension not less than 5 millimeters (0.197 inch); and

c. it satisfies the test requirements specified by the U.S. NRC in 10 CFR 71.75. A special form encapsulation designed in accordance with the NRC requirements in 10 CFR 71.4 in effect on June 30, 1983, and constructed prior to July 1, 1985, may continue to be used. A special form encapsulation either designed or constructed after June 30, 1985, must meet requirements of this definition applicable at the time of its design or construction. Any other special form encapsulation must meet the specifications of this definition.

* * *

[See Prior Text]

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

a. SCO-I. A solid object on which:

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

ii. the fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4x10⁴Bq/cm² (1.0 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 4x10³ Bq/cm² (0.1 microcurie/cm²) for all other alpha emitters; and

iii. the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4x10⁴Bq/cm² (1 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 4x10³ Bq/cm² (0.1 microcurie/cm²) for all other alpha emitters.

b. SCO-II. A solid object on which the limits for SCO-I are exceeded and on which:

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

ii. the fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8x10⁵ Bq/cm² (20 microcuries/cm²) for beta and gamma and low toxicity alpha emitters or 8x10⁴ Bq/cm² (2 microcuries/cm²) for all other alpha emitters; and

iii. the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8x10⁵ Bq/cm² (20 microcuries/cm²) for beta and gamma and low toxicity alpha emitters, or 8x10⁴ Bq/cm² (2 microcuries/cm²) for all other alpha emitters.

Transport Index C the dimensionless number (rounded up to the first decimal place) 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 in millirem per hour at 1 meter from the external surface of the package.~~ determined as follows:

a. for non-fissile material packages, the number determined by multiplying the maximum radiation level in millisievert (mSv) per hour at 1 meter (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at 1 meter (3.3 ft)); or

b. for fissile material packages, the number determined by multiplying the maximum radiation level in mSv per hour at one meter (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 ft)), or for critical control purposes, the number obtained as described in the U.S. NRC regulations, whichever is larger.

~~*Type A Quantity*~~Ca quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material, where A_1 and A_2 are given in ~~Appendix A of this Chapter LAC 33:XV.1517~~ or may be determined by procedures described in ~~Appendix A of this Chapter LAC 33:XV.1517~~.

~~*Type B Package*~~Ca Type B packaging together with its radioactive contents. 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. There is no distinction made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, see DOT regulations in 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 LAC 33:XV.1509.

~~*Type B Packaging*~~Ca packaging designed to retain the integrity of containment and shielding required by U.S. NRC regulations when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR Part 71.

*Type B Quantity*Ca quantity of radioactive material greater than a Type A quantity.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1508. General License: NRC Approved Packages

A. A general license is hereby issued to any licensee of the ~~Division~~ department 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 ~~U. S. Nuclear Regulatory Commission~~ department.

B. This general license applies only to a licensee who:

1. has a quality assurance program approved by the department as satisfying the provisions of the U.S. NRC, 10 CFR 71, subpart H;

~~1~~ 2. has a copy of the specific license, certificate of compliance, or other approval 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;

~~2~~ 3. complies with the terms and conditions of the license, certificate, or other approval, as applicable, and the applicable requirements of this Chapter; and

~~3-4~~ prior to the licensee's first use of the package, has registered with the ~~U.S. Nuclear Regulatory Commission~~ NRC.

C. The general license in ~~LAC 33:XV.1508~~ this Section applies only when the package approval authorizes use of the package under this general license.

~~D. For previously approved Type B packages which are not designated as either B[U] or B[M] in the NRC Certificate of Compliance, this~~ For a Type B or fissile material package, the design of which was approved by the U. S. NRC before April 1, 1996, the general license is subject to additional restrictions of LAC 33:XV.1509.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1509. Previously Approved Type B Packages

A. A Type B package previously approved by the U. S. NRC, but not designated as B(U) or B(M) in the identification number of the NRC Certificate of Compliance, may be used under the general license of LAC 33:XV.1508 with the following additional limitations:

1. fabrication of the packaging was satisfactorily completed ~~before~~ by August 31, 1986, as demonstrated by application of its model number in accordance with U.S. NRC regulations; ~~and~~
2. the package may not be used for a shipment to a location outside the United States, except under special arrangement approved by the U.S. ~~Department of Transportation~~ DOT in accordance with 49 CFR 173.477.403; and
3. a serial number that uniquely identifies each packaging that 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 LSA material package, or a fissile material package previously approved by the U.S. NRC, but without the designation -85 in the identification number of the U.S. NRC Certificate of Compliance, may be used under the general license of LAC 33:XV.1508 with the following additional conditions:

1. fabrication of the package was satisfactorily completed by April 1, 1999, as demonstrated by application of its model number in accordance with U.S. NRC regulations;
2. a package used for a shipment to a location outside the United States is subject to multilateral approval as defined in U.S. DOT regulations at 49 CFR 173.403; and
3. a serial number that uniquely identifies each packaging that conforms to the approved design is assigned to, and legibly and durably marked on, the outside of each packaging.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1510. General License: U.S. DOT Specification Container

A. A general license is issued to any licensee of the ~~division~~ department 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 the regulations of the U.S. DOT in at 49 CFR parts 173 and 178.

B. This general license applies only to a licensee who has a quality assurance program approved by the U.S. NRC as satisfying the provisions of 10 CFR part 71, subchapter H.

C. This general license applies only to a licensee who:

1. has a copy of the specification; and
2. complies with the terms and conditions of the specification and the applicable requirements of this Chapter.

~~B-D.~~ The general license in ~~LAC 33:XV.1510.A~~ Subsection A of this Section is subject to the limitation that the specification container may not be used for a shipment to a location outside the United States, ~~after August 31, 1986 except under special arrangements approved by~~ multilateral approval, as defined in U.S. DOT regulations in accordance with at 49 CFR 173.472403.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26

§1511. General License: Use of Foreign Approved Package

A. A general license is issued to any licensee of the ~~division~~ department 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 that~~ has been revalidated by the U.S. DOT as meeting the applicable requirements of 49 CFR 171.12.

B. Except as otherwise provided in this Section, the general license applies only to a licensee who has a quality assurance program approved by the U. S. NRC as satisfying the applicable provisions of 10 CFR part 71, subpart H.

~~B-C.~~ This general license applies only to shipments made to or from locations outside the United States.

~~C.~~ D. This general license applies only to a licensee who:

1. 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; and
2. complies with the terms and conditions of the certificate and revalidation and with the applicable requirements of this Chapter. With respect to the quality assurance provisions of 10 CFR part 71, subpart H, the licensee is exempt from design, construction, and fabrication considerations.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1512. Routine Determinations

A. Before the first use of any packaging for the shipment of licensed material, the licensee shall:

1. ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce the effectiveness of the packaging;

2. where the maximum normal operating pressure will exceed 35 kPa (5 lbs/in²) gauge, 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; and

3. conspicuously and durably mark the packaging with its model number, serial number, gross weight, and a package identification number assigned by the U. S. NRC. Before applying the model number, the licensee shall determine that the packaging has been fabricated in accordance with the design approved by the U. S. NRC.

B. Prior to each shipment of licensed material, the licensee shall ensure that the package with its contents satisfies the applicable requirements of this Chapter and of the license. The licensee shall determine that:

- A 1. the package is proper for the contents to be shipped;
- B 2. the package is in unimpaired physical condition except for superficial defects such as marks or dents;
- C 3. each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects;
- D 4. any system for containing liquid is adequately sealed and has adequate space or other specified provision for expansion of the liquid;
- E 5. any pressure relief device is operable and set in accordance with written procedures;
- F 6. the package has been loaded and closed in accordance with written procedures;
- 7. for fissile material, any moderator or neutron absorber, if required, is present and in proper condition;

~~—G 8. any structural part of the package which that could be used to lift or tie down the package during transport is rendered inoperable for that purpose unless it satisfies design requirements specified by the U.S. Nuclear Regulatory Commission—NRC in 10 CFR 71.45;~~

~~—H.1 9. The level of non-fixed (removable) radioactive contamination on the external surfaces of each package offered for shipment is as low as reasonably achievable, and within the limits specified in U.S. DOT regulations at 49 CFR 173.443; 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 non-fixed contamination levels. Except as provided under LAC 33:XV.1512.H.2, the amount of radioactivity measured on any single wiping material when averaged over the surface wiped, must not exceed the limits given in Table V of this Chapter 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 non-fixed contamination on the external surfaces of the package exceed ten times the limits listed in Table V.~~

Table V		
Removable External Radioactive Contamination wipe limits		
Containment	Maximum Permissible Limits	
	FCi/cm²	dpm/cm²
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than ten days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates	10 ⁻³	22.0
All other alpha-emitting radionuclides	10 ⁻⁶	2.2

2. 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 ten times the levels prescribed in LAC 33:XV.1512.H.1. The levels at the beginning of transport must not exceed the levels prescribed in LAC 33:XV.1512.H.1.

3. In the case of packages containing radioactive materials in Special Form, a leak test performed in the past six months may be used as evidence that the requirements of LAC 33:XV.1512.H.1 has been met.

I. 10. External radiation levels around the package and around the vehicle, if applicable, will not exceed the limits specified by the U. S. NRC in 10 CFR 71.47, 200 millirem per hour at any point on the vertical planes projected from the outer edges of the vehicle, on the external surface of the package at any time during transportation. The transport index shall not exceed 10; and

J. 11. accessible package surface temperatures shall not For a package transported as exclusive use by rail, highway or water, radiation levels external to the package may exceed the limits specified by the U. S. NRC in 10 CFR 71.43 at any time during transportation. in LAC 33:XV.1512.I but must not exceed any of the following:

1. 200 millirem/hour on the accessible external surface of the package unless the following conditions are met, in which case the limit is 1000 millirem per hour:

a. the shipment is made in a closed transport vehicle;

b. provisions are made to secure the package so that its position within the vehicle remains fixed during transportation; and

c. there are no loading or unloading operations between the beginning and end of the transportation;

~~2. 200 millirem/hour at any point on the outer surface of the vehicle, including the upper and lower surfaces, or in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle;~~

~~3. 10 millirem/hour at any point two meters from the vertical planes represented by the outer lateral surfaces of the vehicle, or, in the case of an open vehicle, at any point two meters from the vertical planes projected from the outer edges of the vehicle; and~~

~~4. Two millirem/hour 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 LAC 33:XV.1012 of these regulations.~~

~~K. A package must be prepared for transport so that in still air at 100°F [30°C] and in the shade, no accessible surface of a package would have a temperature exceeding 122°F [50°C] in a nonexclusive use shipment or 180°F [82°C] in an exclusive use shipment. Accessible package surface temperatures shall not exceed these limits at any time during transportation.~~

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1513. Air Transport of Plutonium

A. Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this Chapter or included indirectly by citation of U.S. ~~Department of Transportation~~ DOT regulations, as may be applicable, the licensee shall assure that plutonium in any form, whether for import, export, or domestic shipment, is not transported by air or delivered to a carrier for air transport unless:

~~A~~ 1. the plutonium is contained in a medical device designed for individual human application;

~~B~~ 2. the plutonium is contained in a material in which the specific activity is not greater than 0.002 microcuries/gram (74 Bq/g) of material and in which the radioactivity is essentially uniformly distributed;

~~C~~ 3. the plutonium is shipped in a single package containing not more than an A₂ quantity of plutonium in any isotope or form and is shipped in accordance with LAC 33:XV.15062; or

~~D~~ 4. the plutonium is shipped in a package specifically authorized for the shipment of plutonium by air in the Certificate of Compliance for that package issued by the U.S. ~~Nuclear Regulatory Commission~~ NRC.

B. Nothing in Subsection A of this Section is to be interpreted as removing or diminishing the requirements of U.S. NRC regulations in 10 CFR 73.24.

C. For a shipment of plutonium by air that is subject to Subsection A.4 of this Section, the licensee shall, through special arrangement with the carrier, require compliance with U.S. DOT regulations (49 CFR 175.704) applicable to the air transport of plutonium.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1514. Records

A. Each licensee shall maintain, for a period of ~~two~~ three years after shipment, a record of each shipment of licensed material not exempt under LAC 33:XV.1505, showing, where applicable:

1. identification of the packaging by model number and serial number;

* * *

(See Prior Text in A.2-6)

7. address to which the shipment was made; ~~and~~

8. results of the determinations required by LAC 33:XV.1512 and by the conditions of the package approval; and

9. in addition, for each item of irradiated fissile material:

- a. identification by model number and serial number;

b. irradiation and decay history to the extent appropriate to demonstrate that its nuclear and thermal characteristics comply with license conditions; and

- c. any abnormal or unusual condition relevant to radiation safety.

B. The licensee shall make available to the ~~division~~ department for inspection, upon reasonable notice, all records required by this Chapter. Records are only valid if stamped, initialed, or signed and dated by authorized personnel or otherwise authenticated.

C. The licensee shall maintain sufficient written records to furnish evidence of the quality of packaging. The records to be maintained include results of the determinations required by LAC 33:XV.1512, design, fabrication, and assembly records; results of reviews, inspections, tests, and audits; results of monitoring work performance and materials analyses; and results of maintenance, modification, and repair activities. Inspection, test, and audit records must identify the inspector or data recorder, the type of observation, the results, the acceptability, and the action taken in connection with any deficiencies noted. The records must be retained for three years after the life of the packaging to which they apply.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1515. Reports

A. The licensee shall report to the ~~division~~ department within 30 days:

A 1. any instance in which there is significant reduction in the effectiveness of any ~~authorized~~ approved Type B or fissile packaging during use; ~~and~~

B 2. details of any defects with safety significance in Type B or fissile ~~the~~ packaging after first use, with the means employed to repair the defects and prevent their recurrence; ~~and~~

3. instances in which the conditions of approval in the Certificate of Compliance were not observed in making a shipment.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1516. Advance Notification of Transport of Nuclear Waste

* * *

[See Prior Text in A-B.2]

3. the quantity of licensed material in a single package exceeds the least of the following:

a. ~~5,000 Curies [185 TBq] of special form radionuclides; 3000 times the A_1 value of the radionuclides, as specified in LAC 33:XV.1517, for special form radioactive material;~~

b. ~~5,000 Curies [185 TBq] of uncompressed gases of Argon 41, Krypton 85m, Krypton 87, Xenon 131m, or Xenon 135; 3000 times the A_2 value of the radionuclides, as specified in LAC 33:XV.1517, for normal form radioactive material; or~~

c. ~~50,000 Curies [1.85 PBq] of Argon 37, or of uncompressed gases of Krypton 85 or Xenon 133, or of Hydrogen 3 as a gas, as luminous paint, or adsorbed on solid material; 1000 TBq (27,000 Ci).~~

d. ~~20 Curies [740 GBq] of other non special form radionuclides for which A_2 is less than or equal to 4 Curies [148 GBq]; or~~

e. ~~200 Curies [7.4 TBq] of other non special form radionuclides for which A_2 is greater than 4 Curies [148 GBq].~~

* * *

[See Prior Text in C-C.6]

D. The notification required by LAC 33:XV.1516.A shall be made in writing to the office of each appropriate governor or governor's designee and to the ~~division~~ department. A notification delivered by mail must be postmarked at least seven days before the beginning of the seven-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 four days before the beginning of the seven-day period during which departure of the shipment is estimated to occur. A copy of the notification shall be retained by the licensee for ~~one~~ three years.

E. The licensee shall notify each appropriate governor, or governor's designee, and the ~~division~~ department of any changes to schedule information provided ~~pursuant to LAC 33:XV.1516.A in accordance with Subsection A of this Section~~. 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 ~~one~~ three 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 to the governor, or governor's designee, of each appropriate state

and to the ~~division~~ department. A copy of the notice shall be retained by the licensee for ~~one~~ three years.

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), amended by the Office of Environmental Assessment, Environmental Planning Division, LR 26:

§1517. Incorporation by Reference

The department incorporates by reference 10 CFR part 71, appendix A (July 1, 1999).

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Office of Environmental Assessment, Environmental Planning Division, LR 26:

Appendix A Repealed.
Determination of A1 and A2

I. Single radionuclides

1. For a single radionuclide of known identity, the values of A1 and A2 are taken from Table A-1 if listed there. The values of A1 and A2 are also applicable for radionuclides contained in (α , η) or (γ , η) neutron sources.

2. For any single radionuclide whose identity is known but which is not listed in Table A-1, the values of A1 and A2 are determined according to the following procedure:

a. If the radionuclide emits only one type of radiation, A1 is determined according to rules in paragraphs (i), (ii), (iii) and (iv) of this Paragraph. For radionuclides emitting different kinds of radiation, A1 is the most restrictive value of those determined for each kind of radiation. However, in both cases, A1 is restricted to a maximum of 1000 Ci (37 TBq). If a parent nuclide decays into a shorter lived daughter with half life not greater than 10 days, A1 is calculated for both the parent and the daughter, and the more limiting of the two values is assigned to the parent nuclide.

(i). for gamma emitters, A1 is determined by the expression:

$$A_1 = \frac{9 \text{ curies}}{\text{gamma-ray constant}}$$

where the gamma ray constant corresponds to the dose in R/h at 1 m per Ci; the number 9 results from the choice of 1 rem/h at a distance of 3 m as the reference dose equivalent rate.

(ii). for x ray emitters, A1 is determined by the atomic number of the nuclide:

_____ for $Z < 55$ — A1 = 1000 Ci (37 TBq)

_____ for $Z > 55$ — A1 = 200 Ci (7.4 TBq)

where Z is the atomic number of the nuclide.

(iii). for beta emitters, A1 is determined by the maximum beta energy (E_{max}) according to Table A-2;

(iv). for alpha emitters, A1 is determined by the expression:

_____ A1 = 1000 A3

where A3 is the value listed in Table A-3;

b. A2 is the more restrictive of the following two values:

(i). the corresponding A1; and

(ii). the value A3 obtained from Table A-3.

3. For any single radionuclide whose identity is unknown, the value of A1 is taken to be 2 Ci (74 GBq) and the value of A2 is taken to be 0.002 Ci (74 MBq). However, if the atomic number of the radionuclide is known to be less than 82, the value of A1 is taken to be 10 Ci (370 GBq) and the value of A2 is taken to be 0.4 Ci (14.8 GBq).

II. Mixtures of radionuclides, including radioactive decay chains.

1. For mixed fission products the following activity limits may be assumed if a detailed analysis of the mixture is not carried out:

_____ A1 = 10 Ci (370 GBq)

_____ A2 = 0.4 Ci (14.8 GBq)

~~2. A single radioactive decay chain is considered to be a single radionuclide when the radionuclides are present in their naturally occurring proportions and no daughter nuclide has a half life either longer than 10 days or longer than that of the parent nuclide. The activity to be taken into account and A1 or A2 value from Table A-1 to be applied are those corresponding to the parent nuclide of that chain. When calculating A1 or A2 values, radiation emitted by daughters must be considered. However, 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 daughter nuclides are considered to be mixtures of different nuclides.~~

~~3. In the case of a mixture of different radionuclides, where the identity and activity of each radionuclide are known, the permissible activity of each radionuclide are known, the permissible activity of each radionuclide R1, R2, ..., Rn is such that F1 + F2 + ... Fn is not greater than unity, where~~

$$F_1 = \frac{\text{Total activity of } R_1}{A_1(R_1)}$$

$$F_2 = \frac{\text{Total activity of } R_2}{A_1(R_2)}$$

$$F_n = \frac{\text{Total activity of } R_n}{A_1(R_n)}$$

A_1 ($R_1, R_2 \dots R_n$) is the value of A_1 or A_2 as appropriate for the nuclide $R_1, R_2 \dots R_n$.

4. When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the formula given in paragraph (3) is applied to establish the values of A_1 or A_2 as appropriate. All the radionuclides whose individual activities are not known (their total activity will, however, be known) are classed in a single group and the most restrictive value of A_1 or A_2 in the denominator of the fraction.

5. Where the identity of each radionuclide is known but the individual activity of none of the radionuclides is known, the most restrictive value of A_1 or A_2 applicable to any one of the radionuclides present is adopted as the applicable value.

6. When the identity of none of the nuclides is known, the value of A_1 is taken to be 2 Ci (74 GBq) and the value of A_2 is taken to be 0.002 Ci (74 MBq). However, if alpha emitters are known to be absent, the value of A_2 is taken to be 0.4 Ci (14.8 GBq).

Table A-1
 A_1 and A_2 Values for Radionuclides
(See footnotes at end of table)

Symbol of radionuclide	Element and Atomic number	A_1 (Ci)	A_2 (Ci)	Specific activity (Ci/g)
227Ac	Actinium (89)	1000	0.003	7.2×10^{-10}
228Ac		10	4.0	2.2×10^{-6}
105Ag	Silver (47)	40	40.0	3.1×10^{-4}
110mAg		7	7.0	4.7×10^{-3}
111Ag		100	20.0	1.6×10^{-5}
241Am	Americium (95)	8	0.008	3.2
243Am		8	0.008	1.9×10^{-1}
37Ar (Compressed or Uncompressed)*	Argon (18)	1000	1000.0	1.0×10^{-5}
41Ar (Uncompressed)*		20	20.0	4.3×10^{-7}
41Ar (Compressed)*		1	1.0	4.3×10^{-7}
73As	Arsenic (33)	1000	400.0	2.4×10^{-4}
74As		20	20.0	1.0×10^{-5}
76As		10	10.0	1.6×10^{-6}
77As		300	20.0	1.1×10^{-6}
211At	Astatine (85)	200	7.0	2.1×10^{-6}
193Au	Gold (79)	200	200.0	9.3×10^{-5}
196Au		30	30.0	1.2×10^{-5}
198Au		40	20.0	2.5×10^{-5}
199Au		200	25.0	2.1×10^{-5}
131Ba	Barium (56)	40	40.0	8.7×10^{-4}
133Ba		40	10.0	4.0×10^{-2}
140Ba		20	20.0	7.3×10^{-4}
7Be	Beryllium (4)	300	300.0	3.5×10^{-5}
206Bi	Bismuth (83)	5	5.0	9.9×10^{-4}

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
207 Bi		10	10.0	2.2 H 10 ²
210 Bi (RaE)		100	4.0	1.2 H 10 ⁵
212 Bi		6	6.0	1.5 H 10 ⁷
249 Bk	Berkelium (97)	1000	1.0	1.8 H 10 ³
77 Br	Bromine (35)	70	25.0	7.1 H 10 ⁵
82 Br		6	6.0	1.1 H 10 ⁶
11 C	Carbon (6)	20	20.0	8.4 H 10 ⁸
14 C		1000	60.0	4.6
45 Ca	Calcium (20)	1000	25.0	1.9 H 10 ⁴
47 Ca		20	20.0	5.9 H 10 ⁵
109 Cd	Cadmium (48)	1000	70.0	2.6 H 10 ³
115 Mecl		30	30.0	2.6 H 10 ⁴
115 Cd		80	20.0	5.1 H 10 ⁵
139 Ce	Cerium (58)	100	100.0	6.5 H 10 ³
141 Ce		300	25.0	2.8 H 10 ⁴
143 Ce		60	20.0	6.6 H 10 ⁵
144 Ce		10	7.0	3.2 H 10 ³
249 Cf	Californium (98)	2	0.002	3.1
250 Cf		7	0.007	1.3 H 10 ²
252 Cf		2	0.009	6.5 H 10 ²
36 Cl	Chlorine (17)	300	10.0	3.2 H 10 ⁻²
38 Cl		10	10.0	1.3 H 10 ⁸
242 Cm	Curium (96)	200	0.2	3.3 H 10 ³
243 Cm		9	0.009	4.2 H 10
244 Cm		10	0.001	8.2 H 10
245 Cm		6	0.006	1.0 H 10 ⁻¹
246 Cm		6	0.006	3.6 H 10 ⁻¹
56 Co	Cobalt (27)	5	5.0	3.0 H 10 ⁴
57 Co		90	90.0	8.5 H 10 ³
58 MCo		1000	1000.0	5.9 H 10 ⁶
58 Co		20	20.0	3.1 H 10 ⁴
60 Co		7	7.0	1.1 H 10 ³
51 Cr	Chromium (24)	600	600.0	9.2 H 10 ⁴
129 Cs	Cesium (55)	40	40.0	7.6 H 10 ⁵
131 Cs		1000	1000.0	1.0 H 10 ⁵
134 MCs		1000	10.0	7.4 H 10 ⁶
134 Cs		10	10.0	1.2 H 10 ³

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
135-Cs		1000	25.0	8.8 H 10 ⁻⁴
136-Cs		7	7.0	7.4 H 10 ⁻⁴
137-Cs		30	10.0	9.8 H 10
64-Cu	Copper (29)	80	25.0	3.8 H 10 ⁶
67-Cu		200	25.0	7.9 H 10 ⁵
165-Dy	Dysprosium (66)	100	20.0	8.2 H 10 ⁶
166-Dy		1000	200.0	2.3 H 10 ⁵
169-Dy	Erbium (68)	1000	25.0	8.2 H 10 ⁴
171-Er		50	20.0	2.4 H 10 ⁶
152-MEu	Europium (63)	30	30.0	2.2 H 10 ⁶
152-Eu		20	10.0	1.9 H 10 ²
154-Eu		10	5.0	1.5 H 10 ²
155-Eu		400	60.0	1.4 H 10 ³
18-F	Fluorine (9)	20	20.0	9.3 H 10 ⁷
52-Fe	Iron (26)	5	5.0	7.3 H 10 ⁶
55-Fe		1000	1000.0	2.2 H 10 ³
59-Fe		10	10.0	4.9 H 10 ⁴
67-Ga	Gallium (31)	100	100.0	6.0 H 10 ⁵
68-Ga		20	20.0	4.0 H 10 ⁷
72-Ga		7	7.0	3.1 H 10 ⁶
153-Gd	Gadolinium (64)	200	100.0	3.6 H 10 ³
159-Gd		300	20.0	1.1 H 10 ⁶
68-Ge	Germanium (32)	20	10.0	7.0 H 10 ³
71-Ge		1000	1000.0	1.6 H 10 ⁵
3-H	Hydrogen (1) see T-Tritium			
181-Hf	Hafnium (72)	30	25.0	1.6 H 10 ⁴
197-MHg	Mercury (80)	200	200.0	6.6 H 10 ⁵
197-Hg		200	200.0	2.5 H 10 ⁵
203-Hg		80	25.0	1.4 H 10 ⁴
166-Ho	Holmium (67)	30	30.0	6.9 H 10 ⁵
123-I	Iodine (53)	50	50.0	1.9 H 10 ⁶
125-I		1000	70.0	1.7 H 10 ⁴
126-I		40	10.0	7.8 H 10 ⁴
129-I		1000	2.0	1.6 H 10 ⁻⁴
131-I		40	10.0	1.2 H 10 ⁵
132-I		7	7.0	1.1 H 10 ⁷
133-I		30	10.0	1.1 H 10 ⁶

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
134I		8	8.0	2.7 H 10 ⁷
135I		10	10.0	3.5 H 10 ⁶
111 In	Indium (49)	30	25.0	4.2 H 10 ⁵
113 MIn		60	60.0	1.6 H 10 ⁷
114 MIn		30	20.0	2.3 H 10 ⁴
115 MIn		100	20.0	6.1 H 10 ⁶
190 Ir	Iridium (77)	10	10.0	6.2 H 10 ⁴
192 Ir		20	10.0	9.1 H 10 ³
194 Ir		10	10.0	8.5 H 10 ⁵
42 K	Potassium (19)	10	10.0	6.0 H 10 ⁶
43 K		20	10.0	3.3 H 10 ⁶
85 MKr (uncompressed) *	Krypton (36)	100	100.0	8.4 H 10 ⁶
85 MKr (compressed) *		3	3.0	8.4 H 10 ⁶
85 Kr (uncompressed) *		1000	1000.0	4.0 H 10 ²
85 Kr (compressed) *		5	5.0	4.0 H 10 ²
87 Kr (uncompressed) *		20	20.0	2.8 H 10 ⁷
87 Kr (compressed) *		0.6	0.6	2.8 H 10 ⁷
140 La	Lanthanum (57)	30	30.0	5.6 H 10 ⁵
177 Lu	Lutetium (71)	300	25.0	1.1 H 10 ⁵
Mfp	Mix Fission Products	10	0.4	
28 Mg	Magnesium (12)	6	6.0	5.2 H 10 ⁶
52 Mn	Manganese (25)	5	5.0	4.4 H 10 ⁵
54 Mn		20	20.0	8.3 H 10 ³
56 Mn		5	5.0	2.2 H 10 ⁷
99 Mo	Molybdenum (42)	100	20.0	4.7 H 10 ⁵
13 N	Nitrogen (7)	20	10.0	1.5 H 10 ⁸
22 Na	Sodium (11)	8	8.0	6.3 H 10 ³
24 Na		5	5.0	8.7 H 10 ⁶
93 MNb	Niobium (41)	1000	200.0	1.1 H 10 ³
95 Nb		20	20.0	3.9 H 10 ⁴
97 Nb		20	20.0	2.6 H 10 ⁷
147 Nd	Neodymium (60)	100	20.0	8.0 H 10 ⁴
149 Nd		30	20.0	1.1 H 10 ⁷
59 Ni	Nickel (28)	1000	900.0	8.1 H 10 ⁻²
63 Ni		1000	100.0	4.6 H 10
65 Ni		10	10.0	1.9 H 10 ⁷
237 Np	Neptunium (93)	5	0.005	6.9 H 10 ⁻⁴

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
²³⁹ Np		200	25.0	2.3 H 10 ⁵
¹⁸⁵ Os	Osmium (76)	20	20.0	7.3 H 10 ³
¹⁹¹ Os		600	200.0	4.6 H 10 ⁴
¹⁹¹ MOs		200	200.0	1.2 H 10 ⁶
¹⁹³ Os		100	20.0	5.3 H 10 ⁵
³² P	Phosphorus (15)	30	30.0	2.9 H 10 ⁵
²³⁰ Pa	Protactinium (91)	20	0.8	3.2 H 10 ⁴
²³¹ Pa		2	0.002	4.5 H 10 ⁻²
²³³ Pa		100	100.0	2.1 H 10 ⁴
²⁰¹ Pb	Lead (82)	20	20.0	1.7 H 10 ⁶
²¹⁰ Pb		100	0.2	8.8 H 10
²¹² Pb		6	5.0	1.4 H 10 ⁶
¹⁰³ Pd	Palladium (46)	1000	700.0	7.5 H 10 ⁴
¹⁰⁹ Pd		100	20.0	2.1 H 10 ⁶
¹⁴⁷ Pm	Promethium (61)	1000	25.0	9.4 H 10 ²
¹⁴⁹ Pm		100	20.0	4.2 H 10 ⁵
²¹⁰ Po	Polonium (84)	200	0.2	4.5 H 10 ³
¹⁴² Pr	Praseodymium (59)	10	10.0	1.2 H 10 ⁴
¹⁴³ Pr		300	20.0	6.6 H 10 ⁴
¹⁹¹ Pt	Platinum (78)	100	100.0	2.3 H 10 ⁵
¹⁹³ MPt		200	200.0	2.0 H 10 ⁵
¹⁹⁷ MPt		300	20.0	1.2 H 10 ⁷
¹⁹⁷ Pt		300	20.0	8.8 H 10 ⁵
²³⁸ Pu	Plutonium (94)	3	0.003	1.7 H 10
²³⁹ Pu		2	0.002	6.2 H 10 ⁻²
²⁴⁰ Pu		2	0.002	2.3 H 10 ⁻¹
²⁴¹ Pu		1000	0.1	1.1 H 10 ²
²⁴² Pu		3	0.003	3.9 H 10 ⁻³
²²³ Ra	Radium (88)	50	0.2	5.0 H 10 ⁴
²²⁴ Ra		6	0.5	1.6 H 10 ⁵
²²⁶ Ra		10	0.05	1.0
²²⁸ Ra		10	0.05	2.3 H 10 ²
⁸¹ Rb	Rubium (37)	30	25.0	8.2 H 10 ⁶
⁸⁶ Rb		30	30.0	8.1 H 10 ⁴
⁸⁷ Rb		Unlimited	Unlimited	6.6 H 10 ⁻⁸
Rb (natural)		Unlimited	Unlimited	6.6 H 10 ⁻⁸
¹⁸⁶ Re	Rhenium (75)	100	20.0	1.9 H 10 ⁵

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
187 Re		Unlimited	Unlimited	3.8 H 10 ⁻⁸
188 Re		10	10.0	1.0 H 10 ⁶
Re (natural)		Unlimited	Unlimited	2.4 H 10 ⁻⁸
103 MRh	Rhodium (45)	1000	1000.0	3.2 H 10 ⁷
105 Rh		200	25.0	8.2 H 10 ⁵
222 Rn	Radon (86)	10	2.0	1.5 H 10 ⁵
97 Ru	Ruthenium (44)	80	80.0	5.5 H 10 ⁵
103 Ru		30	25.0	3.2 H 10 ⁴
105 Ru		20	20.0	6.6 H 10 ⁶
106 Ru		10	7.0	3.4 H 10 ³
35 S	Sulphur (16)	1000	60.0	4.3 H 10 ⁴
122 Sb	Antimony (51)	30	30.0	3.9 H 10 ⁵
124 Sb		5	5.0	1.8 H 10 ⁴
125 Sb		40	25.0	1.4 H 10 ³
46 Se	Scandium (21)	8	8.0	3.4 H 10 ⁴
47 Se		200	20.0	8.2 H 10 ⁵
48 Se		5	5.0	1.5 H 10 ⁶
75 Se	Selenium (34)	40	40.0	1.4 H 10 ⁴
31 Si	Silicon (14)	100	20.0	3.9 H 10 ⁷
147 Sm	Samarium (62)	Unlimited	Unlimited	2.0 H 10 ⁻⁸
151 Sm		1000	90.0	2.6 H 10
153 Sm		300	20.0	4.4 H 10 ⁵
113 Sn	Tin (50)	60	60.0	1.0 H 10 ⁴
119 MSn		100	100.0	4.4 H 10 ³
125 Sn		10	10.0	1.1 H 10 ⁵
85 MSr	Strontium (38)	80	80.0	3.2 H 10 ⁷
85 Sr		30	30.0	2.4 H 10 ⁴
87 MSr		50	50.0	1.2 H 10 ⁷
89 Sr		100	10.0	2.9 H 10 ⁴
90 Sr		10	0.4	1.5 H 10 ²
91 Sr		10	10.0	3.6 H 10 ⁶
92 Sr		10	10.0	1.3 H 10 ⁷
T (uncompressed 9.7)	Tritium (1)	1000	1000.0	9.7 H 10 ³
T (compressed)-3		1000	1000.0	9.7 H 10 ³
T (activated luminous paint)		1000	1000.0	9.7 H 10 ³
T (absorbed on solid carrier)		1000	1000.0	9.7 H 10 ³
T (tritiated water)		1000	1000.0	9.7 H 10 ³

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
T (other forms)		20	20.0	9.7 H 10 ³
182 Ta	Tantalum (73)	20	20.0	6.2 H 10 ³
160 Tb	Terbium (65)	20	10.0	1.1 H 10 ⁴
96 MTe	Technetium (43)	1000	1000.0	3.8 H 10 ⁷
96 Te		6	6.0	3.2 H 10 ⁵
97 MTe		1000	200.0	1.5 H 10 ⁴
97 Te		1000	400.0	1.4 H 10 ³
99 MTe		100	100.0	5.2 H 10 ⁶
99 Te		1000	25.0	1.7 H 10 ⁻²
125 MTe	Tellurium (52)	1000	100.0	1.8 H 10 ⁴
127 MTe		300	20.0	4.0 H 10 ⁴
127 Te		300	20.0	2.6 H 10 ⁶
129 MTe		30	10.0	2.5 H 10 ⁴
129 Te		100	20.0	2.0 H 10 ⁷
131 MTe		10	10.0	8.0 H 10 ⁵
132 Te		7	7.0	3.1 H 10 ⁵
227 Th	Thorium (90)	200	0.2	3.2 H 10 ⁴
228 Th		6	0.008	8.3 H 10 ²
230 Th		3	0.003	1.9 H 10 ⁻²
231 Th		1000	25.0	5.3 H 10 ⁵
232 Th		Unlimited	Unlimited	1.1 H 10 ⁻⁷
234 Th		10	10.0	2.3 H 10 ⁴
Th (natural)		Unlimited	Unlimited	2.2 H 10 ⁻⁷
Th (irradiated) **				
200 Tl	Thallium (81)	20	20.0	5.8 H 10 ⁵
201 Tl		200	200.0	2.2 H 10 ⁵
202 Tl		40	40.0	5.4 H 10 ⁴
204 Tl		300	10.0	4.3 H 10 ²
170 Tm	Thulium (69)	300	10.0	6.0 H 10 ³
171 Tm		1000	100.0	1.1 H 10 ³
230 U	Uranium (92)	100	0.1	2.7 H 10 ⁴
232 U		30	0.03	2.1 H 10
233 U		100	0.1	9.5 H 10 ⁻³
234 U		100	0.1	6.2 H 10 ⁻³
235 U		100	0.2	2.1 H 10 ⁻⁶
236 U		200	0.2	6.3 H 10 ⁻⁵
238 U		Unlimited	Unlimited	3.3 H 10 ⁻⁷

Table A-1 A₁ and A₂ Values for Radionuclides (See footnotes at end of table)				
Symbol of radionuclide	Element and Atomic number	A₁ (Ci)	A₂ (Ci)	Specific activity (Ci/g)
U (natural)		Unlimited	Unlimited	See Table A-4
U (enriched)	20%	Unlimited	Unlimited	See Table A-4
	20% or greater	100	0.1	See Table A-4
U (depleted)		Unlimited	Unlimited	See Table A-4
U (irradiated) ***				
48 V	Vanadium (23)	6.0	6.0	1.7 H 10 ⁵
181 W	Tungsten (74)	200.0	100.	5.0 H 10 ³
185 W		1000.0	25.0	9.7 H 10 ⁻³
187 W		40.0	20.0	7.0 H 10 ⁵
127 Xe (uncompressed) *	Xenon (54)	70.0	70	2.8 H 10 ⁴
127 Xe (compressed) *		5.0	5	2.8 H 10 ⁴
131 M Xe (compressed) *		10.0	10	1.0 H 10 ⁵
131 M Xe (uncompressed) *		100.0	100	1.0 H 10 ⁵
133 Xe (uncompressed) *		1000.0	1000	1.9 H 10 ⁵
133 Xe (compressed) *		5.0	5	1.9 H 10 ⁵
135 Xe (uncompressed) *		70.0	70	2.5 H 10 ⁵
135 Xe (compressed) *		2.0	2	2.5 H 10 ⁵
87 Y	Yttrium (39)	20.0	20	4.5 H 10
90 Y		10.0	10	2.5 H 10 ⁵
91 M Y		30.0	30	4.1 H 10 ⁷
91 Y		30.0	30	2.5 H 10 ⁴
92 Y		10.0	10	9.5 H 10 ⁶
93 Y		10.0	10	3.2 H 10 ⁶
169 Yb	Ytterbium (70)	80.0	80	2.3 H 10 ⁵
175 Yb		400.0	25	1.8 H 10 ⁵
65 Zn	Zinc (30)	30.0	30	8.0 H 10 ³
69 M Zn		40.0	20	3.3 H 10 ⁶
69 Zn		300.0	20	5.3 H 10 ⁷
93 Zr	Zirconium (40)	1000.0	200	3.5 H 10 ⁻³
95 Zr		20.0	20	2.1 H 10 ⁴
97 Zr		20.0	20	2.0 H 10 ⁶

* — For the purpose of Table A-1, compressed gas means a gas at a pressure which exceeds the ambient atmospheric pressure at the location where the containment system was closed.

** — The values of A₁ and A₂ must be calculated in accordance with the procedure specified in Appendix A, Paragraph II(3), taking into account the activity of the fission products and of the uranium 233 in addition to that of the thorium.

*** — The values of A₁ and A₂ must be calculated in accordance with the procedure specified in Appendix A, Paragraph II(3), taking into account the activity of the fission products and plutonium isotopes in addition to that of the uranium.

Table A-2	
Relationship Between A_1 and E_{MAX} for Beta Emitters	
E_{MAX} (MeV)	A_1 (Ci)
<0.5	1,000
0.5 < 1.0	300
1.0 < 1.5	100
1.5 < 2.0	30
≤ 2.0	10

Table A-3			
Relationship Between A_3 and the Atomic Number of the Radionuclide			
	A_3		
Atomic No.	Half live less than 1,000 days	Half Life 1000 days to 10^6 years	Half Live greater than 10^6 years
1 to 81	3 Ci	0.5 Ci	3 Ci
82 and above	.002 Ci	.002 Ci	3 Ci

Table A-4		
Activity-Mass Relationships for Uranium/Thorium		
Thorium and Uranium enrichment¹ weight % ²³⁵U present	Specific Activity	
	Ci/g	g/Ci
0.45	$5.0 \text{ H } 10^{-7}$	$2.0 \text{ H } 10^6$
0.72 (Natural)	$7.06 \text{ H } 10^{-7}$	$1.42 \text{ H } 10^6$
1.0	$7.6 \text{ H } 10^{-7}$	$1.3 \text{ H } 10^6$
1.5	$1.0 \text{ H } 10^{-6}$	$1.0 \text{ H } 10^6$
5.0	$2.7 \text{ H } 10^{-6}$	$3.7 \text{ H } 10^5$
10.0	$4.8 \text{ H } 10^{-6}$	$2.1 \text{ H } 10^5$
20.0	$1.0 \text{ H } 10^{-5}$	$1.0 \text{ H } 10^5$
35.0	$2.0 \text{ H } 10^{-5}$	$5.0 \text{ H } 10^4$
50.0	$2.5 \text{ H } 10^{-5}$	$4.0 \text{ H } 10^4$
90.0	$5.8 \text{ H } 10^{-5}$	$1.7 \text{ H } 10^4$
93.0	$7.0 \text{ H } 10^{-5}$	$1.4 \text{ H } 10^4$
95.0	$9.1 \text{ H } 10^{-5}$	$1.1 \text{ H } 10^4$
Natural Thorium	$2.2 \text{ H } 10^{-7}$	$4.6 \text{ H } 10^6$

¹The figures for uranium include representative values for the activity of the Uranium-234 which is concentrated during the enrichment process. The activity for Thorium includes the equilibrium concentration of Thorium-228.

Table A-5			
Activity Limits for Limited Quantities, Instruments and Devices			
Nature of Contents	Instruments and Devices		Materials Package Limits
	Instrument & Article Limits	Packaging Limits	
Solids: Special Form Other Forms	$10^{-2} A_1$ $10^{-2} A_2$	A_1 A_2	$10^{-3} A_1$ $10^{-2} A_2$
Liquids: Tritiated Water: 0.1 Ci/liter			1000 Curies
Curies 0.1 Ci to 1.0 Ci/l 1.0 Ci/liter Other liquids	$10^3 A_1$		100 Curies 1 Curie $10^4 A_2$
Gases: Tritium ² Special form Other forms	20 Curies $10^{-3} A_1$ $10^{-3} A_2$	200 Curies $10^{-2} A_1$ $10^{-2} A_2$	20 Curies $20^3 A_1$ $10^3 A_2$

~~1. For mixture of radionuclides see Fed. Register #173.433(b)~~
~~2. These values also apply to tritium in activated luminous paint and tritium absorbed on solid carriers.~~

AUTHORITY NOTE: Promulgated in accordance with R.S. 30:2104 and 2113

HISTORICAL NOTE: Promulgated by the Department of Environmental Quality, Nuclear Energy Division, LR 13:569 (October 1987), repealed by the Office of Environmental Assessment, Environmental Planning Division, LR 26: