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August 17, 2010

Rob Lewis, Deputy Director
Division of Materials Safety and State Agreements
US Nuclear Regulatory Commission
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852

Dear Rob:

Please find enclosed the finished copy of the latest revision to the *Suggested State Regulations for Control of Radiation* from the Conference of Radiation Control Program Directors, Inc. (CRCPD):

Part T – Transportation of Radioactive Material

2010 Rationale Part T - Transportation of Radioactive Material

The CRCPD Board of Directors on August 10, 2010 approved the publication of Part T. CRCPD now requests concurrence from your agency. CRCPD requests that a written response relative to federal concurrence by your agency be submitted within 60 days of receipt of this correspondence.

Thank you for your attention to this important matter.

Sincerely,

Ruth E. McBurney

Ruth E. McBurney, CHP
Executive Director

Enclosure

cc: CRCPD Board of Directors
Monica Orendi, NRC
Robert Owen (OH), Chair, SR-T
Bruce Hirschler (CRCPD) SSRCR Publication Manager

PART T

TRANSPORTATION OF RADIOACTIVE MATERIAL

Sec. T.1 - Purpose and Scope.

a. 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.~~

b. The packaging and transport of radioactive material are also subject to other ~~chapters~~Parts of these regulations and to the regulations of other agencies (such as the United States ~~d~~Department of ~~t~~Transportation, the United States ~~p~~Postal ~~s~~Service and the United States ~~n~~Nuclear ~~r~~Regulatory ~~c~~Commission) having jurisdiction over means of transport. The requirements of this ~~chapter~~Part are in addition to, and not in substitution for, other requirements.

c. This ~~chapter~~Part applies to any licensee authorized by specific or general license issued to receive, possess, use, or transfer licensed material, if the licensee delivers that material to a carrier for transport, transports the material outside the site of usage as specified in the license, or transports that material on public highways. No provision of this ~~chapter~~Part authorizes possession of licensed material.

d. Exemptions from the requirement for license are specified in T.4~~ of this Part~~. General licenses for which no package approval is required are issued in T.7 ~~to~~through T.~~12~~11. The general license in T.7 requires that ~~an~~ United States ~~n~~Nuclear ~~r~~Regulatory ~~c~~Commission certificate of compliance or other package approval be issued for the package to be used under the general license. The transport of licensed material or delivery of licensed material to a carrier for transport is subject to the operating controls and procedures requirements of T.15 through T.~~23~~21, to the quality assurance requirements of T.~~24~~21~~,~~ and to the general provisions of rules T.1 through T.5, including~~<old></old><new>~~ referenced United States ~~d~~Department of ~~t~~Transportation regulations.

e. These rules apply to any person required to obtain a certificate of compliance or an approved compliance plan from the United States ~~n~~Nuclear ~~r~~Regulatory ~~c~~Commission pursuant to 10 CFR 71 if the person delivers radioactive material to a common or contract carrier for transport or transports the material outside the confines of the person's plant or other authorized place of use.

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

"A_1" means the maximum activity of special form radioactive material permitted in a Type A package. This value is either listed in Tables ~~III~~A-1, A-1 and ~~IV~~A-3 in Appendix A of this Part, or may be derived in accordance with the procedures prescribed in Appendix A of this Part.

"A_2" means the maximum activity of radioactive material, other than special form material, LSA, and SCO material, permitted in a Type A package. This value is either listed in Tables ~~IV~~A-1, A-1 Supplement ~~and~~ or ~~V~~A-3 in Appendix A of this Part, or may be derived in accordance with the

procedures prescribed in Appendix A of this Part.

"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.

"Certificate of Compliance" (CoC) means the certificate issued by the U.S. Nuclear Regulatory Commission under ~~either~~ subpart D ~~or I~~ of 10 CFR 71 which approves the design of a package for the transportation of radioactive material.

"Certificate Holder" means a person who has been issued a Certificate of Compliance or other package approval by the US Nuclear Regulatory Commission.

"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.

"Consignment" ~~means one or more packages accepted by an operator from one shipper at one time and at one address, receipted for in one lot and moving to one consignee at one destination address.~~means each shipment of a package or groups of packages or load of radioactive material offered by a shipper for transport.

"Containment system" means the assembly of components of the packaging intended to retain the radioactive material during transport.

"Conveyance" means:

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

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

(~~e~~3) For transport by any aircraft~~, any aircraft~~.

"Criticality Safety Index (CSI)" means the dimensionless number (rounded up to the next tenth) assigned to and placed on the label of a fissile material package, to designate the degree of control of accumulation of packages containing fissile material during transportation. Determination of the criticality safety index is described in T.~~11~~10 and T.~~12~~11.

"Deuterium" means, for the purposes of T.4 and T.~~11~~10, deuterium and any deuterium compounds, including heavy water, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1:5000.

"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~~ the radionuclides U-233, U-235, Pu-239, and Pu-241, or any combination of these radionuclides. Fissile material means the fissile nuclides themselves, not material containing fissile nuclides. 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 in 10 CFR 71.155~~.71.11 and 71.18, the definition of Nuclear grade graphite as found in 10 CFR 110.2.~~[1]

"Fissile material package or Type AF package, Type BF package, Type B(U)F package, or Type B(M)F package " means a fissile material packaging together with its fissile material contents.

"Graphite" means, for the purposes of this ~~p~~Part, graphite with a boron equivalent content less than five parts per million and density greater than 1.5 grams per cubic centimeter.

"Highway Route Controlled Quantity (HRCQ)" ~~means [DOT 173.403]~~ means a quantity within a single package which exceeds:

(1) 3,000 times the A_1 value of the radionuclides as specified in 49 CFR 173.435 for special form Class 7 (radioactive) material;

(2) 3,000 times the A_2 value of the radionuclides as specified in 49 CFR 173.435 for normal form Class 7 (radioactive) material; or

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

"Low specific activity (LSA) material" means radioactive material with limited specific activity which is nonfissile or excepted under this ~~p~~Part and which ~~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) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally ~~occuring~~occurring radioactive radionuclides which are not intended to be processed for the use of these radionuclides;~~Ores containing only naturally occurring~~

[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.*

(ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures.[D1]

~~radionuclides[*/] and uranium or thorium concentrates of such ores; or~~

(iii) ~~Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or~~ Radioactive material for which the A_2 value is unlimited; or

(iiiv) ~~Radioactive material, other than fissile material, for which the A_2 value is unlimited; or~~Other radioactive material in which the radioactive material is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentrations determined under Appendix A.~~(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~~ TBq/L (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, excluding powders, that satisfy the requirements of ~~49 CFR 173.43~~ 10 CFR 71.77, 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; for example, concrete, bitumen, or ceramic 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 2×10^{-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 tailings; or alpha emitters with a half-life of less than 10 days.

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

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

~~[*] For example, consolidated wastes, or activated materials.~~

"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.

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

(1) Fissile material package or Type AF package, Type BF package, Type B(U)F package, or Type B(M)F package means a fissile material packaging together with its fissile material contents.

(2) Type A package means a Type A packaging together with its radioactive contents. A Type A package is defined and must comply with the DOT regulations in 49 CFR Part ~~1~~173.

(3) Type B package means a Type B packaging together with its radioactive contents. On approval, a Type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lbs/in^2) gauge or a pressure relief device that would allow the release of radioactive material to the environment under the tests specified in §71.73(hypothetical accident conditions), 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 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 §71.19.

"Packaging" means the assembly of components necessary to ensure compliance with the packaging requirements of 49 CFR Part 173, Subpart I and 10 CFR 71. 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 definition of nuclear waste in this Part is used in the same way as in 49 CFR 173.403.~~

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

(3) It satisfies the test requirements specified by the US Nuclear Regulatory Commission and 10 CFR 71.75 and 10 CFR 71.4.~~. 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 of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the 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:

(i) The non-fixed contamination on the accessible surface averaged over 300 cm^2, (or the area of the surface if less than 300 cm^2)~~,~~ does not exceed 4 ~~becquerel~~ Bq/~~per~~ cm^2 (10^{-4} $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or 0.4 ~~becquerel~~ Bq/~~per~~ cm^2 (10^{-5} $\mu Ci/cm^2$) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2)~~,~~ does not exceed $4x10^4$ ~~becquerel~~ Bq/~~per~~ cm^2 (1.0 $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or $4x10^3$ Bq/~~becquerel per~~ cm^2 (0.1 $\mu Ci/cm^2$) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2–, (or the area of the surface if less than 300 cm^2)~~,~~ does not exceed $4x10^4$ Bq/~~becquerel per~~ cm^2 (1 $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or $4x10^3$ Beeq/~~uerel per~~ cm^2 (0.1 $\mu Ci/cm^2$) for all other alpha emitters.

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

(i) The non-fixed contamination on the accessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2)~~,~~ does not exceed

400 ~~becquerel~~ Bq/~~per~~ cm^2 (10^{-2} μCi/cm^2) for beta and gamma and low toxicity alpha emitters or 40 Bq/~~becquerel per~~ cm^2 (10^{-3} μCi/cm^2) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2)~~,~~ does not exceed $8x10^5$ Bq/~~becquerel per~~ cm^2 (20 μCi/cm^2) for beta and gamma and low toxicity alpha emitters, or $8x10^4$ Bq/~~becquerel per~~ cm^2 (2 μCi/cm^2) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2)~~,~~ does not exceed $8x10^5$ Bq/~~becquerel per~~ cm^2 (20 μCi/cm^2) for beta and gamma and low toxicity alpha emitters, or $8x10^4$ Bq/~~becquerel per~~ cm^2 (2 μCi/cm^2) for all other alpha emitters.

"Transport index (TI)" means the dimensionless number, rounded up to the next tenth, placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is the number determined by multiplying ~~expressing~~ the maximum radiation level in millisievert (mSv) per hour at one ~~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 (3.3 feet).

"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 A quantity" means a 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 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, that together with its radioactive contents, is~~.~~ designed
~~3/~~

~~32/ A Type B package design is designated as B(U) or B(M). On approval, a Type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lbs.in^2) gauge or a pressure relief device that wouledwould allowtheallow the release of radioactive material to the environment under the tests specified in 10 CFR 71.73 (hypothetical accident conditions), 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. 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.~~

~~Is designed~~ to retain the integrity of containment and shielding required by 49 CFR 173 when subjected to the normal conditions of transport and hypothetical accident conditions set forth in 10 CFR 71.
~~"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.

"Unirradiated uranium" means uranium containing not more than two thousand becquerels (fifty-four nanocuries) of plutonium per gram of uranium-235, not more than nine megabecquerels (two hundred forty-three microcuries) of fission products per gram of uranium-235, and not more than 0.005 grams of uranium-236 per gram of uranium-235.

~~"Uranium - natural, depleted, enriched"~~

~~(1) "Natural uranium" means uranium isotopes with the naturally occurring distribution of uranium isotopes, 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~~who 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 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. A~~ny~~ 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 μCi/g).~~ with respect to shipment or carriage of the following low-level materials:

i. Natural material and ores containing naturally occurring radionuclides that are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values specified in Appendix A, Table A-2, of this Part.

ii. Materials for which the activity concentration is not greater than the activity concentration values specified in Appendix A of this Part, or for which the consignment activity is not greater than the limit for an exempt consignment found in Appendix A of this Part.

c. Fissile materials meeting one of the following requirements are exempt from classification as fissile material and from the fissile material package standards of 10 CFR 71.55 and 10 CFR 7~~6~~1.59, but are subject to all other requirements of 10 CFR 71, except as noted.

i. ~~i.~~ Individual package containing 2 grams or less of fissile material.

ii. Individual or bulk packaging containing 15 grams or less of fissile material provided the package has at least 200 grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.

iii. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that there is at least 2000 grams of solid nonfissile material for every gram of fissile material and that there is no more than 180 grams of fissile material distributed within 360 kg of contiguous nonfissile material. ~~The mass ratio of noncombustible, insoluble in water, material (including both the contents and packaging) to fissile material is greater than 2000:1 and the package contents contain less than 350g of fissile material.~~ Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package, but must not be included in determining the required mass ~~for~~ of solid nonfissile material.

iv~~ii~~. Uranium enriched in uranium-235 to a maximum of one percent by weight, and with total plutonium and uranium-233 content of up to one percent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium present in the package is less than 5 percent of the uranium mass.

~~iv~~. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of two percent by ~~weight~~ mass, provided that:

(1) The total plutonium and uranium-233 content does not exceed 0.002 percent of the total mass of uranium;

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

(3) The material must be contained in at least a DOT Type A package.

vi. Plutonium with a total mass ~~of less~~ not more than 1000 grams, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 20 percent by mass of the total quantity of plutonium in the package.

d. Any physician licensed by a State to dispense drugs in the practice of medicine is exempt from ~~§ 71.5~~ this Part with respect to transport by the physician of licensed material for use in the practice of medicine. However, any physician operating under this exemption must be licensed under 10 CFR part 35 or the equivalent Agreement State regulations. ~~[under review]~~

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. ~~c~~Comply with the applicable requirements, appropriate to the mode of transport, of the regulations of the US Department of Transportation 49 CFR parts 107, 171 through 180, and 390 through 397; 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~~172.441, 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) Security Plans - 49 CFR Part 172: subpart I.

(~~7~~8) 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~~D.1906e.

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~~T.5a.i. to the mode of transport to the same extent as if the shipment was subject to the regulations~~. (add 71.5 language here)~~ A request for modification, waiver, or exemption from these requirements, -and any notification referred to in these requirements, shall be submitted in writing to the Agency.

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~~ relating to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.[3/4]

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. [4/5]

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. ~~As an exception, this general license does not apply to spent fuel transported in Type B(DP) packages.~~

3/ 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.

b. This general license applies only to a licensee who has a quality assurance program approved by the Nuclear Regulatory Commission as satisfying the provisions of subpart H of 10 CFR 71

~~b~~c. This general license applies only to a licensee who:

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~~, submits in writing to attn: document control desk, - director, spent fuel project office, office of nuclear material safety and safeguards, using an appropriate method listed in 10 C.F.R. 71.1(a), the licensee's name and license number and the package identification number specified in the package approval.

iv. Has a quality assurance program that complies with Subpart H of 10 CFR 71.~~required by T.20~~21

~~c~~d. The general license in T.7a. applies only when the package approval authorizes use of the package under this general license.

~~d~~e. 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~~ 10CFR 71.19.

~~Sec. T.8 General License: Previously Approved Package.~~

~~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; an 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.~~

~~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~~8 - General License: US Department of Transportation Specification Container.

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~~21.

c. Thi~~s~~se 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.

d. These requirements expire October 1, 2008.

Sec. T.~~10~~ 9 - General License: Use of Foreign Approved Package.

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~~ The general license applies only to ~~international~~ shipments made to or from locations outside the United States.

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

i. Has a quality assurance program approved by the United States Nuclear Regulatory Commission.

ii. 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

iii. 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~~ 10 - General License: Fissile Material. ~~Limited Quantity Per Package.~~

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. The fissile material need not be contained in a package which meets the standards of subparts E and F of 10 CFR 71; however, the material must be contained in a Type A package. The Type A package must also meet the DOT requirements of 49 CFR 173.417(a).

b. The general license applies only to a licensee who has a quality assurance program approved by the NRC as satisfying the provision of subpart H of 10 CFR 71.~~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.11e.ii., this~~ The general license applies only when ~~all of the following requirements are met:~~a package's contents:

i. Contain less than a Type A quantity of ~~fissile~~ radioactive material; and

~~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:~~

~~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. Contain less than 500 total grams of beryllium, graphite, or hydrogenous material enriched in deuterium.

~~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.~~

d. The general license applies only to packages containing fissile material that are labeled with a -CSI which:

i. Has been determined in accordance with T.10e.;

ii. Has a value less than or equal to 10.0; and ~~[check by Kate for possible deletion]~~

iii. For a shipment of multiple packages containing fissile material, the sum of the CSIs must be less than or equal to 50.0 (for shipment on a nonexclusive use conveyance ~~or storage incident to transport~~) and less than or equal to 100.0 (for shipment on an exclusive use conveyance).

e. i. The value for the CSI must be greater than or equal to the number calculated by the following equation:

$$\text{CSI} = 10\left[\frac{\textit{grams}\text{ of }^{235}\text{U}}{X} + \frac{\textit{grams}\text{ of }^{233}\text{U}}{Y} + \frac{\textit{grams}\text{ of Pu}}{Z}\right]$$

ii. The calculated CSI must be rounded up to the first decimal place;

iii. The values of X, Y, and Z used in the CSI equation must be taken from Tables I or II, as appropriate;

iv. If Table II is used to obtain the value of X, then the values for the terms in the equation for uranium-233 and plutonium must be assumed to be zero; and

v. Table I values for X, Y, and Z must be used to determine the CSI if:

(1) Uranium-233 is present in the package;

(2) The mass of plutonium exceeds one percent of the mass of uranium-235;

(3) The uranium is of unknown uranium-235 enrichment or greater than 24 weight percent enrichment; or

(4) Substances having a moderating effectiveness (i.e., an average hydrogen density greater than H_2O [e.g., certain hydrocarbon oils or plastics]) are present in any form, except as polyethylene used for packing or wrapping.

TABLE I — Mass Limits for General License Packages Containing Mixed Quantities of ~~Fissle~~Fissile Material or Uranium-235 of Unknown Enrichment per T.~~1~~10e.

Fissile Materials	Fissile material mass mixed with moderating substances having an average hydrogen density less than or equal to H_2O. (grams)	Fissile material mass mixed with moderating substances having an average hydrogen density greater than H_2O[a]. (grams)
^{235}U (X)	60	38
^{235}U (Y)	43	27
^{239}Pu or ^{241}Pu (Z)	37	24

Table II Mass Limits for General License Packages Containing Uranium-235T of Known Enrichment per T.~~1~~10e.

24	60
20	63
15	67
11	72
10	76
9.5	78
9	81
8.5	82
8	85
7.5	88
7	90
6.5	93
6	97
5.5	102
5	108
4.5	114
4	120
3.5	132
3	150
2.5	180
2	246
1.5	408
1.35	480
1	1020
0.92	1800

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

~~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*~~

[a] When mixtures of moderating substances are present, the lower mass limits shall be used if more than 15 percent of the moderating substance has an average hydrogen density greater than H_2O.

~~*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.~~

Sec. T.11 - General License: ~~Fissile~~ Plutonium- Beryllium Special Form Materials.

a. A general license is issued to any licensee to transport fissile material in the form of plutonium-beryllium (Pu-Be) special form sealed sources, or to deliver Pu-Be sealed sources to a carrier for transport, if the material is shipped in accordance with this section. This material need not be contained in a package which meets the standards of subparts E and F of 10 CFR 71; however, the material must be contained in a Type A package. The Type A package must also meet the DOT requirements of 49 CFR 173.417(a).

b. The general license applies only to a licensee who has a quality assurance program approved by the Nuclear Regulatory Commission as satisfying the provision of subpart H of 10 CFR 71.

c. The general license applies when a package's contents:

i. Contain less than a Type A quantity of material; and

ii. Contain less than 1000 grams of plutonium, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 240~~g~~ grams of the total quantity of plutonium in the package.

d. The general license applies only to packages labeled with a CSI which:

i. Has been determined in accordance with T.11e.

ii. Has a value less than or equal to 100.0; and

iii. For a shipment of multiple packages containing Pu-Be sealed sources, the sum of the CSIs must be less than or equal to 50.0 (for shipment on a nonexclusive use conveyance or storage incident to transport) and to less than or equal to 100.0 (for shipment on an exclusive use conveyance).

e. i. The value for the CSI must be greater than or equal to the number calculated by the

following equation:

$$CSI = 10\left[\frac{\text{grams of } {}^{239}\text{Pu} + \text{grams of } {}^{241}\text{Pu}}{24}\right]$$

ii. The calculated CSI must be rounded up to the first decimal 1 place.

Sec. T.12 - Exemption from classification as fissile material. Fissile material meeting the requirements of at least one of the paragraphs (A) to (F) of this rule are exempt from classification as fissile material and from the fissile material package standards of 10 C.F.R. 71.55 and 10 C.F.R. 71.59, but are subject to all other requirements of T.12, except as noted.

a. Individual package containing two grams or less fissile material.

b. Individual or bulk packaging containing fifteen grams or less of fissile material provided the package has at least two hundred grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.

c. i. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that:

(1) There is at least two thousand grams of solid nonfissile material for every gram of fissile material; and

(2) There is no more than one hundred eighty grams of fissile material distributed within three hundred sixty kilograms of contiguous nonfissile material.

ii. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass of solid nonfissile material.

d. Uranium enriched in uranium-235 to a maximum of one per cent by weight, and with total plutonium and uranium-233 content of up to one per cent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium constitutes less than five per cent of the uranium mass.

e. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of two per cent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 per cent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of two. The material must be contained in at least a United States Department of Transportation type A package.

f. Packages containing, individually, a total plutonium mass of not more than one thousand grams, of which not more than twenty per cent by mass may consist of plutonium-239, plutonium-241, or any combination of these radionuclides.

~~. Fissile material meeting the requirements of at least one of the paragraphs (A) to (F) of this rule are exempt from classification as fissile material and from the fissile material package standards of 10 C.F.R. 71.55 and 10 C.F.R. 71.59, but are subject to all other requirements of this chapterT.12, except as noted.~~

~~a. Individual package containing two grams or less fissile material.~~

~~b. Individual or bulk packaging containing fifteen grams or less of fissile material provided the package has at least two hundred grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.~~

~~c. i. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that:~~

~~(1) There is at least two thousand grams of solid nonfissile material for every gram of fissile material, and~~

~~(2) There is no more than one hundred eighty grams of fissile material distributed within three hundred sixty kilograms of contiguous nonfissile material.~~

~~ii. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass of solid nonfissile material.~~

~~d. Uranium enriched in uranium-235 to a maximum of one per cent by weight, and with total plutonium and uranium-233 content of up to one per cent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium constitutes less than five per cent of the uranium mass.~~

~~e. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of two per cent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 per cent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of two. The material must be contained in at least a United States Department of Transportation type A package.~~

~~f. Packages containing, individually, a total plutonium mass of not more than one thousand grams, of which not more than twenty per cent by mass may consist of plutonium-239, plutonium-241, or any combination of these radionuclides.~~

Operating Controls and Procedures

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. 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/in^2) 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. For fissile material, any moderator or neutron absorber, if required, is present and in proper condition;

h~~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;

i~~h~~. The level of non-fixed (removable) 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 10 times 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

Contaminant	Maximum Permissible Units~~Maximum Permissible Units~~		
~~Contaminant~~	Bq/cm^2	μCi/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

j~~i~~. External radiation levels around the package and around the vehicle, if applicable, will not exceed 2 ~~millisievert~~ mSv 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;

k~~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~~ mSv 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~~ mSv 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~~ mSv 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~~ mSv 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~~ mSv 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 regulation.

l. For shipments made under the provisions of T.15j, the shipper shall provide specific written instructions to the carrier for maintenance of the exclusive use shipment controls. The instructions must be included with the shipping paper information. The written instructions required for exclusive use shipments must be sufficient so that, when followed, they will cause the carrier to avoid actions that will unnecessarily delay delivery or unnecessarily result in increased radiation levels or radiation exposures to transport workers or members of the general public.~~s; and~~

~~k~~m. 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.

n~~l~~. A package may not incorporate a feature intended to allow continuous venting during transport.

[****] *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 mSv per hour (200 mrem/hr) at any accessible surface.*

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 μCi/g) of material~~ less than or equal to the activity concentrations values for plutonium specified in Table A-2 of this chapter 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~~.

Sec. T.17 - Opening Instructions. Before delivery of a package to a carrier for transport, the licensee shall ensure that any special instructions needed to safely open the package have been sent to, or otherwise made available to, the consignee for the consignee's use in accordance with 10 CFR 20.1906(e), or equivalent state regulation.

Sec. T.~~17~~ 18 - 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~~–19 - 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~~–20 - 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,[54] 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;

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~~ TBq (27,000 Ci).

c. Each advance notification required by T.~~19a~~20a. 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

[54] *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.*

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.~~19~~a20a, 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.~~19~~a20a. 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~~ 21 - 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.~~

a. This rule describes quality assurance requirements applying to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, and modification of components of packaging that are important to safety. As used in this ~~rule~~Part, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to control of the physical characteristics and quality of the material or component to predetermined requirements. The licensee, certificate holder, and applicant for a certificate of compliance (CoC) are responsible for the quality assurance requirements as they apply to design, fabrication, testing, and modification of packaging. Each licensee is responsible for the quality assurance provision which applies to its use of a packaging for the shipment of licensed material subject to this ~~rule~~Part.

b. Each licensee, certificate holder, and applicant for a ~~certificate of compliance~~CoC shall establish, maintain, and execute a quality assurance program satisfying each of the applicable criteria of 10 C.F.R. 71.101 ~~to~~through 71.137 and satisfying any specific provisions that are applicable to the licensee's activities including procurement of packaging. The licensee, certificate holder, and applicant for a ~~certificate of compliance~~CoC shall execute the applicable criteria in a graded approach to an extent that is commensurate with the quality assurance requirement's importance to safety.

c. Before the use of any package for the shipment of licensed material subject to this rule, each licensee shall obtain United States Nnuclear Rregulatory Ccommission approval of its quality assurance program.

d. A program for transport container inspection and maintenance limited to radiographic exposure devices, source changers, or packages transporting these devices and meeting the requirements of ~~10 CFR 34.31(b), or equivalent Agreement State requirements SSR~~ Part E.12 of these regulations, is deemed to satisfy the requirements of T.7 and T.21b~~paragraph (B) of this rule~~.

e. The licensee, certificate holder, and applicant for a CoC shall be responsible for the establishment and execution of the quality assurance program. The licensee, certificate holder, and applicant for a CoC may delegate to others, such as contractors, agents, or consultants, the work of establishing and executing the quality assurance program, or any part of the quality assurance program, but shall retain responsibility for the program. The licensee shall clearly establish and delineate, in writing, the authority and duties of persons and organizations performing activities affecting the safety-related functions of structures, systems, and components. These activities include performing the functions associated with attaining quality objectives and the quality assurance functions. While the term licensee is used in these criteria, the requirements are applicable to whatever design, fabrication, assembly, and testing of the package is accomplished with respect to a package before the time a package approval is issued.

f. The quality assurance functions are:

i. Assuring that an appropriate quality assurance program is established and effectively executed; and

ii. Verifying, by procedures such as checking, auditing, and inspection, that activities affecting the safety-related functions have been performed correctly.

g. The persons and organizations performing quality assurance functions must have sufficient authority and organizational freedom to:

i. Identify quality problems;

ii. Initiate, recommend, or provide solutions; and

iii. Verify implementation of solutions.

PART T

APPENDIX A

DETERMINATION OF A_1 AND A_2

I. Values of A_1 and A_2 for individual radionuclides, which are the bases for many activity limits elsewhere in these regulations, are given in TABLE ~~IV~~A-1. The curie (Ci) values specified are obtained by converting from the Terabecquerel (TBq) ~~figure~~ value. 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 A_1 or A_2 are unlimited, it is for radiation control purposes only. For nuclear criticality safety, some materials are subject to controls placed on fissile material.

II. (a) For individual radionuclides whose identities are known, but which are not listed in TABLE ~~IV~~A-1, the A_1 and A_2 values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior ~~Commission~~ Agency approval of the A_1 and A_2 values for radionuclides not listed in Table A-1, before shipping the material.

~~the determination of the values of A_1 and A_2 requires Department approval, except that the values of A_1 and A_2 in TABLE V may be used without obtaining Agency approval.~~

(b) For individual radionuclides whose identities are known, but which are not listed in Table A-2, the exempt material activity concentration and exempt consignment activity values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior ~~Commission~~ Agency approval of the exempt material activity concentration and exempt consignment activity values for radionuclides not listed in Table A-2, before shipping the material.

(c) The licensee shall submit requests for prior approval, described under paragraphs II(a) and II(b) of this Appendix, to the Commission, in accordance with ???? ~~SSR~~Part A.12 of ~~this Part~~these regulations.

III. In the calculations of A_1 and A_2 for a radionuclide not in ~~TABLE IV~~Table A-1, 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 A_1 or A_2 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 is as follows:

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

where B(i) is the activity of radionuclide i and $A_1(i)$ is the A_1 value for radionuclide I

(b)

For normal form radioactive material, the maximum quantity transported in a Type A package is as follows:

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

where B(i) is the activity of radionuclide i and $A_1(i)$ and $A_2(i)$ are the A_1 and A_2 values for radionuclide respectively.

(c) 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.

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

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

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

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

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

where f(i) is the fraction of activity concentration of radionuclide ~~I~~i in the mixture, and [A](i)~~I~~ is the activity concentration for exempt material containing radionuclide ~~I~~i.

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

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

where f(i) is the fraction of activity of radionuclide ~~I~~i in the mixture, and A(i) is the activity limit for exempt consignments for radionuclide ~~I~~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 A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
~~TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES~~							
~~Symbol of radionuclide~~	~~Element and atomic number~~	~~A_1 (TBq)~~	~~A_1 (Ci)~~	~~A_2 (TBq)~~	~~A_2 (Ci)~~	~~Specific activity (TBq/g)~~	~~Specific activity (Ci/g)~~
Ac-225 (a)	Actinium (89)	$8.0X10^{-1}$	$2.2X10^{1}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$2.1X10^{3}$	$5.8X10^{4}$
Ac-227 (a)		$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-5}$	$2.4X10^{-3}$	2.7	$7.2X10^{1}$
Ac-228		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$8.4X10^{4}$	$2.2X10^{6}$
Ag-105	Silver (47)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.1X10^{3}$	$3.0X10^{4}$
Ag-108m (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.7X10^{-1}$	$2.6X10^{1}$
Ag-110m (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.8X10^{2}$	$4.7X10^{3}$
Ag-111		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Al-26	Aluminum (13)	$1.0X10^{-1}$	2.7	$1.0X10^{-1}$	2.7	$7.0X10^{-4}$	$1.9X10^{-2}$
Am-241	Americium (95)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-5}$	$2.7X10^{-2}$	$1.3X10^{-1}$	3.4
Am-242m (a)		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-5}$	$2.7X10^{-2}$	$3.6X10^{-1}$	$1.0X10^{1}$
Am-243 (a)		5.0	$1.4X10^{2}$	$1.0X10^{-5}$	$2.7X10^{-2}$	$7.4X10^{-3}$	$2.0X10^{-1}$
Ar-37	Argon (18)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.7X10^{3}$	$9.9X10^{4}$
Ar-39		$2.0X10^{1}$	$5.4X10^{2}$	$4.0X10^{1}$	$1.1X10^{3}$	1.3	$3.4X10^{1}$
Ar-41		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.5X10^{6}$	$4.2X10^{7}$
As-72	Arsenic (33)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$6.2X10^{4}$	$1.7X10^{6}$
As-73		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$8.2X10^{2}$	$2.2X10^{4}$
As-74		1.0	$2.7X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$3.7X10^{3}$	$9.9X10^{4}$
As-76		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$5.8X10^{4}$	$1.6X10^{6}$
As-77		$2.0X10^{1}$	$5.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.9X10^{4}$	$1.0X10^{6}$
At-211 (a)	Astatine (85)	$2.0X10^{1}$	$5.4X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$7.6X10^{4}$	$2.1X10^{6}$

TABLE A-1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Au-193	Gold (79)	7.0	$1.9X10^{2}$	2.0	$5.4X10^{1}$	$3.4X10^{4}$	$9.2X10^{5}$
Au-194		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.5X10^{4}$	$4.1X10^{5}$
Au-195	Gold (79)	$1.0X10^{1}$	$2.7X10^{2}$	6.0	$1.6X10^{2}$	$1.4X10^{2}$	$3.7X10^{3}$
Au-198		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.0X10^{3}$	$2.4X10^{5}$
Au-199		$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$7.7X10^{3}$	$2.1X10^{5}$
Ba-131 (a)	Barium (56)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$3.1X10^{3}$	$8.4X10^{4}$
Ba-133		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	9.4	$2.6X10^{2}$
Ba-133m		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.2X10^{4}$	$6.1X10^{5}$
Ba-140 (a)		$5.0X10^{-1}$	$1.4X10^{1}$	$3.0X10^{-1}$	8.1	$2.7X10^{3}$	$7.3X10^{4}$
Be-7	Beryllium (4)	$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$1.3X10^{4}$	$3.5X10^{5}$
Be-10		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-1}$	$1.6X10^{1}$	$8.3X10^{-4}$	$2.2X10^{-2}$
Bi-205	Bismuth (83)	$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$1.5X10^{-3}$	$4.2X10^{4}$
Bi-206		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$3.8X10^{3}$	$1.0X10^{5}$
Bi-207		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	1.9	$5.2X10^{1}$
Bi-210		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.6X10^{3}$	$1.2X10^{5}$
Bi-210m (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.1X10^{-5}$	$5.7X10^{-4}$
Bi-212 (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.4X10^{5}$	$1.5X10^{7}$
Bk-247	Berkelium (97)	8.0	$2.2X10^{2}$	$8.0X10^{-2}$	$2.2X10^{-2}$	$3.8X10^{-2}$	1.0
Bk-249 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{-1}$	8.1	$6.1X10^{1}$	$1.6X10^{3}$
Br-76	Bromine (35)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$9.4X10^{4}$	$2.5X10^{6}$
Br-77		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$2.6X10^{4}$	$7.1X10^{5}$
Br-82		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{4}$	$1.1X10^{6}$
C-11	Carbon (6)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.1X10^{7}$	$8.4X10^{8}$
C-14		$4.0X10^{1}$	$1.1X10^{3}$	3.0	$8.1X10^{1}$	$1.6X10^{-1}$	4.5
Ca-45		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$6.6X10^{2}$	$1.8X10^{4}$

TABLE A-1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Ca-47 (a)		3.0	$8.1X10^{1}$	$3.0X10^{-1}$	8.1	$2.3X10^{4}$	$6.1X10^{5}$
Cd-109	Cadmium (48)	$3.0X10^{1}$	$8.1X10^{2}$	2.0	$5.4X10^{1}$	$9.6X10^{1}$	$2.6X10^{3}$
Cd-113m		$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	8.3	$2.2X10^{2}$
Cd-115 (a)		3.0	$8.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.9X10^{4}$	$5.1X10^{5}$
Cd-115m		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$9.4X10^{2}$	$2.5X10^{4}$
Ce-139	Cerium (58)	7.0	$1.9X10^{2}$	2.0	$5.4X10^{1}$	$2.5X10^{2}$	$6.8X10^{3}$
Ce-141		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.1X10^{3}$	$2.8X10^{4}$
Ce-143		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{4}$	$6.6X10^{5}$
Ce-144 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.2X10^{2}$	$3.2X10^{3}$
Cf-248	Californium (98)	$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$5.8X10^{1}$	$1.6X10^{3}$
Cf-249		3.0	$8.1X10^{1}$	$8.0X10^{-4}$	$2.2X10^{-2}$	$1.5X10^{-1}$	4.1
Cf-250		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	4.0	$1.1X10^{2}$
Cf-251		7.0	$1.9X10^{2}$	$7.0X10^{-4}$	$1.9X10^{-2}$	$5.9X10^{-2}$	1.6
Cf-252 (h)		$1.0X10^{-1}$	2.7	$1.0X10^{-3}$	$2.7X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
Cf-253 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{-2}$	1.1	$1.1X10^{3}$	$2.9X10^{4}$
Cf-254		$1.0X10^{-3}$	$2.7X10^{-2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.1X10^{2}$	$8.5X10^{3}$
Cl-36	Chlorine (17)	$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{-3}$	$3.3X10^{-2}$
Cl-38		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$4.9X10^{6}$	$1.3X10^{8}$
Cm-240	Curium (96)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$7.5X10^{2}$	$2.0X10^{4}$
Cm-241		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$6.1X10^{2}$	$1.7X10^{4}$
Cm-242	Curium (96)	$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$1.2X10^{2}$	$3.3X10^{3}$
Cm-243		9.0	$2.4X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.9X10^{-3}$	$5.2X10^{1}$
Cm-244		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	3.0	$8.1X10^{1}$

TABLE A-1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Cm-245		9.0	$2.4X10^{2}$	$9.0X10^{-4}$	$2.4X10^{-2}$	$6.4X10^{-3}$	$1.7X10^{-1}$
Cm-246		9.0	$2.4X10^{2}$	$9.0X10^{-4}$	$2.4X10^{-2}$	$1.1X10^{-2}$	$3.1X10^{-1}$
Cm-247 (a)		3.0	$8.1X10^{1}$	$1.0X10^{-5}$	$2.7X10^{-2}$	$3.4X10^{-6}$	$9.3X10^{-5}$
Cm-248		$2.0X10^{-2}$	$5.4X10^{-1}$	$3.0X10^{-4}$	$8.1X10^{-3}$	$1.6X10^{-5}$	$4.2X10^{-3}$
Co-55	Cobalt (27)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$
Co-56		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.1X10^{3}$	$3.0X10^{4}$
Co-57		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$3.1X10^{2}$	$8.4X10^{3}$
Co-58		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.2X10^{3}$	$3.2X10^{4}$
Co-58m	Cobalt (27)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$2.2X10^{5}$	$5.9X10^{6}$
Co-60		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.2X10^{1}$	$1.1X10^{3}$
Cr-51	Chromium (24)	$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$3.4X10^{3}$	$9.2X10^{4}$
Cs-129		4.0	$1.1X10^{2}$	4.0	$1.1X10^{2}$	$2.8X10^{4}$	$7.6X10^{5}$
Cs-131		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$3.8X10^{3}$	$1.0X10^{5}$
Cs-132		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$5.7X10^{3}$	$1.5X10^{5}$
Cs-134		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.8X10^{1}$	$1.3X10^{3}$
Cs-134m	Cesium (55)	$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{5}$	$8.0X10^{6}$
Cs-135		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$4.3X10^{-5}$	$1.2X10^{-3}$
Cs-136		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.7X10^{3}$	$7.3X10^{4}$
Cs-137 (a)		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	3.2	$8.7X10^{1}$
Cu-64	Copper (29)	6.0	$1.6X10^{2}$	1.0	$2.7X10^{1}$	$1.4X10^{5}$	$3.9X10^{6}$
Cu-67		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.8X10^{4}$	$7.6X10^{5}$
Dy-159		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$2.1X10^{2}$	$5.7X10^{3}$
Dy-165	Dysprosium (66)	$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{5}$	$8.2X10^{6}$
Dy-166 (a)		$9.0X10^{-1}$	$2.4X10^{1}$	$3.0X10^{-1}$	8.1	$8.6X10^{3}$	$2.3X10^{5}$

TABLE A-1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Er-169	Erbium (68)	$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$3.1X10^{3}$	$8.3X10^{4}$
Er-171		$8.0X10^{-1}$	$2.2X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$9.0X10^{4}$	$2.4X10^{6}$
Eu-147	Europium (63)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.4X10^{3}$	$3.7X10^{4}$
Eu-148		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.0X10^{2}$	$1.6X10^{4}$
Eu-149		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$3.5X10^{2}$	$9.4X10^{3}$
Eu-150 (short lived)		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
Eu-150 (long lived)		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
Eu-152		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	6.5	$1.8X10^{2}$
Eu-152m		$8.0X10^{-1}$	$2.2X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$8.2X10^{4}$	$2.2X10^{6}$
Eu-154		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	9.8	$2.6X10^{2}$
Eu-155		$2.0X10^{1}$	$5.4X10^{2}$	3.0	$8.1X10^{1}$	$1.8X10^{1}$	$4.9X10^{2}$
Eu-156		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.0X10^{3}$	$5.5X10^{4}$
F-18	Fluorine (9)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.5X10^{6}$	$9.5X10^{7}$
Fe-52 (a)	Iron (26)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.7X10^{5}$	$7.3X10^{6}$
Fe-55		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$8.8X10^{1}$	$2.4X10^{3}$
Fe-59		$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$1.8X10^{3}$	$5.0X10^{4}$
Fe-60 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-1}$	5.4	$7.4X10^{-4}$	$2.0X10^{-2}$
Ga-67	Gallium (31)	7.0	$1.9X10^{2}$	3.0	$8.1X10^{1}$	$2.2X10^{4}$	$6.0X10^{5}$
Ga-68		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.5X10^{6}$	$4.1X10^{7}$
Ga-72		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$
Gd-146 (a)	Gadolinium (64)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.9X10^{2}$	$1.9X10^{4}$
Gd-148		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-2}$	$5.4X10^{-2}$	1.2	$3.2X10^{1}$
Gd-153		$1.0X10^{1}$	$2.7X10^{2}$	9.0	$2.4X10^{2}$	$1.3X10^{2}$	$3.5X10^{3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Gd-159		3.0	$8.1X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$3.9X10^4$	$1.1X10^6$
Ge-68 (a)	Germanium (32)	$5.0X10^{-1}$	$1.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$2.6X10^2$	$7.1X10^3$
Ge-71		$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	$5.8X10^3$	$1.6X10^5$
Ge-77		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.3X10^5$	$3.6X10^6$
Hf-172 (a)	Hafnium (72)	$6.0X10^{-1}$	$1.6X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$4.1X10^1$	$1.1X10^3$
Hf-175		3.0	$8.1X10^1$	3.0	$8.1X10^1$	$3.9X10^2$	$1.1X10^4$
Hf-181		2.0	$5.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$6.3X10^2$	$1.7X10^4$
Hf-182		Unlimited	Unlimited	Unlimited	Unlimited	$8.1X10^{-6}$	$2.2X10^{-4}$
Hg-194 (a)	Mercury (80)	1.0	$2.7X10^1$	1.0	$2.7X10^1$	$1.3X10^{-1}$	3.5
Hg-195m (a)		3.0	$8.1X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$1.5X10^4$	$4.0X10^5$
Hg-197		$2.0X10^1$	$5.4X10^2$	$1.0X10^1$	$2.7X10^2$	$9.2X10^3$	$2.5X10^5$
Hg-197m		$1.0X10^1$	$2.7X10^2$	$4.0X10^{-1}$	$1.1X10^1$	$2.5X10^4$	$6.7X10^5$
Hg-203		5.0	$1.4X10^2$	1.0	$2.7X10^1$	$5.1X10^2$	$1.4X10^4$
Ho-166	Holmium (67)	$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$2.6X10^4$	$7.0X10^5$
Ho-166m		$6.0X10^{-1}$	$1.6X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$6.6X10^{-2}$	1.8
I-123	Iodine (53)	6.0	$1.6X10^2$	3.0	$8.1X10^1$	$7.1X10^4$	$1.9X10^6$
I-124		1.0	$2.7X10^1$	1.0	$2.7X10^1$	$9.3X10^3$	$2.5X10^5$
I-125		$2.0X10^1$	$5.4X10^2$	3.0	$8.1X10^1$	$6.4X10^2$	$1.7X10^4$
I-126		2.0	$5.4X10^1$	1.0	$2.7X10^1$	$2.9X10^3$	$8.0X10^4$
I-129		Unlimited	Unlimited	Unlimited	Unlimited	$6.5X10^{-6}$	$1.8X10^{-4}$
I-131		3.0	$8.1X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$4.6X10^3$	$1.2X10^5$
I-132		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$3.8X10^5$	$1.0X10^7$
I-133		$7.0X10^{-1}$	$1.9X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$4.2X10^4$	$1.1X10^6$
I-134		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$9.9X10^5$	$2.7X10^7$
I-135 (a)		$6.0X10^{-1}$	$1.6X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$1.3X10^5$	$3.5X10^6$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
In-111	Indium (49)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$1.5X10^{4}$	$4.2X10^{5}$
In-113m		4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$6.2X10^{5}$	$1.7X10^{7}$
In-114m (a)		$1.0X10^{1}$	$2.7X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$8.6X10^{2}$	$2.3X10^{4}$
In-115m		7.0	$1.9X10^{2}$	1.0	$2.7X10^{1}$	$2.2X10^{5}$	$6.1X10^{6}$
Ir-189 (a)	Iridium (77)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$1.9X10^{3}$	$5.2X10^{4}$
Ir-190		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.3X10^{3}$	$6.2X10^{4}$
Ir-192		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.4X10^{2}$	$9.2X10^{3}$
Ir-194		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$3.1X10^{4}$	$8.4X10^{5}$
K-40	Potassium (19)	$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$2.4X10^{-7}$	$6.4X10^{-6}$
K-42		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$2.2X10^{5}$	$6.0X10^{6}$
K-43		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$
Kr-81	Krypton (36)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$7.8X10^{-4}$	$2.1X10^{-2}$
Kr-85		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$1.5X10^{1}$	$3.9X10^{2}$
Kr-85m		8.0	$2.2X10^{2}$	3.0	$8.1X10^{1}$	$3.0X10^{5}$	$8.2X10^{6}$
Kr-87		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.0X10^{6}$	$2.8X10^{7}$
La-137	Lanthanum (57)	$3.0X10^{1}$	$8.1X10^{2}$	6.0	$1.6X10^{2}$	$1.6X10^{-3}$	$4.4X10^{-2}$
La-140		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$2.1X10^{4}$	$5.6X10^{5}$
Lu-172	Lutetium (71)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.2X10^{3}$	$1.1X10^{5}$
Lu-173		8.0	$2.2X10^{2}$	8.0	$2.2X10^{2}$	$5.6X10^{1}$	$1.5X10^{3}$
Lu-174		9.0	$2.4X10^{2}$	9.0	$2.4X10^{2}$	$2.3X10^{1}$	$6.2X10^{2}$
Lu-174m		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$2.0X10^{2}$	$5.3X10^{3}$
Lu-177		$3.0X10^{1}$	$8.1X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.1X10^{3}$	$1.1X10^{5}$
Mg-28 (a)	Magnesium (12)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.0X10^{5}$	$5.4X10^{6}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Mn-52	Manganese (25)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.6X10^{4}$	$4.4X10^{5}$
Mn-53		Unlimited	Unlimited	Unlimited	Unlimited	$6.8X10^{-5}$	$1.8X10^{-3}$
Mn-54		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$2.9X10^{2}$	$7.7X10^{3}$
Mn-56		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$8.0X10^{5}$	$2.2X10^{7}$
Mo-93	Molybdenum (42)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	$4.1X10^{-2}$	1.1
Mo-99 (a) (h)		1.0	$2.7X10^{1}$	$7.4X10^{-1}$	$2.0X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$
N-13	Nitrogen (7)	$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.4X10^{7}$	$1.5X10^{9}$
Na-22	Sodium (11)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.3X10^{2}$	$6.3X10^{3}$
Na-24		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$3.2X10^{5}$	$8.7X10^{6}$
Nb-93m	Niobium (41)	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	8.8	$2.4X10^{2}$
Nb-94		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.9X10^{-3}$	$1.9X10^{-1}$
Nb-95		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.5X10^{3}$	$3.9X10^{4}$
Nb-97		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.9X10^{5}$	$2.7X10^{7}$
Nd-147	Neodymium (60)	6.0	$1.6X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{3}$	$8.1X10^{4}$
Nd-149		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$4.5X10^{5}$	$1.2X10^{7}$
Ni-59	Nickel (28)	Unlimited	Unlimited	Unlimited	Unlimited	$3.0X10^{-3}$	$8.0X10^{-2}$
Ni-63		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	2.1	$5.7X10^{1}$
Ni-65		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$7.1X10^{5}$	$1.9X10^{7}$
Np-235	Neptunium (93)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$5.2X10^{1}$	$1.4X10^{3}$
Np-236 (short-lived)		$2.0X10^{1}$	$5.4X10^{2}$	2.0	$5.4X10^{1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
Np-236 (long-lived)		$2.0X10^{1}$	$5.4X10^{2}$	2.0	$5.4X10^{1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
Np-237		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	$2.6X10^{-5}$	$7.1X10^{-4}$
Np-239		7.0	$1.9X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$8.6X10^{3}$	$2.3X10^{5}$
Os-185		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$2.8X10^{2}$	$7.5X10^{3}$
Os-191		$1.0X10^{1}$	$2.7X10^{2}$	2.0	$5.4X10^{1}$	$1.6X10^{3}$	$4.4X10^{4}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Os-191m	Osmium (76)	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	$4.6X10^{4}$	$1.3X10^{6}$
Os-193		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{4}$	$5.3X10^{5}$
Os-194 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.1X10^{1}$	$3.1X10^{2}$
P-32	Phosphorus (15)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.1X10^{4}$	$2.9X10^{5}$
P-33		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Pa-230 (a)	Protactinium (91)	2.0	$5.4X10^{1}$	$7.0X10^{-2}$	1.9	$1.2X10^{3}$	$3.3X10^{4}$
Pa-231		4.0	$1.1X10^{2}$	$4.0X10^{-4}$	$1.1X10^{-2}$	$1.7X10^{-3}$	$4.7X10^{-2}$
Pa-233		5.0	$1.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$7.7X10^{2}$	$2.1X10^{4}$
Pb-201	Lead (82)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$6.2X10^{4}$	$1.7X10^{6}$
Pb-202		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	$1.2X10^{-4}$	$3.4X10^{-3}$
Pb-203		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$1.1X10^{4}$	$3.0X10^{5}$
Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	$4.5X10^{-6}$	$1.2X10^{-4}$
Pb-210 (a)		1.0	$2.7X10^{1}$	$5.0X10^{-2}$	1.4	2.8	$7.6X10^{1}$
Pb-212 (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$2.0X10^{-1}$	5.4	$5.1X10^{4}$	$1.4X10^{6}$
Pd-103 (a)	Palladium (46)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$2.8X10^{3}$	$7.5X10^{4}$
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	$1.9X10^{-5}$	$5.1X10^{-4}$
Pd-109		2.0	$5.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$7.9X10^{4}$	$2.1X10^{6}$
Pm-143	Promethium (61)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$1.3X10^{2}$	$3.4X10^{3}$
Pm-144		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.2X10^{1}$	$2.5X10^{3}$
Pm-145		$3.0X10^{1}$	$8.1X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	5.2	$1.4X10^{2}$
Pm-147		$4.0X10^{1}$	$1.1X10^{3}$	2.0	$5.4X10^{1}$	$3.4X10^{1}$	$9.3X10^{2}$
Pm-148m (a)		$8.0X10^{-1}$	$2.2X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$7.9X10^{2}$	$2.1X10^{4}$
Pm-149		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Pm-151		2.0	$5.4X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$2.7X10^4$	$7.3X10^5$
Po-210	Polonium (84)	$4.0X10^1$	$1.1X10^3$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.7X10^2$	$4.5X10^3$
Pr-142	Praseodymium (59)	$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$4.3X10^4$	$1.2X10^6$
Pr-143		3.0	$8.1X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$2.5X10^3$	$6.7X10^4$
Pt-188 (a)	Platinum (78)	1.0	$2.7X10^1$	$8.0X10^{-1}$	$2.2X10^1$	$2.5X10^3$	$6.8X10^4$
Pt-191		4.0	$1.1X10^2$	3.0	$8.1X10^1$	$8.7X10^3$	$2.4X10^5$
Pt-193		$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	1.4	$3.7X10^1$
Pt-193m		$4.0X10^1$	$1.1X10^3$	$5.0X10^{-1}$	$1.4X10^1$	$5.8X10^3$	$1.6X10^5$
Pt-195m		$1.0X10^1$	$2.7X10^2$	$5.0X10^{-1}$	$1.4X10^1$	$6.2X10^3$	$1.7X10^5$
Pt-197		$2.0X10^1$	$5.4X10^2$	$6.0X10^{-1}$	$1.6X10^1$	$3.2X10^4$	$8.7X10^5$
Pt-197m		$1.0X10^1$	$2.7X10^2$	$6.0X10^{-1}$	$1.6X10^1$	$3.7X10^5$	$1.0X10^7$
Pu-236	Plutonium (94)	$3.0X10^1$	$8.1X10^2$	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^1$	$5.3X10^2$
Pu-237		$2.0X10^1$	$5.4X10^2$	$2.0X10^1$	$5.4X10^2$	$4.5X10^2$	$1.2X10^4$
Pu-238		$1.0X10^1$	$2.7X10^2$	$1.0X10^{-3}$	$2.7X10^{-2}$	$6.3X10^{-1}$	$1.7X10^1$
Pu-239		$1.0X10^1$	$2.7X10^2$	$1.0X10^{-3}$	$2.7X10^{-2}$	$2.3X10^{-3}$	$6.2X10^{-2}$
Pu-240		$1.0X10^1$	$2.7X10^2$	$1.0X10^{-3}$	$2.7X10^{-2}$	$8.4X10^{-3}$	$2.3X10^{-1}$
Pu-241 (a)		$4.0X10^1$	$1.1X10^3$	$6.0X10^{-2}$	1.6	3.8	$1.0X10^2$
Pu-242		$1.0X10^1$	$2.7X10^2$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.5X10^{-4}$	$3.9X10^{-3}$
Pu-244 (a)		$4.0X10^{-1}$	$1.1X10^1$	$1.0X10^{-3}$	$2.7X10^{-2}$	$6.7X10^{-7}$	$1.8X10^{-5}$
Ra-223 (a)	Radium (88)	$4.0X10^{-1}$	$1.1X10^1$	$7.0X10^{-3}$	$1.9X10^{-1}$	$1.9X10^3$	$5.1X10^4$
Ra-224 (a)		$4.0X10^{-1}$	$1.1X10^1$	$2.0X10^{-2}$	$5.4X10^{-1}$	$5.9X10^3$	$1.6X10^5$
Ra-225 (a)		$2.0X10^{-1}$	5.4	$4.0X10^{-3}$	$1.1X10^{-1}$	$1.5X10^3$	$3.9X10^4$
Ra-226 (a)		$2.0X10^{-1}$	5.4	$3.0X10^{-3}$	$8.1X10^{-2}$	$3.7X10^{-2}$	1.0
Ra-228 (a)		$6.0X10^{-1}$	$1.6X10^1$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.0X10^1$	$2.7X10^2$
Rb-81		2.0	$5.4X10^1$	$8.0X10^{-1}$	$2.2X10^1$	$3.1X10^5$	$8.4X10^6$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Rb-83 (a)	Rubidium (37)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$6.8X10^2$	$1.8X10^4$
Rb-84		1.0	$2.7X10^1$	1.0	$2.7X10^1$	$1.8X10^3$	$4.7X10^4$
Rb-86		$5.0X10^{-1}$	$1.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$3.0X10^3$	$8.1X10^4$
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	$3.2X10^{-9}$	$8.6X10^{-8}$
Rb(nat)		Unlimited	Unlimited	Unlimited	Unlimited	$6.7X10^6$	$1.8X10^8$
Re-184	Rhenium (75)	1.0	$2.7X10^1$	1.0	$2.7X10^1$	$6.9X10^2$	$1.9X10^4$
Re-184m		3.0	$8.1X10^1$	1.0	$2.7X10^1$	$1.6X10^2$	$4.3X10^3$
Re-186		2.0	$5.4X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$6.9X10^3$	$1.9X10^5$
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	$1.4X10^{-9}$	$3.8X10^{-8}$
Re-188		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$3.6X10^4$	$9.8X10^5$
Re-189 (a)		3.0	$8.1X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$2.5X10^4$	$6.8X10^5$
Re(nat)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	$2.4X10^{-8}$
Rh-99	Rhodium (45)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$3.0X10^3$	$8.2X10^4$
Rh-101		4.0	$1.1X10^2$	3.0	$8.1X10^1$	$4.1X10^1$	$1.1X10^3$
Rh-102		$5.0X10^{-1}$	$1.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$4.5X10^1$	$1.2X10^3$
Rh-102m		2.0	$5.4X10^1$	2.0	$5.4X10^1$	$2.3X10^2$	$6.2X10^3$
Rh-103m		$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	$1.2X10^6$	$3.3X10^7$
Rh-105		$1.0X10^1$	$2.7X10^2$	$8.0X10^{-1}$	$2.2X10^1$	$3.1X10^4$	$8.4X10^5$
Rn-222 (a)	Radon (86)	$3.0X10^{-1}$	8.1	$4.0X10^{-3}$	$1.1X10^{-1}$	$5.7X10^3$	$1.5X10^5$
Ru-97	Ruthenium (44)	5.0	$1.4X10^2$	5.0	$1.4X10^2$	$1.7X10^4$	$4.6X10^5$
Ru-103 (a)		2.0	$5.4X10^1$	2.0	$5.4X10^1$	$1.2X10^3$	$3.2X10^4$
Ru-105		1.0	$2.7X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$2.5X10^5$	$6.7X10^6$
Ru-106 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.2X10^2$	$3.3X10^3$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
S-35	Sulphur (16)	$4.0X10^{1}$	$1.1X10^{3}$	3.0	$8.1X10^{1}$	$1.6X10^{3}$	$4.3X10^{4}$
Sb-122	Antimony (51)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$
Sb-124		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$6.5X10^{2}$	$1.7X10^{4}$
Sb-125		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$3.9X10^{1}$	$1.0X10^{3}$
Sb-126		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.1X10^{3}$	$8.4X10^{4}$
Sc-44	Scandium (21)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.7X10^{5}$	$1.8X10^{7}$
Sc-46		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.3X10^{3}$	$3.4X10^{4}$
Sc-47		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.1X10^{4}$	$8.3X10^{5}$
Sc-48		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$5.5X10^{4}$	$1.5X10^{6}$
Se-75	Selenium (34)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$5.4X10^{2}$	$1.5X10^{4}$
Se-79	Selenium (34)	$4.0X10^{1}$	$1.1X10^{3}$	2.0	$5.4X10^{1}$	$2.6X10^{-3}$	$7.0X10^{-2}$
Si-31	Silicon (14)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.4X10^{6}$	$3.9X10^{7}$
Si-32		$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	3.9	$1.1X10^{2}$
Sm-145	Samarium (62)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.8X10^{1}$	$2.6X10^{3}$
Sm-147		Unlimited	Unlimited	Unlimited	Unlimited	$8.5X10^{-1}$	$2.3X10^{-8}$
Sm-151		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.7X10^{-1}$	$2.6X10^{1}$
Sm-153		9.0	$2.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.6X10^{4}$	$4.4X10^{5}$
Sn-113 (a)	Tin (50)	4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$3.7X10^{2}$	$1.0X10^{4}$
Sn-117m		7.0	$1.9X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.0X10^{3}$	$8.2X10^{4}$
Sn-119m		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	$1.4X10^{2}$	$3.7X10^{3}$
Sn-121m (a)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-1}$	$2.4X10^{1}$	2.0	$5.4X10^{1}$
Sn-123		$8.0X10^{-1}$	$2.2X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{2}$	$8.2X10^{3}$
Sn-125		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{3}$	$1.1X10^{5}$
Sn-126 (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.0X10^{-3}$	$2.8X10^{-2}$
Sr-82 (a)	Strontium (38)	$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$2.3X10^{3}$	$6.2X10^{4}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Sr-85		2.0	$5.4X10^1$	2.0	$5.4X10^1$	$8.8X10^2$	$2.4X10^4$
Sr-85m		5.0	$1.4X10^2$	5.0	$1.4X10^2$	$1.2X10^6$	$3.3X10^7$
Sr-87m		3.0	$8.1X10^1$	3.0	$8.1X10^1$	$4.8X10^5$	$1.3X10^7$
Sr-89		$6.0X10^{-1}$	$1.6X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$1.1X10^3$	$2.9X10^4$
Sr-90 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	5.1	$1.4X10^2$
Sr-91 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.3X10^5$	$3.6X10^6$
Sr-92 (a)		1.0	$2.7X10^1$	$3.0X10^{-1}$	8.1	$4.7X10^5$	$1.3X10^7$
T(H-3)	Tritium (1)	$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	$3.6X10^2$	$9.7X10^3$
Ta-178 (long-lived)	Tantalum (73)	1.0	$2.7X10^1$	$8.0X10^{-1}$	$2.2X10^1$	$4.2X10^6$	$1.1X10^8$
Ta-179		$3.0X10^1$	$8.1X10^2$	$3.0X10^1$	$8.1X10^2$	$4.1X10^1$	$1.1X10^3$
Ta-182		$9.0X10^{-1}$	$2.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$2.3X10^2$	$6.2X10^3$
Tb-157		$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	$5.6X10^{-1}$	$1.5X10^1$
Tb-158	Terbium (65)	1.0	$2.7X10^1$	1.0	$2.7X10^1$	$5.6X10^{-1}$	$1.5X10^1$
Tb-160		1.0	$2.7X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$4.2X10^2$	$1.1X10^4$
Tc-95m (a)		2.0	$5.4X10^1$	2.0	$5.4X10^1$	$8.3X10^2$	$2.2X10^4$
Tc-96		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.2X10^4$	$3.2X10^5$
Tc-96m (a)		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.4X10^6$	$3.8X10^7$
Tc-97	Technetium (43)	Unlimited	Unlimited	Unlimited	Unlimited	$5.2X10^{-5}$	$1.4X10^{-3}$
Tc-97m		$4.0X10^1$	$1.1X10^3$	1.0	$2.7X10^1$	$5.6X10^2$	$1.5X10^4$
Tc-98		$8.0X10^{-1}$	$2.2X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$3.2X10^{-5}$	$8.7X10^{-4}$
Tc-99		$4.0X10^1$	$1.1X10^3$	$9.0X10^{-1}$	$2.4X10^1$	$6.3X10^{-4}$	$1.7X10^{-2}$
Tc-99m		$1.0X10^1$	$2.7X10^2$	4.0	$1.1X10^2$	$1.9X10^5$	$5.3X10^6$
Te-121	Tellurium (52)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$2.4X10^3$	$6.4X10^4$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Te-121m		5.0	$1.4X10^2$	3.0	$8.1X10^1$	$2.6X10^2$	$7.0X10^3$
Te-123m		8.0	$2.2X10^2$	1.0	$2.7X10^1$	$3.3X10^2$	$8.9X10^3$
Te-125m		$2.0X10^1$	$5.4X10^2$	$9.0X10^{-1}$	$2.4X10^1$	$6.7X10^2$	$1.8X10^4$
Te-127		$2.0X10^1$	$5.4X10^2$	$7.0X10^{-1}$	$1.9X10^1$	$9.8X10^4$	$2.6X10^6$
Te-127m (a)		$2.0X10^1$	$5.4X10^2$	$5.0X10^{-1}$	$1.4X10^1$	$3.5X10^2$	$9.4X10^3$
Te-129		$7.0X10^{-1}$	$1.9X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$7.7X10^5$	$2.1X10^7$
Te-129m (a)		$8.0X10^{-1}$	$2.2X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.1X10^3$	$3.0X10^4$
Te-131m (a)		$7.0X10^{-1}$	$1.9X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$3.0X10^4$	$8.0X10^5$
Te-132 (a)		$5.0X10^{-1}$	$1.4X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.1X10^4$	$8.0X10^5$
Th-227		$1.0X10^1$	$2.7X10^2$	$5.0X10^{-3}$	$1.4X10^{-1}$	$1.1X10^3$	$3.1X10^4$
Th-228 (a)	Thorium (90)	$5.0X10^{-1}$	$1.4X10^1$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.0X10^1$	$8.2X10^2$
Th-229		5.0	$1.4X10^2$	$5.0X10^{-4}$	$1.4X10^{-2}$	$7.9X10^{-3}$	$2.1X10^{-1}$
Th-230		$1.0X10^1$	$2.7X10^2$	$1.0X10^{-3}$	$2.7X10^{-2}$	$7.6X10^{-4}$	$2.1X10^{-2}$
Th-231		$4.0X10^1$	$1.1X10^3$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.0X10^4$	$5.3X10^5$
Th-232	Thorium (90)	Unlimited	Unlimited	Unlimited	Unlimited	$4.0X10^{-9}$	$1.1X10^{-7}$
Th-234 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$8.6X10^2$	$2.3X10^4$
Th(nat)		Unlimited	Unlimited	Unlimited	Unlimited	$8.1X10^{-9}$	$2.2X10^{-7}$
Ti-44 (a)	Titanium (22)	$5.0X10^{-1}$	$1.4X10^1$	$4.0X10^{-1}$	$1.1X10^1$	6.4	$1.7X10^2$
Tl-200		$9.0X10^{-1}$	$2.4X10^1$	$9.0X10^{-1}$	$2.4X10^1$	$2.2X10^4$	$6.0X10^5$
Tl-201	Thallium (81)	$1.0X10^1$	$2.7X10^2$	4.0	$1.1X10^2$	$7.9X10^3$	$2.1X10^5$
Tl-202		2.0	$5.4X10^1$	2.0	$5.4X10^1$	$2.0X10^3$	$5.3X10^4$
Tl-204		$1.0X10^1$	$2.7X10^2$	$7.0X10^{-1}$	$1.9X10^1$	$1.7X10^1$	$4.6X10^2$
Tm-167		7.0	$1.9X10^2$	$8.0X10^{-1}$	$2.2X10^1$	$3.1X10^3$	$8.5X10^4$
Tm-170	Thulium (69)	3.0	$8.1X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$2.2X10^2$	$6.0X10^3$
Tm-171		$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
U-230 (fast lung absorption) (a)(d)	Uranium (92)	$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (medium lung absorption) (a)(e)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (slow lung absorption) (a)(f)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-232 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-232 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-233 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-234 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
234 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
-234 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
U-235 (all lung absorption types) (a),(d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	$8.0X10^{-8}$	$2.2X10^{-6}$
U-236 (fast lung absorption) (d)	Uranium (92)	Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (medium lung absorption) (e)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (slow lung absorption) (f)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-238 (all lung absorption types) (d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	$1.2X10^{-8}$	$3.4X10^{-7}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
U (nat)		Unlimited	Unlimited	Unlimite	Unlimited	$2.6X10^{-8}$	$7.1X10^{-7}$
U (enriched to 20% or less)(g)		Unlimited	Unlimited	Unlimited	Unlimited	N/A	N/A
U (dep)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	(See Table A-3)
V-48	Vanadium (23)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$6.3X10^{3}$	$1.7X10^{5}$
V-49		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{2}$	$8.1X10^{3}$
W-178 (a)	Tungsten (74)	9.0	$2.4X10^{2}$	5.0	$1.4X10^{2}$	$1.3X10^{3}$	$3.4X10^{4}$
W-181		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$2.2X10^{2}$	$6.0X10^{3}$
W-185		$4.0X10^{1}$	$1.1X10^{3}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.5X10^{2}$	$9.4X10^{3}$
W-187		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.6X10^{4}$	$7.0X10^{5}$
W-188 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$3.0X10^{-1}$	8.1	$3.7X10^{2}$	$1.0X10^{4}$
Xe-122 (a)	Xenon (54)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.8X10^{4}$	$1.3X10^{6}$
Xe-123		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.4X10^{5}$	$1.2X10^{7}$
Xe-127		4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$1.0X10^{3}$	$2.8X10^{4}$
Xe-131m		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.1X10^{3}$	$8.4X10^{4}$
Xe-133		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$6.9X10^{3}$	$1.9X10^{5}$
Xe-135		3.0	$8.1X10^{1}$	2.0	$5.4X10^{1}$	$9.5X10^{4}$	$2.6X10^{6}$
Y-87 (a)	Yttrium (39)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.7X10^{4}$	$4.5X10^{5}$
Y-88		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$5.2X10^{2}$	$1.4X10^{4}$
Y-90		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.0X10^{4}$	$5.4X10^{5}$
Y-91		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.1X10^{2}$	$2.5X10^{4}$
Y-91m		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.5X10^{6}$	$4.2X10^{7}$
Y-92		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$3.6X10^{5}$	$9.6X10^{6}$
Y-93		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.2X10^{5}$	$3.3X10^{6}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Yb-169	Ytterbium (79)	4.0	$1.1X10^2$	1.0	$2.7X10^1$	$8.9X10^2$	$2.4X10^4$
Yb-175		$3.0X10^1$	$8.1X10^2$	$9.0X10^{-1}$	$2.4X10^1$	$6.6X10^3$	$1.8X10^5$
Zn-65	Zinc (30)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$3.0X10^2$	$8.2X10^3$
Zn-69		3.0	$8.1X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$1.8X10^6$	$4.9X10^7$
Zn-69m (a)		3.0	$8.1X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$1.2X10^5$	$3.3X10^6$
Zr-88	Zirconium (40)	3.0	$8.1X10^1$	3.0	$8.1X10^1$	$6.6X10^2$	$1.8X10^4$
Zr-93		Unlimited	Unlimited	Unlimited	Unlimited	$9.3X10^{-5}$	$2.5X10^{-3}$
Zr-95 (a)		2.0	$5.4X10^1$	$8.0X10^{-1}$	$2.2X10^1$	$7.9X10^2$	$2.1X10^4$
Zr-97 (a)		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$7.1X10^4$	$1.9X10^6$

NOTES

(a) A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days

(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-12 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214,

U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

(c) The quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.

(d) These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO3)_2$ in both normal and accident conditions of transport.

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

(f) These values apply to all compounds of uranium other than those specified in (d) and (e), above.

(g) These values apply to unirradiated uranium only.

(h) These values apply to domestic transport only. For international transport, use the values in the table below.

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)

TABLE A - 1 (SUPPLEMENT) A_1 AND A_2 VALUES FOR RADIONUCLIDES FOR INTERNATIONAL SHIPMENTS

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Cf-252	Californium (98)	$5.0X10^{-2}$	1.4	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
Mo-99 (a)	Molybdenum (42)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Ac-225 (a)	Actinium (89)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ac-227 (a)		$1.0X10^{-1}$	$2.7X10^{-12}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ac-228		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-105	Silver (47)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-108m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-110m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-111		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Al-26	Aluminum (13)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Am-241	Americium (95)	1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Am-242m (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Am-243 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ar-37	Argon (18)	$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ar-39		$1.0X10^{7}$	$2.7X10^{-4}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ar-41		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
As-72	Arsenic (33)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
As-73		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
As-74		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
As-76		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
As-77		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
At-211 (a)	Astatine (85)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-193	Gold (79)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Au-194		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Au-195		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-198		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Au-199		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-131 (a)	Barium (56)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-133		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-133m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-140 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Be-7	Beryllium (4)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Be-10		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-205	Bismuth (83)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-206		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bi-207		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-210		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-210m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bi-212 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bk-247	Berkelium (97)	1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Bk-249 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Br-76	Bromine (35)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Br-77		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Br-82		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
C-11	Carbon (6)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
C-14		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-41	Calcium (20)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-45		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-47 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-109	Cadmium (48)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-113m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-115 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-115m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-139	Cerium (58)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-141		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ce-143		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-144 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cf-248	Californium (98)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-249		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cf-250		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-251		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cf-252		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-253 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cf-254		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cl-36	Chlorine (17)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Cl-38	Chlorine (17)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-240	Curium (96)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-241		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cm-242		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-243		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-244		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-245		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cm-246		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cm-247 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-248		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Co-55	Cobalt (27)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-56		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Co-57		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-58		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-58m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Co-60		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cr-51	Chromium (24)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Cs-129	Cesium (55)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-131		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cs-132		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Cs-134	Cesium (55)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cs-134m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-135		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Cs-136		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-137 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cu-64	Copper (29)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cu-67		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Dy-159	Dysprosium (66)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Dy-165		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Dy-166 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Er-169	Erbium (68)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Er-171		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-147	Europium (63)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-148		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-149		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Eu-150 (short lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-150 (long lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-152		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-152 m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Eu-154		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-155		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Eu-156		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
F-18	Fluorine (9)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-52 (a)	Iron (26)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-55		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-59		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-60 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ga-67	Gallium (31)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ga-68		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ga-72		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Gd-146 (a)	Gadolinium (64)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Gd-148		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Gd-153		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Gd-159		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ge-68 (a)	Germanium (32)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ge-71		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ge-77		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Hf-172 (a)	Hafnium (72)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-175		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-181		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Hf-182		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-194 (a)	Mercury (80)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-195m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-197		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Hg-197m	Mercury (80)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-203		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ho-166	Holmium (67)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ho-166m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-123		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
I-124		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-125		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-126		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-129	Iodine (53)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-131		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-132		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-133		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-134		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-135 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-111		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-113m	Indium (49)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-114m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
In-115m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-189 (a)	Iridium (77)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ir-190		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-192		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ir-194	Iridium (77)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
K-40		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
K-42	Potassium (19)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
K-43		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Kr-81		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Kr-85	Krypton (36)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{4}$	$2.7X10^{-7}$
Kr-85m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$
Kr-87		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
La-137	Lanthanum (57)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
La-140		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Lu-172		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Lu-173		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-174	Lutetium (71)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-174m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-177		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Mg-28 (a)	Magnesium (12)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mn-52	Manganese (25)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Mn-53		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{9}$	$2.7X10^{-2}$
Mn-54		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Mn-56		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mo-93	Molybdenum (42)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Mo-99 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
N-13	Nitrogen (7)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Na-22	Sodium (11)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Na-24		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Nb-93m	Niobium (41)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Nb-94		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nb-95		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nb-97		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nd-147	Neodymium (60)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nd-149		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ni-59	Nickel (28)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ni-63		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ni-65		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Np-235	Neptunium (93)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-236 (short-lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-236 (long-lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Np-237		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Np-239		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-185	Osmium (76)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Os-191		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-191m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-193		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Os-194 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
P-32	Phosphorus (15)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
P-33		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pa-230 (a)	Protactinium (91)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pa-231		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Pa-233		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pb-201	Lead (82)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-202		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-203		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-205		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pb-210 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pb-212 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pd-103 (a)	Palladium (46)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pd-107		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pd-109		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Pm-143	Promethium (61)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-144		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-145		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pm-147		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pm-148m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-149		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-151		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Po-210	Polonium (84)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pr-142	Praseodymium (59)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pr-143		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-188 (a)	Platinum (78)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-191		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-193		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pt-193m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pt-195m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-197		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-197m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pu-236	Plutonium (94)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-237		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pu-238		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-239		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Pu-240		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Pu-241 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pu-242		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-244 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ra-223 (a)	Radium (88)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-224 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-225 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-226 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ra-228 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Rb-81	Rubidium (37)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-83 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-84		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-86		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Rb-87		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rb(nat)		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Re-184	Rhenium (75)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-184m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-186		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-187		$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Re-188		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Re-189 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Re(nat)		$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Rh-99	Rhodium (45)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-101		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rh-102		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-102m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-103m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Rh-105		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rn-222 (a)	Radon (86)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ru-97	Ruthenium (44)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ru-103 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ru-105		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ru-106 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
S-35	Sulphur (16)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Sb-122	Antimony (51)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sb-124		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sb-125		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sb-126		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sc-44	Scandium (21)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sc-46		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sc-47		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sc-48		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Se-75	Selenium (34)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Se-79		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Si-31	Silicon (14)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Si-32		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sm-145	Samarium (62)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sm-147		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sm-151		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Sm-153		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-113 (a)	Tin (50)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-117m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-119m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-121m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-123		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-125		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sn-126 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-82 (a)	Strontium (38)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-85		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-85m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sr-87m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-89		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-90 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Sr-91 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-92 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
T(H-3)	Tritium (1)	$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Ta-178 (long-lived)	Tantalum (73)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ta-179		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ta-182		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Tb-157	Terbium (65)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tb-158		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tb-160		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-95m (a)	Technetium (43)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-96		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-96m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-97		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Tc-97m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-98		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-99		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-99m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-121	Tellurium (52)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-121m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Te-123m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Te-125m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-127		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-127m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-129		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-129m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-131m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-132 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Th-227	Thorium (90)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-228 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-229		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Th-230		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-231		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Th-232		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-234 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Th (nat)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ti-44 (a)	Titanium (22)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Tl-200	Thallium (81)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-201		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-202		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-204		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{4}$	$2.7X10^{-7}$
Tm-167	Thulium (69)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Tm-170		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tm-171		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
U-230 (fast lung absorption) (a)(d)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (medium lung absorption) (a)(e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (slow lung absorption) (a)(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-232 (fast lung absorption) (d)	Uranium (92)	1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (medium lung absorption) (e)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (slow lung absorption) (f)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-233 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (medium lung absorption) (e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
U-234 (medium lung absorption) (e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-235 (all lung absorption types) (a),(d),(e),(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (medium lung absorption) (e)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-238 (all lung absorption types) (d),(e),(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U (nat)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (enriched to 20% or less)(g)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (dep)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
V-48	Vanadium (23)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
V-49		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-178 (a)	Tungsten (74)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
W-181		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
W-185		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-187		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
W-188 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-122 (a)	Xenon (54)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Xe-123		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Xe-127		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-131m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{4}$	$2.7X10^{-7}$
Xe-133		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{4}$	$2.7X10^{-7}$
Xe-135		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$
Y-87 (a)	Yttrium (39)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-88		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-90		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Y-91		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-91m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-92		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Y-93		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Yb-169	Ytterbium (79)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Yb-175		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zn-65	Zinc (30)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zn-69		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zn-69m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Zr-88	Zirconium (40)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-93		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zr-95 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-97 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

NOTES

(a) A_1 and/or A_2 values include contributions from daughter nuclides w/half-lives less than 10 days.

(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
	Th-nat Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
	U-nat Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214,
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

(c) The quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)

(d) These values apply only to compounds of uranium that take the chemical form of UF6, UO2F2, and UO2(NO3)2 in both normal and accident conditions of transport.

(e) These values apply only to compounds of uranium that take the chemical form of UO3, UF4, UCl4, and hexavalent compounds in both normal and accident conditions of transport.

(f) These values apply to all compounds of uranium other than those specified in (d) and (e), above.

(g) These values apply to unirradiated uranium only.

~~T~~TABLE A-3: GENERAL VALUES FOR A_1 AND A_2

Contents	A_1		A_2		Activity concentration for exempt material	Activity concentration for exempt material	Activity limits for exempt consignments	Activity limits for exempt consignments
	(TBq)	(Ci)	(TBq)	(Ci)	(Bq/g)	(Ci/g)	(Bq)	(Ci)
Only beta or gamma emitting radionuclides are known to be present	1×10^{-1}	2.7×10^{0}	2×10^{-2}	5.4×10^{-1}	1×10^{1}	2.7×10^{-10}	1×10^{4}	2.7×10^{-7}
Only alpha emitting radionuclides are known to be present	2×10^{-1}	5.4×10^{0}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}
No relevant data are available	1×10^{-3}	2.7×10^{-2}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}

TABLE A-4: ACTIVITY-MASS RELATIONSHIPS FOR URANIUM

Uranium Enrichment[1] wt % U-235 present	Specific Activity	
	TBq/g	Ci/g
0.45	1.8×10^{-8}	5.0×10^{-7}
0.72	2.6×10^{-8}	7.1×10^{-7}
1	2.8×10^{-8}	7.6×10^{-7}
1.5	3.7×10^{-8}	1.0×10^{-6}
5	1.0×10^{-7}	2.7×10^{-6}
10	1.8×10^{-7}	4.8×10^{-6}
20	3.7×10^{-7}	1.0×10^{-5}
35	7.4×10^{-7}	2.0×10^{-5}
50	9.3×10^{-7}	2.5×10^{-5}
90	2.2×10^{-6}	25.8×10^{-5}

93	2.6×10^{-6}	7.0×10^{-5}
95	3.4×10^{-6}	9.1×10^{-5}

[1] The figures for uranium include representative values for the activity of the uranium-234 that is concentrated during the enrichment process.

~~TABLE IV~~

~~A_1 AND A_2 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~~	~~$3.8x10^{3}$~~	~~$1.0x10^{5}$~~
~~Bi-207~~		~~0.7~~	~~18.9~~	~~0.7~~	~~18.9~~	~~1.9~~	~~$5.2x10^{1}$~~

~~TABLE IV~~
~~A_1 AND A_2 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)~~
~~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~~	~~$1.2x10^{-2}$~~	~~$3.3x10^{-2}$~~
~~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~~	~~$5.2x10^{1}$~~
~~Cm-244~~		~~4~~	~~108~~	~~$4x10^{-4}$~~	~~$1.08x10^{-2}$~~	~~3.0~~	~~$8.1x10^{1}$~~

~~TABLE IV~~

~~A_1 AND A_2 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 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~~	~~$6.1x10^{4}$~~	~~$1.6x10^{6}$~~	
~~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~~	~~$2.6x10^{2}$~~	

~~[a] *International shipments of Einsteinium require multilateral approval of A_1 and A_2 values.*~~

~~TABLE IV~~
~~A_1 AND A_2 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)~~
~~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~~	~~$1.8x10^2$~~	~~$5.0x10^4$~~
~~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~~	~~$5.8x10^2$~~	~~$1.6x10^5$~~
~~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 A_1 and A_2 values.*~~

~~I-123~~	~~Iodine (53)~~	~~6~~	~~162~~	~~6~~	~~162~~	~~$7.1x10^4$~~	~~$1.9x10^6$~~
~~I-124~~		~~0.9~~	~~24.3~~	~~0.9~~	~~24.3~~	~~$9.3x10^2$~~	~~$2.5x10^5$~~
~~I-125~~		~~20~~	~~541~~	~~2~~	~~54.1~~	~~$6.4x10^2$~~	~~$1.7x10^4$~~

~~TABLE IV~~
~~A_1 AND A_2 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-126~~	~~2~~	~~54.1~~	~~0.9~~	~~24.3~~	~~2.9×10^{3}~~	~~8.0×10^{4}~~	
~~I-129~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~6.5×10^{-6}~~	~~1.8×10^{-4}~~	
~~I-131~~	~~3~~	~~81.1~~	~~0.5~~	~~13.5~~	~~4.6×10^{3}~~	~~1.2×10^{5}~~	
~~I-132~~	~~0.4~~	~~10.8~~	~~0.4~~	~~10.8~~	~~3.8×10^{5}~~	~~1.0×10^{7}~~	
~~I-133~~	~~0.6~~	~~16.2~~	~~0.5~~	~~13.5~~	~~4.2×10^{4}~~	~~1.1×10^{6}~~	
~~I-134~~	~~0.3~~	~~8.11~~	~~0.3~~	~~8.11~~	~~9.9×10^{5}~~	~~2.7×10^{7}~~	
~~I-135~~	~~0.6~~	~~16.2~~	~~0.5~~	~~13.5~~	~~1.3×10^{5}~~	~~3.5×10^{6}~~	
~~In-111~~	~~Indium (49)~~	~~2~~	~~54.1~~	~~2~~	~~54.1~~	~~1.5×10^{4}~~	~~4.2×10^{5}~~
~~In-113m~~		~~4~~	~~108~~	~~4~~	~~108~~	~~6.2×10^{5}~~	~~1.7×10^{7}~~
~~In-114m~~		~~0.3~~	~~8.11~~	~~0.3~~	~~8.11~~	~~8.6×10^{2}~~	~~2.3×10^{4}~~
~~In-115m~~		~~6~~	~~162~~	~~0.9~~	~~24.3~~	~~2.2×10^{5}~~	~~6.1×10^{6}~~
~~Ir-189~~	~~Iridium (77)~~	~~10~~	~~270~~	~~10~~	~~270~~	~~1.9×10^{2}~~	~~5.2×10^{4}~~
~~Ir-190~~		~~0.7~~	~~18.9~~	~~0.7~~	~~18.9~~	~~2.3×10^{3}~~	~~6.2×10^{4}~~
~~Ir-192~~		~~1~~	~~27.0~~	~~0.5~~	~~13.5~~	~~3.4×10^{2}~~	~~9.2×10^{3}~~
~~Ir-193m~~		~~10~~	~~270~~	~~10~~	~~270~~	~~2.4×10^{3}~~	~~6.4×10^{4}~~
~~Ir-194~~		~~0.2~~	~~5.41~~	~~0.2~~	~~5.41~~	~~3.1×10^{4}~~	~~8.4×10^{5}~~
~~K-40~~	~~Potassium (19)~~	~~0.6~~	~~16.2~~	~~0.6~~	~~16.2~~	~~2.4×10^{-7}~~	~~6.4×10^{-6}~~
~~K-42~~		~~0.2~~	~~5.41~~	~~0.2~~	~~5.41~~	~~2.2×10^{5}~~	~~6.0×10^{6}~~
~~K-43~~		~~1.0~~	~~27.0~~	~~0.5~~	~~13.5~~	~~1.2×10^{5}~~	~~3.3×10^{6}~~
~~Kr-81~~	~~Krypton (36)~~	~~40~~	~~1080~~	~~40~~	~~1080~~	~~7.8×10^{-4}~~	~~2.1×10^{-2}~~
~~Kr-85m~~		~~6~~	~~162~~	~~6~~	~~162~~	~~3.0×10^{5}~~	~~8.2×10^{6}~~
~~Kr-85~~		~~20~~	~~541~~	~~10~~	~~270~~	~~1.5×10^{4}~~	~~3.9×10^{2}~~
~~Kr-87~~		~~0.2~~	~~5.41~~	~~0.2~~	~~5.41~~	~~1.0×10^{6}~~	~~2.8×10^{7}~~
~~La-137~~	~~Lanthanum (57)~~	~~40~~	~~1080~~	~~2~~	~~54.1~~	~~1.6×10^{-3}~~	~~4.4×10^{-2}~~
~~La-140~~		~~0.4~~	~~10.8~~	~~0.4~~	~~10.8~~	~~2.1×10^{4}~~	~~5.6×10^{5}~~
~~Lu-172~~	~~Lutetium (71)~~	~~0.5~~	~~13.5~~	~~0.5~~	~~13.5~~	~~4.2×10^{3}~~	~~1.1×10^{5}~~
~~Lu-173~~		~~8~~	~~216~~	~~8~~	~~216~~	~~5.6×10^{1}~~	~~1.5×10^{3}~~
~~Lu-174m~~		~~20~~	~~541~~	~~8~~	~~216~~	~~2.0×10^{2}~~	~~5.3×10^{2}~~
~~Lu-174~~		~~8~~	~~216~~	~~4~~	~~108~~	~~2.3×10^{1}~~	~~6.2×10^{2}~~
~~Lu-177~~		~~30~~	~~811~~	~~0.9~~	~~24.3~~	~~4.1×10^{3}~~	~~1.1×10^{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~~	~~2.0×10^{5}~~	~~5.4×10^{6}~~
~~Mn-52~~	~~Manganese (25)~~	~~0.3~~	~~8.11~~	~~0.3~~	~~8.11~~	~~1.6×10^{4}~~	~~4.4×10^{5}~~
~~Mn-53~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~6.8×10^{-5}~~	~~1.8×10^{-3}~~	
~~Mn-54~~		~~1~~	~~27.0~~	~~1~~	~~27.0~~	~~2.9×10^{2}~~	~~7.7×10^{3}~~
~~Mn-56~~		~~0.2~~	~~5.41~~	~~0.2~~	~~5.41~~	~~8.0×10^{5}~~	~~2.2×10^{7}~~
~~Mo-93~~	~~Molybdenum (42)~~	~~40~~	~~1080~~	~~7~~	~~189~~	~~4.1×10^{-2}~~	~~1.1~~

~~TABLE IV~~
~~A_1 AND A_2 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)~~
~~Mo-99~~		~~0.6~~	~~16.2~~	~~0.5~~	~~13.5~~[e/]	~~$1.8x10^4$~~	~~$4.8x10^5$~~
~~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~~	~~$1.1x10^4$~~	~~$3.0x10^5$~~

~~[e/] *20 Ci for Mo^{99} for domestic use*~~

~~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~~	~~$5.1x10^4$~~	~~$1.4x10^6$~~

~~TABLE IV~~

~~A_1 AND A_2 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)~~
~~Pd-103~~	~~Palladium (46)~~	~~40~~	~~1080~~	~~40~~	~~1080~~	~~$2.8x10^3$~~	~~$7.5x10^4$~~
~~Pd-107~~	~~Unlimited~~	~~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~~	~~$3.7x10^4$~~
~~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~~	~~$5.9x10^3$~~	~~$1.6x10^5$~~
~~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~~	~~$3.1x10^5$~~	~~$8.4x10^6$~~

TABLE IV
A_1 AND A_2 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)
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	$1.6x10^3$	$4.3x10^3$	
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	$1.3x10^3$	$3.4x10^4$	
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	$2.6x10^{-3}$	$7.0x10^{-2}$	

~~TABLE IV~~

~~A_1 AND A_2 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)~~
~~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~~	~~$9.8x10^1$~~	~~$2.6x10^2$~~
~~Sm-147~~		~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~$8.5x10^{-1}$0~~	~~$2.3x10^{-8}$~~
~~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~~	~~$1.2x10^4$~~	~~$3.2x10^5$~~
~~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~~	~~$6.3x10^{-4}$~~	~~$1.7x10^{-2}$~~

~~TABLE IV~~
~~A_1 AND A_2 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)~~
~~Te-118~~	~~Tellurium (52)~~	~~0.2~~	~~5.41~~	~~0.2~~	~~5.41~~	~~6.8×10^{3}~~	~~1.8×10^{5}~~
~~Te-121m~~		~~5~~	~~135~~	~~5~~	~~135~~	~~2.6×10^{2}~~	~~7.0×10^{3}~~
~~Te-121~~		~~2~~	~~54.1~~	~~2~~	~~54.1~~	~~2.4×10^{3}~~	~~6.4×10^{4}~~
~~Te-123m~~		~~7~~	~~189~~	~~7~~	~~189~~	~~3.3×10^{2}~~	~~8.9×10^{3}~~
~~Te-125m~~		~~30~~	~~811~~	~~9~~	~~243~~	~~6.7×10^{2}~~	~~1.8×10^{4}~~
~~Te-127m~~		~~20~~	~~541~~	~~0.5~~	~~13.5~~	~~3.5×10^{2}~~	~~9.4×10^{3}~~
~~Te-127~~		~~20~~	~~541~~	~~0.5~~	~~13.5~~	~~9.8×10^{4}~~	~~2.6×10^{6}~~
~~Te-129m~~		~~0.6~~	~~16.2~~	~~0.5~~	~~13.5~~	~~1.1×10^{3}~~	~~3.0×10^{4}~~
~~Te-129~~		~~0.6~~	~~16.2~~	~~0.5~~	~~13.5~~	~~7.7×10^{5}~~	~~2.1×10^{7}~~
~~Te-131m~~		~~0.7~~	~~18.9~~	~~0.5~~	~~13.5~~	~~3.0×10^{4}~~	~~8.0×10^{5}~~
~~Te-132~~		~~0.4~~	~~10.8~~	~~0.4~~	~~10.8~~	~~1.1×10^{4}~~	~~3.0×10^{5}~~
~~Th-227~~	~~Thorium (90)~~	~~9~~	~~243~~	~~1×10^{-2}~~	~~0.270~~	~~1.1×10^{3}~~	~~3.1×10^{4}~~
~~Th-228~~		~~0.3~~	~~8.11~~	~~4×10^{-4}~~	~~1.08×10^{-2}~~	~~3.0×10^{1}~~	~~8.2×10^{2}~~
~~Th-229~~		~~0.3~~	~~8.11~~	~~3×10^{-5}~~	~~8.11×10^{-4}~~	~~7.9×10^{-3}~~	~~2.1×10^{-1}~~
~~Th-230~~		~~2~~	~~54.1~~	~~2×10^{-4}~~	~~5.41×10^{-3}~~	~~7.6×10^{-4}~~	~~2.1×10^{-2}~~
~~Th-231~~		~~40~~	~~1080~~	~~0.9~~	~~24.3~~	~~2.0×10^{4}~~	~~5.3×10^{5}~~
~~Th-232~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~		~~4.0×10^{-9}~~	~~1.1×10^{-7}~~
~~Th-234~~		~~0.2~~	~~5.41~~	~~0.2~~	~~5.41~~	~~8.6×10^{2}~~	~~2.3×10^{4}~~
~~Th (natural)~~		~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~8.1×10^{-9}~~	~~2.2×10^{-7}~~
~~Ti-44~~	~~Titanium (22)~~	~~0.5~~	~~13.5~~	~~0.2~~	~~5.41~~	~~6.4~~	~~1.7×10^{2}~~
~~Tl-200~~	~~Thallium (81.1)~~	~~0.8~~	~~21.6~~	~~0.8~~	~~21.6~~	~~2.2×10^{4}~~	~~6.0×10^{5}~~
~~Tl-201~~		~~10~~	~~270~~	~~10~~	~~270~~	~~7.9×10^{3}~~	~~2.1×10^{5}~~
~~Tl-202~~		~~2~~	~~54.1~~	~~2~~	~~54.1~~	~~2.0×10^{3}~~	~~5.3×10^{4}~~
~~Tl-204~~		~~4~~	~~108~~	~~0.5~~	~~13.5~~	~~1.7×10^{1}~~	~~4.6×10^{2}~~
~~Tm-167~~	~~Thulium (69)~~	~~7~~	~~189~~	~~7~~	~~189~~	~~3.1×10^{3}~~	~~8.5×10^{4}~~
~~Tm-168~~		~~0.8~~	~~21.6~~	~~0.8~~	~~21.6~~	~~3.1×10^{2}~~	~~8.3×10^{3}~~
~~Tm-170~~		~~4~~	~~108~~	~~0.5~~	~~13.5~~	~~2.2×10^{2}~~	~~6.0×10^{3}~~
~~Tm-171~~		~~40~~	~~1080~~	~~10~~	~~270~~	~~4.0×10^{1}~~	~~1.1×10^{3}~~
~~U-230~~	~~Uranium (92)~~	~~40~~	~~1080~~	~~1×10^{-2}~~	~~0.270~~	~~1.0×10^{3}~~	~~2.7×10^{4}~~
~~U-232~~		~~3~~	~~81.1~~	~~3×10^{-4}~~	~~8.11×10^{-3}~~	~~8.3×10^{-1}~~	~~2.2×10^{1}~~
~~U-233~~		~~10~~	~~270~~	~~1×10^{-3}~~	~~2.70×10^{-2}~~	~~3.6×10^{-4}~~	~~9.7×10^{-3}~~
~~U-234~~		~~10~~	~~270~~	~~1×10^{-3}~~	~~2.70×10^{-2}~~	~~2.3×10^{-4}~~	~~6.2×10^{-3}~~
~~U-235~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~		~~8.0×10^{-8}~~	~~2.2×10^{-6}~~
~~U-236~~		~~10~~	~~270~~	~~1×10^{-3}~~	~~2.70×10^{-2}~~	~~2.4×10^{-6}~~	~~6.5×10^{-5}~~
~~U-238~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~	~~Unlimited~~		~~1.2×10^{-8}~~	~~3.4×10^{-7}~~

~~TABLE IV~~

~~A_1 AND A_2 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 (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~~	~~$5.2x10^3$~~	~~$1.4x10^4$~~
~~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 A_1 AND A_2~~

~~Contents~~	~~A_1~~		~~A_2~~	
	~~TBq~~	~~Ci~~	~~TBq~~	~~Ci~~
~~Only 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~~ ~~*/~~ ~~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~~	~~$3.4x10^{-6}$~~	~~$9.1x10^{-5}$~~

~~*/ *The figures for uranium include representative values for the activity of the uranium 235 which is concentrated during the enrichment process.*~~

PART T

TRANSPORTATION OF RADIOACTIVE MATERIAL

Sec. T.1 - Purpose and Scope.

a. The regulations in this Part establish requirements for packaging, preparation for shipment, and transportation of radioactive material;

b. The packaging and transport of radioactive material are also subject to other Parts of these regulations and to the regulations of other agencies (such as the United States Department of Transportation, the United States Postal Service and the United States Nuclear Regulatory Commission) having jurisdiction over means of transport. The requirements of this Part are in addition to, and not in substitution for, other requirements.

c. This Part applies to any licensee authorized by specific or general license issued to receive, possess, use, or transfer licensed material, if the licensee delivers that material to a carrier for transport, transports the material outside the site of usage as specified in the license, or transports that material on public highways. No provision of this Part authorizes possession of licensed material.

d. Exemptions from the requirement for license are specified in T.4. General licenses for which no package approval is required are issued in T.7 through T.11. The general license in T.7 requires that a United States Nuclear Regulatory Commission certificate of compliance or other package approval be issued for the package to be used under the general license. The transport of licensed material or delivery of licensed material to a carrier for transport is subject to the operating controls and procedures requirements of T.15 through T.21, to the quality assurance requirements of T.21 and to the general provisions of rules T.1 through T.5, including referenced United States Department of Transportation regulations.

e. These rules apply to any person required to obtain a certificate of compliance or an approved compliance plan from the United States Nuclear Regulatory Commission pursuant to 10 CFR 71 if the person delivers radioactive material to a common or contract carrier for transport or transports the material outside the confines of the person's plant or other authorized place of use.

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

"A_1" means the maximum activity of special form radioactive material permitted in a Type A package. This value is either listed in Tables A-1, A-1 and A-3 in Appendix A of this Part, or may be derived in accordance with the procedures prescribed in Appendix A of this Part.

"A_2" means the maximum activity of radioactive material, other than special form material, LSA, and SCO material, permitted in a Type A package. This value is either listed in Tables A-1, A-1 Supplement or A-3 in Appendix A of this Part, or may be derived in accordance with the procedures prescribed in Appendix A of this Part.

"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.

"Certificate of Compliance" (CoC) means the certificate issued by the U.S. Nuclear Regulatory Commission under subpart D of 10 CFR 71 which approves the design of a package for the transportation of radioactive material.

"Certificate Holder" means a person who has been issued a Certificate of Compliance or other package approval by the US Nuclear Regulatory Commission.

"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.

"Consignment" means each shipment of a package or groups of packages or load of radioactive material offered by a shipper for transport.

"Containment system" means the assembly of components of the packaging intended to retain the radioactive material during transport.

"Conveyance" means:

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

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

(3) For transport by any aircraft.

"Criticality Safety Index (CSI)" means the dimensionless number (rounded up to the next tenth) assigned to and placed on the label of a fissile material package, to designate the degree of control of accumulation of packages containing fissile material during transportation. Determination of the criticality safety index is described in T.10 and T.11.

"Deuterium" means, for the purposes of T.4 and T.10, deuterium and any deuterium compounds, including heavy water, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1:5000.

"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 the radionuclides U-233, U-235, Pu-239, and Pu-241, or any combination

of these radionuclides. Fissile material means the fissile nuclides themselves, not material containing fissile nuclides. 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 in 10 CFR 71.15.

"Fissile material package or Type AF package, Type BF package, Type B(U)F package, or Type B(M)F package " means a fissile material packaging together with its fissile material contents.

"Graphite" means, for the purposes of this Part, graphite with a boron equivalent content less than five parts per million and density greater than 1.5 grams per cubic centimeter.

"Highway Route Controlled Quantity (HRCQ)" means a quantity within a single package which exceeds:

(1) 3,000 times the A_1 value of the radionuclides as specified in 49 CFR 173.435 for special form Class 7 (radioactive) material;

(2) 3,000 times the A_2 value of the radionuclides as specified in 49 CFR 173.435 for normal form Class 7 (radioactive) material; or

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

"Low specific activity (LSA) material" means radioactive material with limited specific activity which is nonfissile or excepted under this Part and which satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of three groups:

(1) <u>LSA-I</u>

(i) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radioactive radionuclides which are not intended to be processed for the use of these radionuclides;

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

(iii) Radioactive material for which the A_2 value is unlimited; or

(iv) Other radioactive material in which the radioactive material is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentrations determined under Appendix A.

(2) <u>LSA-II</u>

(i) Water with tritium concentration up to 0.8 TBq/L (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, excluding powders, that satisfy the requirements of 10 CFR 71.77, 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; for example, concrete, bitumen, or ceramic 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 2×10^{-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 tailings; or alpha emitters with a half-life of less than 10 days.

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

"Normal form radioactive material" means radioactive material that has not been demonstrated to qualify as "special form radioactive material."

"Nuclear waste" means a quantity of source, byproduct or special nuclear material 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.

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

(1) Fissile material package or Type AF package, Type BF package, Type B(U)F package, or Type B(M)F package means a fissile material packaging together with its fissile material contents.

(2) Type A package means a Type A packaging together with its radioactive contents. A Type A package is defined and must comply with the DOT regulations in 49 CFR Part 173.

(3) Type B package means a Type B packaging together with its radioactive contents. On approval, a Type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lbs/in^2) gauge or a pressure relief device that would allow the release of radioactive material to the environment under the tests specified in §71.73(hypothetical accident

conditions), 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 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 §71.19.

"Packaging" means the assembly of components necessary to ensure compliance with the packaging requirements of 49 CFR Part 173, Subpart I and 10 CFR 71. 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 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 mm (0.2 in.); and

(3) It satisfies the test requirements specified by the US Nuclear Regulatory Commission and 10 CFR 71.75 and 10 CFR 71.4.

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

(i) The non-fixed contamination on the accessible surface averaged over 300 cm^2, (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 (10^{-4} $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm^2 (10^{-5} $\mu Ci/cm^2$) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or

the area of the surface if less than 300 $cm^{2)}$ does not exceed $4x10^4$ Bq/cm^2 (1.0 $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or $4x10^3$ Bq/cm^2 (0.1 $\mu Ci/cm^2$) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2, (or the area of the surface if less than 300 cm^2) does not exceed $4x10^4$ Bq/cm^2 (1 $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or $4x10^3$ Bq/cm^2 (0.1 $\mu Ci/cm^2$) for all other alpha emitters.

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

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

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8x10^5$ Bq/cm^2 (20 $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or $8x10^4$ Bq/cm^2 (2 $\mu Ci/cm^2$) for all other alpha emitters; and

(iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8x10^5$ Bq/cm^2 (20 $\mu Ci/cm^2$) for beta and gamma and low toxicity alpha emitters, or $8x10^4$ Bq/cm^2 (2 $\mu Ci/cm^2$) for all other alpha emitters.

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

"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 A quantity" means a 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 or may be determined by procedures described in Appendix A.

"Type B package" means a Type B packaging, that together with its radioactive contents, is designed to retain the integrity of containment and shielding required by 49 CFR 173 when subjected to the

normal conditions of transport and hypothetical accident conditions set forth in 10 CFR 71.

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

"Unirradiated uranium" means uranium containing not more than two thousand becquerels (fifty-four nanocuries) of plutonium per gram of uranium-235, not more than nine megabecquerels (two hundred forty-three microcuries) of fission products per gram of uranium-235, and not more than 0.005 grams of uranium-236 per gram of uranium-235.

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 who 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 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. A licensee is exempt from the requirements of this Part with respect to shipment or carriage of the following low-level materials:

   i. Natural material and ores containing naturally occurring radionuclides that are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values specified in Appendix A, Table A-2, of this Part.

   ii. Materials for which the activity concentration is not greater than the activity concentration values specified in Appendix A of this Part, or for which the consignment activity is not greater than the limit for an exempt consignment found in Appendix A of this Part.

c. Fissile materials meeting one of the following requirements are exempt from classification as fissile material and from the fissile material package standards of 10 CFR 71.55 and 10 CFR 71.59, but are subject to all other requirements of 10 CFR 71, except as noted.

   i. Individual package containing 2 grams or less of fissile material.

   ii. Individual or bulk packaging containing 15 grams or less of fissile material provided

the package has at least 200 grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.

iii. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that there is at least 2000 grams of solid nonfissile material for every gram of fissile material and that there is no more than 180 grams of fissile material distributed within 360 kg of contiguous nonfissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package, but must not be included in determining the required mass of solid nonfissile material.

iv. Uranium enriched in uranium-235 to a maximum of one percent by weight, and with total plutonium and uranium-233 content of up to one percent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium present in the package is less than 5 percent of the uranium mass.

v. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of two percent by mass, provided that:

(1) The total plutonium and uranium-233 content does not exceed 0.002 percent of the total mass of uranium;

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

(3) The material must be contained in at least a DOT Type A package.

vi. Plutonium with a total mass not more than 1000 grams, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 20 percent by mass of the total quantity of plutonium in the package.

d. Any physician licensed by a State to dispense drugs in the practice of medicine is exempt from this Part with respect to transport by the physician of licensed material for use in the practice of medicine. However, any physician operating under this exemption must be licensed under 10 CFR part 35 or the equivalent Agreement State regulations.

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 49 CFR parts 107, 171 through 180, and 390 through 397; 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 172.441, 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) Security Plans - 49 CFR Part 172: subpart I.

(8) 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.1906e.

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 T.5a.i. to the mode of transport to the same extent as if the shipment was subject to the regulations A request for modification, waiver, or exemption from these requirements, and any notification referred to in these requirements, shall be submitted in writing to the Agency.

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 relating to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.[3/]

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 requirements relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting. [3/]

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 has a quality assurance program approved by the Nuclear Regulatory Commission as satisfying the provisions of subpart H of 10 CFR 71

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

   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, submits in writing to attn: document control desk, director, spent fuel project office, office of nuclear material safety and safeguards, using an appropriate method listed in 10 C.F.R. 71.1(a), the licensee's name and license number and the package identification number specified in the package approval.

[3/] *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.*

iv. Has a quality assurance program that complies with Subpart H of 10 CFR 71.

d. The general license in T.7a. applies only when the package approval authorizes use of the package under this general license.

e. 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 10CFR 71.19.

Sec. T.8 - General License: US Department of Transportation Specification Container.

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.21.

c. This general license 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.

d. These requirements expire October 1, 2008.

Sec. T.9 - General License: Use of Foreign Approved Package.

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. The general license applies only to shipments made to or from locations outside the United States.

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

i. Has a quality assurance program approved by the United States Nuclear Regulatory Commission.

ii. 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

iii. Complies with the terms and conditions of the certificate and revalidation, and with the applicable requirements of this Part.

Sec. T.10 - General License: Fissile Material.

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. The fissile material need not be contained in a package which meets the standards of subparts E and F of 10 CFR 71; however, the material must be contained in a Type A package. The Type A package must also meet the DOT requirements of 49 CFR 173.417(a).

b. The general license applies only to a licensee who has a quality assurance program approved by the NRC as satisfying the provision of subpart H of 10 CFR 71.

c. The general license applies only when a package's contents:

i. Contain less than a Type A quantity of radioactive material; and

ii. Contain less than 500 total grams of beryllium, graphite, or hydrogenous material enriched in deuterium.

d. The general license applies only to packages containing fissile material that are labeled with a CSI which:

i. Has been determined in accordance with T.10e.;

ii. Has a value less than or equal to 10.0; and

iii. For a shipment of multiple packages containing fissile material, the sum of the CSIs must be less than or equal to 50.0 (for shipment on a nonexclusive use conveyance) and less than or equal to 100.0 (for shipment on an exclusive use conveyance).

e. i. The value for the CSI must be greater than or equal to the number calculated by the following equation:

$$\mathrm{CSI} = 10\left[\frac{\textit{grams}\ \text{of}\ {}^{235}\mathrm{U}}{X} + \frac{\textit{grams}\ \text{of}\ {}^{233}\mathrm{U}}{Y} + \frac{\textit{grams}\ \text{of Pu}}{Z}\right]$$

ii. The calculated CSI must be rounded up to the first decimal place;

iii. The values of X, Y, and Z used in the CSI equation must be taken from Tables I or II, as appropriate;

iv. If Table II is used to obtain the value of X, then the values for the terms in the equation for uranium-233 and plutonium must be assumed to be zero; and

v. Table I values for X, Y, and Z must be used to determine the CSI if:

(1) Uranium-233 is present in the package;

(2) The mass of plutonium exceeds one percent of the mass of uranium-235;

(3) The uranium is of unknown uranium-235 enrichment or greater than 24 weight percent enrichment; or

(4) Substances having a moderating effectiveness (i.e., an average hydrogen density greater than H_2O [e.g., certain hydrocarbon oils or plastics]) are present in any form, except as polyethylene used for packing or wrapping.

TABLE I — Mass Limits for General License Packages Containing Mixed Quantities of Fissile Material or Uranium-235 of Unknown Enrichment per T.10e.

Fissile Materials	Fissile material mass mixed with moderating substances having an average hydrogen density less than or equal to H_2O. (grams)	Fissile material mass mixed with moderating substances having an average hydrogen density greater than H_2O[a]. (grams)
^{235}U (X)	60	38
^{233}U (Y)	43	27
^{239}Pu or ^{241}Pu (Z)	37	24

Table II Mass Limits for General License Packages Containing Uranium-235T of Known Enrichment per T.10e.

24	60
20	63
15	67
11	72
10	76
9.5	78
9	81
8.5	82
8	85
7.5	88
7	90
6.5	93
6	97
5.5	102
5	108
4.5	114
4	120
3.5	132
3	150
2.5	180
2	246
1.5	408
1.35	480
1	1020
0.92	1800

[a] *When mixtures of moderating substances are present, the lower mass limits shall be used if more than 15 percent of the moderating substance has an average hydrogen density greater than H_2O.*

Sec. T.11 - General License: Plutonium- Beryllium Special Form Materials.

a. A general license is issued to any licensee to transport fissile material in the form of plutonium-beryllium (Pu-Be) special form sealed sources, or to deliver Pu-Be sealed sources to a carrier for transport, if the material is shipped in accordance with this section. This material need not be contained in a package which meets the standards of subparts E and F of 10 CFR 71; however, the material must be contained in a Type A package. The Type A package must also meet the DOT requirements of 49 CFR 173.417(a).

b. The general license applies only to a licensee who has a quality assurance program approved by the Nuclear Regulatory Commission as satisfying the provision of subpart H of 10 CFR 71.

c. The general license applies when a package's contents:

   i. Contain less than a Type A quantity of material; and

   ii. Contain less than 1000 grams of plutonium, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 240~~g~~ grams of the total quantity of plutonium in the package.

d. The general license applies only to packages labeled with a CSI which:

   i. Has been determined in accordance with T.11e.

   ii. Has a value less than or equal to 100.0; and

   iii. For a shipment of multiple packages containing Pu-Be sealed sources, the sum of the CSIs must be less than or equal to 50.0 (for shipment on a nonexclusive use conveyance or storage incident to transport) and to less than or equal to 100.0 (for shipment on an exclusive use conveyance).

e. i. The value for the CSI must be greater than or equal to the number calculated by the following equation:

$$CSI = 10\left[\frac{\text{grams of } ^{239}\text{Pu} + \text{grams of } ^{241}\text{Pu}}{24}\right]$$

   ii. The calculated CSI must be rounded up to the first decimal l place.

Sec. T.12 - Exemption from classification as fissile material. Fissile material meeting the requirements of at least one of the paragraphs (A) to (F) of this rule are exempt from classification as fissile material and from the fissile material package standards of 10 C.F.R. 71.55 and 10 C.F.R. 71.59, but are subject to all other requirements of T.12, except as noted.

a. Individual package containing two grams or less fissile material.

b. Individual or bulk packaging containing fifteen grams or less of fissile material provided the package has at least two hundred grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.

c. i. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that:

(1) There is at least two thousand grams of solid nonfissile material for every gram of fissile material, and

(2) There is no more than one hundred eighty grams of fissile material distributed within three hundred sixty kilograms of contiguous nonfissile material.

ii. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass of solid nonfissile material.

d. Uranium enriched in uranium-235 to a maximum of one per cent by weight, and with total plutonium and uranium-233 content of up to one per cent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium constitutes less than five per cent of the uranium mass.

e. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of two per cent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 per cent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of two. The material must be contained in at least a United States Department of Transportation type A package.

f. Packages containing, individually, a total plutonium mass of not more than one thousand grams, of which not more than twenty per cent by mass may consist of plutonium-239, plutonium-241, or any combination of these radionuclides.

Operating Controls and Procedures

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. 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/in^2) 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. For fissile material, any moderator or neutron absorber, if required, is present and in proper condition;

h. 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;

i. The level of non-fixed (removable) 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 10 times 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

Contaminant	Maximum Permissible Units		
	Bq/cm^2	$\mu Ci/cm^2$	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

j. External radiation levels around the package and around the vehicle, if applicable, will not exceed 2 mSv 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;

k. 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 mSv 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 mSv 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 mSv 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 mSv 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 mSv 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 regulation.

l. For shipments made under the provisions of T.15j., the shipper shall provide specific written instructions to the carrier for maintenance of the exclusive use shipment controls. The instructions must be included with the shipping paper information. The written instructions required for exclusive use shipments must be sufficient so that, when followed, they will cause the carrier to avoid actions that will unnecessarily delay delivery or unnecessarily result in increased radiation levels or radiation exposures to transport workers or members of the general public.

m. 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.

n. 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 less than or equal to the activity concentration values for plutonium specified in Table A-2 of this chapter and in which the radioactivity is essentially uniformly distributed;

[****/] *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 mSv per hour (200 mrem/hr) at any accessible surface*

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.

Sec. T.17 - Opening Instructions. Before delivery of a package to a carrier for transport, the licensee shall ensure that any special instructions needed to safely open the package have been sent to, or otherwise made available to, the consignee for the consignee's use in accordance with 10 CFR 20.1906(e), or equivalent state regulation.

Sec. T.18 - 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.19 - 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, 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.20 - 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,[4/] 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;

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 TBq (27,000 Ci).

c. Each advance notification required by T.20a. 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.20a. 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

[4/] *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, Washing DC 20555/ The list will be published annually in the Federal Register on or about June 30 to reflect any changes in information.*

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.20a. 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.21 - Quality Assurance Requirements.

a. This rule describes quality assurance requirements applying to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, and modification of components of packaging that are important to safety. As used in this Part, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to control of the physical characteristics and quality of the material or component to predetermined requirements. The licensee, certificate holder, and applicant for a certificate of compliance (CoC) are responsible for the quality assurance requirements as they apply to design, fabrication, testing, and modification of packaging. Each licensee is responsible for the quality assurance provision which applies to its use of a packaging for the shipment of licensed material subject to this Part.

b. Each licensee, certificate holder, and applicant for a CoC shall establish, maintain, and execute a quality assurance program satisfying each of the applicable criteria of 10 C.F.R. 71.101 through 71.137 and satisfying any specific provisions that are applicable to the licensee's activities including procurement of packaging. The licensee, certificate holder, and applicant for a CoC shall execute the applicable criteria in a graded approach to an extent that is commensurate with the quality assurance requirement's importance to safety.

c. Before the use of any package for the shipment of licensed material subject to this rule, each licensee shall obtain United States Nuclear Regulatory Commission approval of its quality assurance program.

d. A program for transport container inspection and maintenance limited to radiographic exposure devices, source changers, or packages transporting these devices and meeting the requirements of Part E.12 of these regulations, is deemed to satisfy the requirements of T.7 and T.21b.

e. The licensee, certificate holder, and applicant for a CoC shall be responsible for the establishment and execution of the quality assurance program. The licensee, certificate holder, and applicant for a CoC may delegate to others, such as contractors, agents, or consultants, the work of establishing and executing the quality assurance program, or any part of the quality assurance program, but shall retain responsibility for the program. The licensee shall clearly establish and delineate, in writing, the authority and duties of persons and organizations performing activities affecting the safety-related functions of structures, systems, and components. These activities include performing the functions associated with attaining quality objectives and the quality assurance functions. While the term licensee is used in these criteria, the requirements are applicable to whatever design, fabrication, assembly, and testing of the package is accomplished with respect to a package before the time a package approval is issued.

f. The quality assurance functions are:

   i. Assuring that an appropriate quality assurance program is established and effectively executed; and

   ii. Verifying, by procedures such as checking, auditing, and inspection, that activities affecting the safety-related functions have been performed correctly.

g. The persons and organizations performing quality assurance functions must have sufficient authority and organizational freedom to:

   i. Identify quality problems;

   ii. Initiate, recommend, or provide solutions; and

   iii. Verify implementation of solutions.

PART T

APPENDIX A

DETERMINATION OF A_1 AND A_2

I. Values of A_1 and A_2 for individual radionuclides, which are the bases for many activity limits elsewhere in these regulations, are given in TABLE A-1. The curie (Ci) values specified are obtained by converting from the Terabecquerel (TBq) value. 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 A_1 or A_2 are unlimited, it is for radiation control purposes only. For nuclear criticality safety, some materials are subject to controls placed on fissile material.

II. (a) For individual radionuclides whose identities are known, but which are not listed in TABLE A-1, the A_1 and A_2 values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior Agency approval of the A_1 and A_2 values for radionuclides not listed in Table A-1, before shipping the material.

(b) For individual radionuclides whose identities are known, but which are not listed in Table A-2, the exempt material activity concentration and exempt consignment activity values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior Agency approval of the exempt material activity concentration and exempt consignment activity values for radionuclides not listed in Table A-2, before shipping the material.

(c) The licensee shall submit requests for prior approval, described under paragraphs II(a) and II(b) of this Appendix, to the Commission, in accordance with Part A.12 of these regulations.

III. In the calculations of A_1 and A_2 for a radionuclide not in Table A-1, 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 A_1 or A_2 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 is as follows:

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

where B(i) is the activity of radionuclide i and $A_1(i)$ is the A_1 value for radionuclide I(b)

For normal form radioactive material, the maximum quantity transported in a Type A package is as follows:

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

where B(i) is the activity of radionuclide i and $A_1(i)$ and $A_2(i)$ are the A_1 and A_2 values for radionuclide respectively.

(c) 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.

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

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

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

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

$$[A] = \frac{1}{\sum_i \frac{f(i)}{[A](i)}}$$

where f(i) is the fraction of activity concentration of radionuclide i in the mixture, and

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

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

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

where f(i) is the fraction of activity of radionuclide i in the mixture, and A(i) is the activity limit for exempt consignments for radionuclide 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 A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Ac-225 (a)	Actinium (89)	$8.0X10^{-1}$	$2.2X10^{1}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$2.1X10^{3}$	$5.8X10^{4}$
Ac-227 (a)		$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-5}$	$2.4X10^{-3}$	2.7	$7.2X10^{1}$
Ac-228		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$8.4X10^{4}$	$2.2X10^{6}$
Ag-105	Silver (47)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.1X10^{3}$	$3.0X10^{4}$
Ag-108m (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.7X10^{-1}$	$2.6X10^{1}$
Ag-110m (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.8X10^{2}$	$4.7X10^{3}$
Ag-111		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Al-26	Aluminum (13)	$1.0X10^{-1}$	2.7	$1.0X10^{-1}$	2.7	$7.0X10^{-4}$	$1.9X10^{-2}$
Am-241	Americium (95)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.3X10^{-1}$	3.4
Am-242m (a)		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.6X10^{-1}$	$1.0X10^{1}$
Am-243 (a)		5.0	$1.4X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$7.4X10^{-3}$	$2.0X10^{-1}$
Ar-37	Argon (18)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.7X10^{3}$	$9.9X10^{4}$
Ar-39		$2.0X10^{1}$	$5.4X10^{2}$	$4.0X10^{1}$	$1.1X10^{3}$	1.3	$3.4X10^{1}$
Ar-41		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.5X10^{6}$	$4.2X10^{7}$
As-72	Arsenic (33)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$6.2X10^{4}$	$1.7X10^{6}$
As-73		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$8.2X10^{2}$	$2.2X10^{4}$
As-74		1.0	$2.7X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$3.7X10^{3}$	$9.9X10^{4}$
As-76		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$5.8X10^{4}$	$1.6X10^{6}$
As-77		$2.0X10^{1}$	$5.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.9X10^{4}$	$1.0X10^{6}$
At-211 (a)	Astatine (85)	$2.0X10^{1}$	$5.4X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$7.6X10^{4}$	$2.1X10^{6}$
Au-193	Gold (79)	7.0	$1.9X10^{2}$	2.0	$5.4X10^{1}$	$3.4X10^{4}$	$9.2X10^{5}$
Au-194		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.5X10^{4}$	$4.1X10^{5}$
Au-195	Gold (79)	$1.0X10^{1}$	$2.7X10^{2}$	6.0	$1.6X10^{2}$	$1.4X10^{2}$	$3.7X10^{3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Au-198		1.0	$2.7X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$9.0X10^3$	$2.4X10^5$
Au-199		$1.0X10^1$	$2.7X10^2$	$6.0X10^{-1}$	$1.6X10^1$	$7.7X10^3$	$2.1X10^5$
Ba-131 (a)	Barium (56)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$3.1X10^3$	$8.4X10^4$
Ba-133		3.0	$8.1X10^1$	3.0	$8.1X10^1$	9.4	$2.6X10^2$
Ba-133m		$2.0X10^1$	$5.4X10^2$	$6.0X10^{-1}$	$1.6X10^1$	$2.2X10^4$	$6.1X10^5$
Ba-140 (a)		$5.0X10^{-1}$	$1.4X10^1$	$3.0X10^{-1}$	8.1	$2.7X10^3$	$7.3X10^4$
Be-7	Beryllium (4)	$2.0X10^1$	$5.4X10^2$	$2.0X10^1$	$5.4X10^2$	$1.3X10^4$	$3.5X10^5$
Be-10		$4.0X10^1$	$1.1X10^3$	$6.0X10^{-1}$	$1.6X10^1$	$8.3X10^{-4}$	$2.2X10^{-2}$
Bi-205	Bismuth (83)	$7.0X10^{-1}$	$1.9X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$1.5X10^{-3}$	$4.2X10^4$
Bi-206		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$3.8X10^3$	$1.0X10^5$
Bi-207		$7.0X10^{-1}$	$1.9X10^1$	$7.0X10^{-1}$	$1.9X10^1$	1.9	$5.2X10^1$
Bi-210		1.0	$2.7X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$4.6X10^3$	$1.2X10^5$
Bi-210m (a)		$6.0X10^{-1}$	$1.6X10^1$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.1X10^{-5}$	$5.7X10^{-4}$
Bi-212 (a)		$7.0X10^{-1}$	$1.9X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$5.4X10^5$	$1.5X10^7$
Bk-247	Berkelium (97)	8.0	$2.2X10^2$	$8.0X10^{-4}$	$2.2X10^{-2}$	$3.8X10^{-2}$	1.0
Bk-249 (a)		$4.0X10^1$	$1.1X10^3$	$3.0X10^{-1}$	8.1	$6.1X10^1$	$1.6X10^3$
Br-76	Bromine (35)	$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$9.4X10^4$	$2.5X10^6$
Br-77		3.0	$8.1X10^1$	3.0	$8.1X10^1$	$2.6X10^4$	$7.1X10^5$
Br-82		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^4$	$1.1X10^6$
C-11	Carbon (6)	1.0	$2.7X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$3.1X10^7$	$8.4X10^8$
C-14		$4.0X10^1$	$1.1X10^3$	3.0	$8.1X10^1$	$1.6X10^{-1}$	4.5
Ca-45		$4.0X10^1$	$1.1X10^3$	1.0	$2.7X10^1$	$6.6X10^2$	$1.8X10^4$
Ca-47 (a)		3.0	$8.1X10^1$	$3.0X10^{-1}$	8.1	$2.3X10^4$	$6.1X10^5$
Cd-109	Cadmium (48)	$3.0X10^1$	$8.1X10^2$	2.0	$5.4X10^1$	$9.6X10^1$	$2.6X10^3$
Cd-113m		$4.0X10^1$	$1.1X10^3$	$5.0X10^{-1}$	$1.4X10^1$	8.3	$2.2X10^2$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Cd-115 (a)		3.0	$8.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.9X10^{4}$	$5.1X10^{5}$
Cd-115m		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$9.4X10^{2}$	$2.5X10^{4}$
Ce-139	Cerium (58)	7.0	$1.9X10^{2}$	2.0	$5.4X10^{1}$	$2.5X10^{2}$	$6.8X10^{3}$
Ce-141		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.1X10^{3}$	$2.8X10^{4}$
Ce-143		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{4}$	$6.6X10^{5}$
Ce-144 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.2X10^{2}$	$3.2X10^{3}$
Cf-248	Californium (98)	$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$5.8X10^{1}$	$1.6X10^{3}$
Cf-249		3.0	$8.1X10^{1}$	$8.0X10^{-4}$	$2.2X10^{-2}$	$1.5X10^{-1}$	4.1
Cf-250		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	4.0	$1.1X10^{2}$
Cf-251		7.0	$1.9X10^{2}$	$7.0X10^{-4}$	$1.9X10^{-2}$	$5.9X10^{-2}$	1.6
Cf-252 (h)		$1.0X10^{-1}$	2.7	$1.0X10^{-3}$	$2.7X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
Cf-253 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{-2}$	1.1	$1.1X10^{3}$	$2.9X10^{4}$
Cf-254		$1.0X10^{-3}$	$2.7X10^{-2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.1X10^{2}$	$8.5X10^{3}$
Cl-36	Chlorine (17)	$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{-3}$	$3.3X10^{-2}$
Cl-38		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$4.9X10^{6}$	$1.3X10^{8}$
Cm-240	Curium (96)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$7.5X10^{2}$	$2.0X10^{4}$
Cm-241		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$6.1X10^{2}$	$1.7X10^{4}$
Cm-242	Curium (96)	$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$1.2X10^{2}$	$3.3X10^{3}$
Cm-243		9.0	$2.4X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.9X10^{-3}$	$5.2X10^{1}$
Cm-244		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	3.0	$8.1X10^{1}$
Cm-245		9.0	$2.4X10^{2}$	$9.0X10^{-4}$	$2.4X10^{-2}$	$6.4X10^{-3}$	$1.7X10^{-1}$
Cm-246		9.0	$2.4X10^{2}$	$9.0X10^{-4}$	$2.4X10^{-2}$	$1.1X10^{-2}$	$3.1X10^{-1}$
Cm-247 (a)		3.0	$8.1X10^{1}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.4X10^{-6}$	$9.3X10^{-5}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Cm-248		$2.0X10^{-2}$	$5.4X10^{-1}$	$3.0X10^{-4}$	$8.1X10^{-3}$	$1.6X10^{-5}$	$4.2X10^{-3}$
Co-55	Cobalt (27)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$
Co-56		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.1X10^{3}$	$3.0X10^{4}$
Co-57		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$3.1X10^{2}$	$8.4X10^{3}$
Co-58		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.2X10^{3}$	$3.2X10^{4}$
Co-58m	Cobalt (27)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$2.2X10^{5}$	$5.9X10^{6}$
Co-60		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.2X10^{1}$	$1.1X10^{3}$
Cr-51	Chromium (24)	$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$3.4X10^{3}$	$9.2X10^{4}$
Cs-129		4.0	$1.1X10^{2}$	4.0	$1.1X10^{2}$	$2.8X10^{4}$	$7.6X10^{5}$
Cs-131		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$3.8X10^{3}$	$1.0X10^{5}$
Cs-132		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$5.7X10^{3}$	$1.5X10^{5}$
Cs-134		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.8X10^{1}$	$1.3X10^{3}$
Cs-134m	Cesium (55)	$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{5}$	$8.0X10^{6}$
Cs-135		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$4.3X10^{-5}$	$1.2X10^{-3}$
Cs-136		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.7X10^{3}$	$7.3X10^{4}$
Cs-137 (a)		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	3.2	$8.7X10^{1}$
Cu-64	Copper (29)	6.0	$1.6X10^{2}$	1.0	$2.7X10^{1}$	$1.4X10^{5}$	$3.9X10^{6}$
Cu-67		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.8X10^{4}$	$7.6X10^{5}$
Dy-159		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$2.1X10^{2}$	$5.7X10^{3}$
Dy-165	Dysprosium (66)	$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{5}$	$8.2X10^{6}$
Dy-166 (a)		$9.0X10^{-1}$	$2.4X10^{1}$	$3.0X10^{-1}$	8.1	$8.6X10^{3}$	$2.3X10^{5}$
Er-169	Erbium (68)	$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$3.1X10^{3}$	$8.3X10^{4}$
Er-171		$8.0X10^{-1}$	$2.2X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$9.0X10^{4}$	$2.4X10^{6}$
Eu-147		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.4X10^{3}$	$3.7X10^{4}$
Eu-148		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.0X10^{2}$	$1.6X10^{4}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Eu-149	Europium (63)	$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$3.5X10^{2}$	$9.4X10^{3}$
Eu-150 (short lived)		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
Eu-150 (long lived)		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
Eu-152		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	6.5	$1.8X10^{2}$
Eu-152m		$8.0X10^{-1}$	$2.2X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$8.2X10^{4}$	$2.2X10^{6}$
Eu-154	Europium (63)	$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	9.8	$2.6X10^{2}$
Eu-155		$2.0X10^{1}$	$5.4X10^{2}$	3.0	$8.1X10^{1}$	$1.8X10^{1}$	$4.9X10^{2}$
Eu-156		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.0X10^{3}$	$5.5X10^{4}$
F-18	Fluorine (9)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.5X10^{6}$	$9.5X10^{7}$
Fe-52 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.7X10^{5}$	$7.3X10^{6}$
Fe-55	Iron (26)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$8.8X10^{1}$	$2.4X10^{3}$
Fe-59		$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$1.8X10^{3}$	$5.0X10^{4}$
Fe-60 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-1}$	5.4	$7.4X10^{-4}$	$2.0X10^{-2}$
Ga-67	Gallium (31)	7.0	$1.9X10^{2}$	3.0	$8.1X10^{1}$	$2.2X10^{4}$	$6.0X10^{5}$
Ga-68		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.5X10^{6}$	$4.1X10^{7}$
Ga-72		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$
Gd-146 (a)	Gadolinium (64)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.9X10^{2}$	$1.9X10^{4}$
Gd-148		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	1.2	$3.2X10^{1}$
Gd-153		$1.0X10^{1}$	$2.7X10^{2}$	9.0	$2.4X10^{2}$	$1.3X10^{2}$	$3.5X10^{3}$
Gd-159		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.9X10^{4}$	$1.1X10^{6}$
Ge-68 (a)	Germanium (32)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.6X10^{2}$	$7.1X10^{3}$
Ge-71		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$5.8X10^{3}$	$1.6X10^{5}$
Ge-77		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.3X10^{5}$	$3.6X10^{6}$
Hf-172 (a)	Hafnium (72)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.1X10^{1}$	$1.1X10^{3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Hf-175		3.0	$8.1X10^1$	3.0	$8.1X10^1$	$3.9X10^2$	$1.1X10^4$
Hf-181		2.0	$5.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$6.3X10^2$	$1.7X10^4$
Hf-182		Unlimited	Unlimited	Unlimited	Unlimited	$8.1X10^{-6}$	$2.2X10^{-4}$
Hg-194 (a)	Mercury (80)	1.0	$2.7X10^1$	1.0	$2.7X10^1$	$1.3X10^{-1}$	3.5
Hg-195m (a)		3.0	$8.1X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$1.5X10^4$	$4.0X10^5$
Hg-197		$2.0X10^1$	$5.4X10^2$	$1.0X10^1$	$2.7X10^2$	$9.2X10^3$	$2.5X10^5$
Hg-197m		$1.0X10^1$	$2.7X10^2$	$4.0X10^{-1}$	$1.1X10^1$	$2.5X10^4$	$6.7X10^5$
Hg-203		5.0	$1.4X10^2$	1.0	$2.7X10^1$	$5.1X10^2$	$1.4X10^4$
Ho-166	Holmium (67)	$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$2.6X10^4$	$7.0X10^5$
Ho-166m		$6.0X10^{-1}$	$1.6X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$6.6X10^{-2}$	1.8
I-123	Iodine (53)	6.0	$1.6X10^2$	3.0	$8.1X10^1$	$7.1X10^4$	$1.9X10^6$
I-124		1.0	$2.7X10^1$	1.0	$2.7X10^1$	$9.3X10^3$	$2.5X10^5$
I-125		$2.0X10^1$	$5.4X10^2$	3.0	$8.1X10^1$	$6.4X10^2$	$1.7X10^4$
I-126		2.0	$5.4X10^1$	1.0	$2.7X10^1$	$2.9X10^3$	$8.0X10^4$
I-129		Unlimited	Unlimited	Unlimited	Unlimited	$6.5X10^{-6}$	$1.8X10^{-4}$
I-131		3.0	$8.1X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$4.6X10^3$	$1.2X10^5$
I-132		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$3.8X10^5$	$1.0X10^7$
I-133		$7.0X10^{-1}$	$1.9X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$4.2X10^4$	$1.1X10^6$
I-134		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$9.9X10^5$	$2.7X10^7$
I-135 (a)		$6.0X10^{-1}$	$1.6X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$1.3X10^5$	$3.5X10^6$
In-111	Indium (49)	3.0	$8.1X10^1$	3.0	$8.1X10^1$	$1.5X10^4$	$4.2X10^5$
In-113m		4.0	$1.1X10^2$	2.0	$5.4X10^1$	$6.2X10^5$	$1.7X10^7$
In-114m (a)		$1.0X10^1$	$2.7X10^2$	$5.0X10^{-1}$	$1.4X10^1$	$8.6X10^2$	$2.3X10^4$
In-115m		7.0	$1.9X10^2$	1.0	$2.7X10^1$	$2.2X10^5$	$6.1X10^6$
Ir-189 (a)	Iridium (77)	$1.0X10^1$	$2.7X10^2$	$1.0X10^1$	$2.7X10^2$	$1.9X10^3$	$5.2X10^4$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Ir-190		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.3X10^{3}$	$6.2X10^{4}$
Ir-192		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.4X10^{2}$	$9.2X10^{3}$
Ir-194		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$3.1X10^{4}$	$8.4X10^{5}$
K-40	Potassium (19)	$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$2.4X10^{-7}$	$6.4X10^{-6}$
K-42		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$2.2X10^{5}$	$6.0X10^{6}$
K-43		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$
Kr-81	Krypton (36)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$7.8X10^{-4}$	$2.1X10^{-2}$
Kr-85		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$1.5X10^{1}$	$3.9X10^{2}$
Kr-85m		8.0	$2.2X10^{2}$	3.0	$8.1X10^{1}$	$3.0X10^{5}$	$8.2X10^{6}$
Kr-87		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.0X10^{6}$	$2.8X10^{7}$
La-137	Lanthanum (57)	$3.0X10^{1}$	$8.1X10^{2}$	6.0	$1.6X10^{2}$	$1.6X10^{-3}$	$4.4X10^{-2}$
La-140		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$2.1X10^{4}$	$5.6X10^{5}$
Lu-172	Lutetium (71)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.2X10^{3}$	$1.1X10^{5}$
Lu-173		8.0	$2.2X10^{2}$	8.0	$2.2X10^{2}$	$5.6X10^{1}$	$1.5X10^{3}$
Lu-174		9.0	$2.4X10^{2}$	9.0	$2.4X10^{2}$	$2.3X10^{1}$	$6.2X10^{2}$
Lu-174m		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$2.0X10^{2}$	$5.3X10^{3}$
Lu-177		$3.0X10^{1}$	$8.1X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.1X10^{3}$	$1.1X10^{5}$
Mg-28 (a)	Magnesium (12)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.0X10^{5}$	$5.4X10^{6}$
Mn-52	Manganese (25)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.6X10^{4}$	$4.4X10^{5}$
Mn-53		Unlimited	Unlimited	Unlimited	Unlimited	$6.8X10^{-5}$	$1.8X10^{-3}$
Mn-54		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$2.9X10^{2}$	$7.7X10^{3}$
Mn-56		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$8.0X10^{5}$	$2.2X10^{7}$
Mo-93	Molybdenum (42)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	$4.1X10^{-2}$	1.1
Mo-99 (a) (h)		1.0	$2.7X10^{1}$	$7.4X10^{-1}$	$2.0X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
N-13	Nitrogen (7)	$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.4X10^{7}$	$1.5X10^{9}$
Na-22	Sodium (11)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.3X10^{2}$	$6.3X10^{3}$
Na-24		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$3.2X10^{5}$	$8.7X10^{6}$
Nb-93m	Niobium (41)	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	8.8	$2.4X10^{2}$
Nb-94		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.9X10^{-3}$	$1.9X10^{-1}$
Nb-95		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.5X10^{3}$	$3.9X10^{4}$
Nb-97		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.9X10^{5}$	$2.7X10^{7}$
Nd-147	Neodymium (60)	6.0	$1.6X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{3}$	$8.1X10^{4}$
Nd-149		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$4.5X10^{5}$	$1.2X10^{7}$
Ni-59	Nickel (28)	Unlimited	Unlimited	Unlimited	Unlimited	$3.0X10^{-3}$	$8.0X10^{-2}$
Ni-63		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	2.1	$5.7X10^{1}$
Ni-65		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$7.1X10^{5}$	$1.9X10^{7}$
Np-235	Neptunium (93)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$5.2X10^{1}$	$1.4X10^{3}$
Np-236 (short-lived)		$2.0X10^{1}$	$5.4X10^{2}$	2.0	$5.4X10^{1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
Np-236 (long-lived)		$2.0X10^{1}$	$5.4X10^{2}$	2.0	$5.4X10^{1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
Np-237		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	$2.6X10^{-5}$	$7.1X10^{-4}$
Np-239		7.0	$1.9X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$8.6X10^{3}$	$2.3X10^{5}$
Os-185	Osmium (76)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$2.8X10^{2}$	$7.5X10^{3}$
Os-191		$1.0X10^{1}$	$2.7X10^{2}$	2.0	$5.4X10^{1}$	$1.6X10^{3}$	$4.4X10^{4}$
Os-191m		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	$4.6X10^{4}$	$1.3X10^{6}$
Os-193		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{4}$	$5.3X10^{5}$
Os-194 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.1X10^{1}$	$3.1X10^{2}$
P-32	Phosphorus (15)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.1X10^{4}$	$2.9X10^{5}$
P-33		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Pa-230 (a)	Protactinium (91)	2.0	$5.4X10^{1}$	$7.0X10^{-2}$	1.9	$1.2X10^{3}$	$3.3X10^{4}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Pa-231		4.0	$1.1X10^{2}$	$4.0X10^{-4}$	$1.1X10^{-2}$	$1.7X10^{-3}$	$4.7X10^{-2}$
Pa-233		5.0	$1.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$7.7X10^{2}$	$2.1X10^{4}$
Pb-201	Lead (82)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$6.2X10^{4}$	$1.7X10^{6}$
Pb-202		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	$1.2X10^{-4}$	$3.4X10^{-3}$
Pb-203		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$1.1X10^{4}$	$3.0X10^{5}$
Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	$4.5X10^{-6}$	$1.2X10^{-4}$
Pb-210 (a)		1.0	$2.7X10^{1}$	$5.0X10^{-2}$	1.4	2.8	$7.6X10^{1}$
Pb-212 (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$2.0X10^{-1}$	5.4	$5.1X10^{4}$	$1.4X10^{6}$
Pd-103 (a)	Palladium (46)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$2.8X10^{3}$	$7.5X10^{4}$
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	$1.9X10^{-5}$	$5.1X10^{-4}$
Pd-109		2.0	$5.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$7.9X10^{4}$	$2.1X10^{6}$
Pm-143	Promethium (61)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$1.3X10^{2}$	$3.4X10^{3}$
Pm-144		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.2X10^{1}$	$2.5X10^{3}$
Pm-145		$3.0X10^{1}$	$8.1X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	5.2	$1.4X10^{2}$
Pm-147		$4.0X10^{1}$	$1.1X10^{3}$	2.0	$5.4X10^{1}$	$3.4X10^{1}$	$9.3X10^{2}$
Pm-148m (a)		$8.0X10^{-1}$	$2.2X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$7.9X10^{2}$	$2.1X10^{4}$
Pm-149		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$
Pm-151		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.7X10^{4}$	$7.3X10^{5}$
Po-210	Polonium (84)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.7X10^{2}$	$4.5X10^{3}$
Pr-142	Praseodymium (59)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.3X10^{4}$	$1.2X10^{6}$
Pr-143		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{3}$	$6.7X10^{4}$
Pt-188 (a)	Platinum (78)	1.0	$2.7X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$2.5X10^{3}$	$6.8X10^{4}$
Pt-191		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$8.7X10^{3}$	$2.4X10^{5}$
Pt-193		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	1.4	$3.7X10^{1}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Pt-193m		$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Pt-195m		$1.0X10^{1}$	$2.7X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.2X10^{3}$	$1.7X10^{5}$
Pt-197		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.2X10^{4}$	$8.7X10^{5}$
Pt-197m		$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.7X10^{5}$	$1.0X10^{7}$
Pu-236	Plutonium (94)	$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^{1}$	$5.3X10^{2}$
Pu-237		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$4.5X10^{2}$	$1.2X10^{4}$
Pu-238		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$6.3X10^{-1}$	$1.7X10^{1}$
Pu-239		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$2.3X10^{-3}$	$6.2X10^{-2}$
Pu-240		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$8.4X10^{-3}$	$2.3X10^{-1}$
Pu-241 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-2}$	1.6	3.8	$1.0X10^{2}$
Pu-242		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.5X10^{-4}$	$3.9X10^{-3}$
Pu-244 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$6.7X10^{-7}$	$1.8X10^{-5}$
Ra-223 (a)	Radium (88)	$4.0X10^{-1}$	$1.1X10^{1}$	$7.0X10^{-3}$	$1.9X10^{-1}$	$1.9X10^{3}$	$5.1X10^{4}$
Ra-224 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$5.9X10^{3}$	$1.6X10^{5}$
Ra-225 (a)		$2.0X10^{-1}$	5.4	$4.0X10^{-3}$	$1.1X10^{-1}$	$1.5X10^{3}$	$3.9X10^{4}$
Ra-226 (a)		$2.0X10^{-1}$	5.4	$3.0X10^{-3}$	$8.1X10^{-2}$	$3.7X10^{-2}$	1.0
Ra-228 (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.0X10^{1}$	$2.7X10^{2}$
Rb-81	Rubidium (37)	2.0	$5.4X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.1X10^{5}$	$8.4X10^{6}$
Rb-83 (a)		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$6.8X10^{2}$	$1.8X10^{4}$
Rb-84		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.8X10^{3}$	$4.7X10^{4}$
Rb-86		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$3.0X10^{3}$	$8.1X10^{4}$
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	$3.2X10^{-9}$	$8.6X10^{-8}$
Rb(nat)		Unlimited	Unlimited	Unlimited	Unlimited	$6.7X10^{6}$	$1.8X10^{8}$
Re-184	Rhenium (75)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$6.9X10^{2}$	$1.9X10^{4}$
Re-184m		3.0	$8.1X10^{1}$	1.0	$2.7X10^{1}$	$1.6X10^{2}$	$4.3X10^{3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Re-186	Rhenium (75)	2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$6.9X10^{3}$	$1.9X10^{5}$
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	$1.4X10^{-9}$	$3.8X10^{-8}$
Re-188		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.6X10^{4}$	$9.8X10^{5}$
Re-189 (a)		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{4}$	$6.8X10^{5}$
Re(nat)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	$2.4X10^{-8}$
Rh-99	Rhodium (45)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$3.0X10^{3}$	$8.2X10^{4}$
Rh-101		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$4.1X10^{1}$	$1.1X10^{3}$
Rh-102		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$4.5X10^{1}$	$1.2X10^{3}$
Rh-102m		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$2.3X10^{2}$	$6.2X10^{3}$
Rh-103m		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$1.2X10^{6}$	$3.3X10^{7}$
Rh-105		$1.0X10^{1}$	$2.7X10^{2}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.1X10^{4}$	$8.4X10^{5}$
Rn-222 (a)	Radon (86)	$3.0X10^{-1}$	8.1	$4.0X10^{-3}$	$1.1X10^{-1}$	$5.7X10^{3}$	$1.5X10^{5}$
Ru-97	Ruthenium (44)	5.0	$1.4X10^{2}$	5.0	$1.4X10^{2}$	$1.7X10^{4}$	$4.6X10^{5}$
Ru-103 (a)		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.2X10^{3}$	$3.2X10^{4}$
Ru-105		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{5}$	$6.7X10^{6}$
Ru-106 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.2X10^{2}$	$3.3X10^{3}$
S-35	Sulphur (16)	$4.0X10^{1}$	$1.1X10^{3}$	3.0	$8.1X10^{1}$	$1.6X10^{3}$	$4.3X10^{4}$
Sb-122	Antimony (51)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$
Sb-124		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$6.5X10^{2}$	$1.7X10^{4}$
Sb-125		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$3.9X10^{1}$	$1.0X10^{3}$
Sb-126		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.1X10^{3}$	$8.4X10^{4}$
Sc-44	Scandium (21)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.7X10^{5}$	$1.8X10^{7}$
Sc-46		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.3X10^{3}$	$3.4X10^{4}$
Sc-47		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.1X10^{4}$	$8.3X10^{5}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Sc-48		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$5.5X10^{4}$	$1.5X10^{6}$
Se-75	Selenium (34)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$5.4X10^{2}$	$1.5X10^{4}$
Se-79	Selenium (34)	$4.0X10^{1}$	$1.1X10^{3}$	2.0	$5.4X10^{1}$	$2.6X10^{-3}$	$7.0X10^{-2}$
Si-31		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.4X10^{6}$	$3.9X10^{7}$
Si-32	Silicon (14)	$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	3.9	$1.1X10^{2}$
Sm-145		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.8X10^{1}$	$2.6X10^{3}$
Sm-147	Samarium (62)	Unlimited	Unlimited	Unlimited	Unlimited	$8.5X10^{-1}$	$2.3X10^{-8}$
Sm-151		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.7X10^{-1}$	$2.6X10^{1}$
Sm-153		9.0	$2.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.6X10^{4}$	$4.4X10^{5}$
Sn-113 (a)		4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$3.7X10^{2}$	$1.0X10^{4}$
Sn-117m		7.0	$1.9X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.0X10^{3}$	$8.2X10^{4}$
Sn-119m		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	$1.4X10^{2}$	$3.7X10^{3}$
Sn-121m (a)	Tin (50)	$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-1}$	$2.4X10^{1}$	2.0	$5.4X10^{1}$
Sn-123		$8.0X10^{-1}$	$2.2X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{2}$	$8.2X10^{3}$
Sn-125		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{3}$	$1.1X10^{5}$
Sn-126 (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.0X10^{-3}$	$2.8X10^{-2}$
Sr-82 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$2.3X10^{3}$	$6.2X10^{4}$
Sr-85		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$8.8X10^{2}$	$2.4X10^{4}$
Sr-85m		5.0	$1.4X10^{2}$	5.0	$1.4X10^{2}$	$1.2X10^{6}$	$3.3X10^{7}$
Sr-87m		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$4.8X10^{5}$	$1.3X10^{7}$
Sr-89	Strontium (38)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.1X10^{3}$	$2.9X10^{4}$
Sr-90 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	5.1	$1.4X10^{2}$
Sr-91 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.3X10^{5}$	$3.6X10^{6}$
Sr-92 (a)		1.0	$2.7X10^{1}$	$3.0X10^{-1}$	8.1	$4.7X10^{5}$	$1.3X10^{7}$
T(H-3)	Tritium (1)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.6X10^{2}$	$9.7X10^{3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Ta-178 (long-lived)	Tantalum (73)	1.0	$2.7X10^1$	$8.0X10^{-1}$	$2.2X10^1$	$4.2X10^6$	$1.1X10^8$
Ta-179		$3.0X10^1$	$8.1X10^2$	$3.0X10^1$	$8.1X10^2$	$4.1X10^1$	$1.1X10^3$
Ta-182		$9.0X10^{-1}$	$2.4X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$2.3X10^2$	$6.2X10^3$
Tb-157	Terbium (65)	$4.0X10^1$	$1.1X10^3$	$4.0X10^1$	$1.1X10^3$	$5.6X10^{-1}$	$1.5X10^1$
Tb-158		1.0	$2.7X10^1$	1.0	$2.7X10^1$	$5.6X10^{-1}$	$1.5X10^1$
Tb-160		1.0	$2.7X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$4.2X10^2$	$1.1X10^4$
Tc-95m (a)	Technetium (43)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$8.3X10^2$	$2.2X10^4$
Tc-96		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.2X10^4$	$3.2X10^5$
Tc-96m (a)		$4.0X10^{-1}$	$1.1X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.4X10^6$	$3.8X10^7$
Tc-97		Unlimited	Unlimited	Unlimited	Unlimited	$5.2X10^{-5}$	$1.4X10^{-3}$
Tc-97m		$4.0X10^1$	$1.1X10^3$	1.0	$2.7X10^1$	$5.6X10^2$	$1.5X10^4$
Tc-98		$8.0X10^{-1}$	$2.2X10^1$	$7.0X10^{-1}$	$1.9X10^1$	$3.2X10^{-5}$	$8.7X10^{-4}$
Tc-99		$4.0X10^1$	$1.1X10^3$	$9.0X10^{-1}$	$2.4X10^1$	$6.3X10^{-4}$	$1.7X10^{-2}$
Tc-99m		$1.0X10^1$	$2.7X10^2$	4.0	$1.1X10^2$	$1.9X10^5$	$5.3X10^6$
Te-121	Tellurium (52)	2.0	$5.4X10^1$	2.0	$5.4X10^1$	$2.4X10^3$	$6.4X10^4$
Te-121m		5.0	$1.4X10^2$	3.0	$8.1X10^1$	$2.6X10^2$	$7.0X10^3$
Te-123m		8.0	$2.2X10^2$	1.0	$2.7X10^1$	$3.3X10^2$	$8.9X10^3$
Te-125m		$2.0X10^1$	$5.4X10^2$	$9.0X10^{-1}$	$2.4X10^1$	$6.7X10^2$	$1.8X10^4$
Te-127		$2.0X10^1$	$5.4X10^2$	$7.0X10^{-1}$	$1.9X10^1$	$9.8X10^4$	$2.6X10^6$
Te-127m (a)		$2.0X10^1$	$5.4X10^2$	$5.0X10^{-1}$	$1.4X10^1$	$3.5X10^2$	$9.4X10^3$
Te-129		$7.0X10^{-1}$	$1.9X10^1$	$6.0X10^{-1}$	$1.6X10^1$	$7.7X10^5$	$2.1X10^7$
Te-129m (a)		$8.0X10^{-1}$	$2.2X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.1X10^3$	$3.0X10^4$
Te-131m (a)		$7.0X10^{-1}$	$1.9X10^1$	$5.0X10^{-1}$	$1.4X10^1$	$3.0X10^4$	$8.0X10^5$
Te-132 (a)		$5.0X10^{-1}$	$1.4X10^1$	$4.0X10^{-1}$	$1.1X10^1$	$1.1X10^4$	$8.0X10^5$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Th-227	Thorium (90)	$1.0X10^{1}$	$2.7X10^{2}$	$5.0X10^{-3}$	$1.4X10^{-1}$	$1.1X10^{3}$	$3.1X10^{4}$
Th-228 (a)		$5.0X10^{-1}$	$1.4X10^{1}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.0X10^{1}$	$8.2X10^{2}$
Th-229		5.0	$1.4X10^{2}$	$5.0X10^{-4}$	$1.4X10^{-2}$	$7.9X10^{-3}$	$2.1X10^{-1}$
Th-230		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$7.6X10^{-4}$	$2.1X10^{-2}$
Th-231		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.0X10^{4}$	$5.3X10^{5}$
Th-232		Unlimited	Unlimited	Unlimited	Unlimited	$4.0X10^{-9}$	$1.1X10^{-7}$
Th-234 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$8.6X10^{2}$	$2.3X10^{4}$
Th(nat)		Unlimited	Unlimited	Unlimited	Unlimited	$8.1X10^{-9}$	$2.2X10^{-7}$
Ti-44 (a)	Titanium (22)	$5.0X10^{-1}$	$1.4X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	6.4	$1.7X10^{2}$
Tl-200	Thallium (81)	$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$2.2X10^{4}$	$6.0X10^{5}$
Tl-201		$1.0X10^{1}$	$2.7X10^{2}$	4.0	$1.1X10^{2}$	$7.9X10^{3}$	$2.1X10^{5}$
Tl-202		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$2.0X10^{3}$	$5.3X10^{4}$
Tl-204		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$1.7X10^{1}$	$4.6X10^{2}$
Tm-167	Thulium (69)	7.0	$1.9X10^{2}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.1X10^{3}$	$8.5X10^{4}$
Tm-170		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.2X10^{2}$	$6.0X10^{3}$
Tm-171		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$
U-230 (fast lung absorption) (a)(d)	Uranium (92)	$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (medium lung absorption) (a)(e)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (slow lung absorption) (a)(f)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-232 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-232 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-233 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
U-233 (medium lung absorption) (e)	Uranium (92)	$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-234 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
234 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
-234 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
U-235 (all lung absorption types) (a),(d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	$8.0X10^{-8}$	$2.2X10^{-6}$
U-236 (fast lung absorption) (d)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (medium lung absorption) (e)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (slow lung absorption) (f)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-238 (all lung absorption types) (d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	$1.2X10^{-8}$	$3.4X10^{-7}$
U (nat)		Unlimited	Unlimited	Unlimite	Unlimited	$2.6X10^{-8}$	$7.1X10^{-7}$
U (enriched to 20% or less)(g)		Unlimited	Unlimited	Unlimited	Unlimited	N/A	N/A
U (dep)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	(See Table A-3)
V-48	Vanadium (23)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$6.3X10^{3}$	$1.7X10^{5}$
V-49		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{2}$	$8.1X10^{3}$
W-178 (a)	Tungsten (74)	9.0	$2.4X10^{2}$	5.0	$1.4X10^{2}$	$1.3X10^{3}$	$3.4X10^{4}$
W-181		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$2.2X10^{2}$	$6.0X10^{3}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
W-185		$4.0X10^{1}$	$1.1X10^{3}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.5X10^{2}$	$9.4X10^{3}$
W-187		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.6X10^{4}$	$7.0X10^{5}$
W-188 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$3.0X10^{-1}$	8.1	$3.7X10^{2}$	$1.0X10^{4}$
Xe-122 (a)	Xenon (54)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.8X10^{4}$	$1.3X10^{6}$
Xe-123		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.4X10^{5}$	$1.2X10^{7}$
Xe-127		4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$1.0X10^{3}$	$2.8X10^{4}$
Xe-131m		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.1X10^{3}$	$8.4X10^{4}$
Xe-133		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$6.9X10^{3}$	$1.9X10^{5}$
Xe-135		3.0	$8.1X10^{1}$	2.0	$5.4X10^{1}$	$9.5X10^{4}$	$2.6X10^{6}$
Y-87 (a)	Yttrium (39)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.7X10^{4}$	$4.5X10^{5}$
Y-88		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$5.2X10^{2}$	$1.4X10^{4}$
Y-90		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.0X10^{4}$	$5.4X10^{5}$
Y-91		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.1X10^{2}$	$2.5X10^{4}$
Y-91m		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.5X10^{6}$	$4.2X10^{7}$
Y-92		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$3.6X10^{5}$	$9.6X10^{6}$
Y-93		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.2X10^{5}$	$3.3X10^{6}$
Yb-169	Ytterbium (79)	4.0	$1.1X10^{2}$	1.0	$2.7X10^{1}$	$8.9X10^{2}$	$2.4X10^{4}$
Yb-175		$3.0X10^{1}$	$8.1X10^{2}$	$9.0X10^{-1}$	$2.4X10^{1}$	$6.6X10^{3}$	$1.8X10^{5}$
Zn-65	Zinc (30)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$3.0X10^{2}$	$8.2X10^{3}$
Zn-69		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.8X10^{6}$	$4.9X10^{7}$
Zn-69m (a)		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$
Zr-88	Zirconium (40)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$6.6X10^{2}$	$1.8X10^{4}$
Zr-93		Unlimited	Unlimited	Unlimited	Unlimited	$9.3X10^{-5}$	$2.5X10^{-3}$
Zr-95 (a)		2.0	$5.4X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$7.9X10^{2}$	$2.1X10^{4}$

TABLE A - 1: A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Zr-97 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$7.1X10^{4}$	$1.9X10^{6}$

NOTES

(a) A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days

(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-12 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214,
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

(c) The quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.

(d) These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO3)_2$ in both normal and accident conditions of transport.

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

(f) These values apply to all compounds of uranium other than those specified in (d) and (e), above.

(g) These values apply to unirradiated uranium only.

(h) These values apply to domestic transport only. For international transport, use the values in the table below.

TABLE A - 1 (SUPPLEMENT)
A_1 AND A_2 VALUES FOR RADIONUCLIDES FOR INTERNATIONAL SHIPMENTS

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Cf-252	Californium (98)	$5.0X10^{-2}$	1.4	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
Mo-99 (a)	Molybdenum (42)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Ac-225 (a)	Actinium (89)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ac-227 (a)		$1.0X10^{-1}$	$2.7X10^{-12}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ac-228		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-105	Silver (47)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-108m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-110m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-111		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Al-26	Aluminum (13)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Am-241	Americium (95)	1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Am-242m (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Am-243 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ar-37	Argon (18)	$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ar-39		$1.0X10^{7}$	$2.7X10^{-4}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ar-41		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
As-72	Arsenic (33)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
As-73		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
As-74		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
As-76		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
As-77		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
At-211 (a)	Astatine (85)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Au-193	Gold (79)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-194		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Au-195		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-198		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Au-199		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-131 (a)	Barium (56)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-133		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-133m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-140 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Be-7	Beryllium (4)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Be-10		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-205	Bismuth (83)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-206		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bi-207		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-210		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-210m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bi-212 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bk-247	Berkelium (97)	1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Bk-249 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Br-76	Bromine (35)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Br-77		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Br-82		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
C-11	Carbon (6)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
C-14		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-41	Calcium (20)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-45		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-47 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-109	Cadmium (48)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-113m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-115 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-115m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-139	Cerium (58)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-141		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ce-143		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-144 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cf-248	Californium (98)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-249		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cf-250		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-251		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cf-252		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-253 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cf-254		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Cl-36	Chlorine (17)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cl-38	Chlorine (17)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-240	Curium (96)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-241		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cm-242		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-243		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-244		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-245		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cm-246		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cm-247 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-248		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Co-55	Cobalt (27)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-56		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Co-57		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-58		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-58m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Co-60		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cr-51	Chromium (24)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Cs-129	Cesium (55)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-131		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cs-132		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Cs-134	Cesium (55)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cs-134m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-135		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Cs-136		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-137 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cu-64	Copper (29)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cu-67		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Dy-159	Dysprosium (66)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Dy-165		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Dy-166 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Er-169	Erbium (68)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Er-171		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-147	Europium (63)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-148		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-149		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Eu-150 (short lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-150 (long lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-152		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-152 m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Eu-154		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-155		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Eu-156		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
F-18	Fluorine (9)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-52 (a)	Iron (26)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-55		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-59		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-60 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ga-67	Gallium (31)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ga-68		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ga-72		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Gd-146 (a)	Gadolinium (64)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Gd-148		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Gd-153		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Gd-159		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ge-68 (a)	Germanium (32)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ge-71		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ge-77		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Hf-172 (a)	Hafnium (72)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-175		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-181		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Hf-182		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-194 (a)	Mercury (80)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-195m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-197		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Hg-197m	Mercury (80)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-203		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ho-166	Holmium (67)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ho-166m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-123		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
I-124		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-125		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-126		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-129	Iodine (53)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-131		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-132		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-133		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-134		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-135 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-111		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-113m	Indium (49)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-114m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
In-115m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-189 (a)	Iridium (77)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ir-190		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-192	Iridium (77)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ir-194		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
K-40	Potassium (19)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
K-42		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
K-43		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Kr-81	Krypton (36)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Kr-85		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{4}$	$2.7X10^{-7}$
Kr-85m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$
Kr-87		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
La-137	Lanthanum (57)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
La-140		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Lu-172	Lutetium (71)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Lu-173		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-174		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-174m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-177		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Mg-28 (a)	Magnesium (12)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mn-52	Manganese (25)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Mn-53		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{9}$	$2.7X10^{-2}$
Mn-54		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Mn-56		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mo-93	Molybdenum (42)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Mo-99 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
N-13	Nitrogen (7)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Na-22	Sodium (11)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Na-24		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Nb-93m	Niobium (41)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Nb-94		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nb-95		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nb-97		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nd-147	Neodymium (60)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nd-149		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ni-59	Nickel (28)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ni-63		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ni-65		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Np-235	Neptunium (93)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-236 (short-lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-236 (long-lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Np-237		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Np-239		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-185	Osmium (76)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Os-191		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-191m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-193		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Os-194 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
P-32	Phosphorus (15)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
P-33		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pa-230 (a)	Protactinium (91)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pa-231		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Pa-233		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pb-201	Lead (82)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-202		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-203		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-205		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pb-210 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pb-212 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pd-103 (a)	Palladium (46)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pd-107		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pd-109		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Pm-143	Promethium (61)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-144		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-145		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pm-147		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pm-148m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-149		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-151		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Po-210	Polonium (84)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pr-142	Praseodymium (59)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pr-143		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-188 (a)	Platinum (78)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-191		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-193		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pt-193m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pt-195m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-197		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-197m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pu-236	Plutonium (94)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-237		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pu-238		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-239		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Pu-240		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Pu-241 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pu-242		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-244 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ra-223 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-224 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-225 (a)	Radium (88)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-226 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ra-228 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Rb-81		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-83 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-84	Rubidium (37)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-86		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Rb-87		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rb(nat)		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Re-184		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-184m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-186	Rhenium (75)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-187		$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Re-188		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Re-189 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Re(nat)		$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Rh-99	Rhodium (45)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-101		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rh-102		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-102m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-103m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Rh-105		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rn-222 (a)	Radon (86)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ru-97	Ruthenium (44)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ru-103 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ru-105		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ru-106 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
S-35	Sulphur (16)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Sb-122	Antimony (51)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sb-124		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sb-125		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sb-126		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sc-44	Scandium (21)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sc-46		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sc-47		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sc-48		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Se-75	Selenium (34)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Se-79		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Si-31	Silicon (14)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Si-32		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sm-145	Samarium (62)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sm-147		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sm-151		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Sm-153		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-113 (a)	Tin (50)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-117m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-119m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-121m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-123		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-125		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sn-126 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-82 (a)	Strontium (38)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-85		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-85m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sr-87m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-89		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-90 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Sr-91 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-92 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
T(H-3)	Tritium (1)	$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Ta-178 (long-lived)	Tantalum (73)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ta-179		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ta-182		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Tb-157	Terbium (65)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tb-158		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tb-160		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-95m (a)	Technetium (43)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-96		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-96m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-97		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Tc-97m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-98		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-99		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-99m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-121	Tellurium (52)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-121m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Te-123m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-125m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Te-127		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-127m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-129		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-129m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-131m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-132 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Th-227	Thorium (90)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-228 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-229		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Th-230		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-231		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Th-232		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-234 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Th (nat)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ti-44 (a)	Titanium (22)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Tl-200	Thallium (81)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-201		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-202		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-204		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{4}$	$2.7X10^{-7}$
Tm-167	Thulium (69)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tm-170		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Tm-171		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
U-230 (fast lung absorption) (a)(d)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (medium lung absorption) (a)(e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (slow lung absorption) (a)(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-232 (fast lung absorption) (d)	Uranium (92)	1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (medium lung absorption) (e)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (slow lung absorption) (f)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-233 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (medium lung absorption) (e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (medium lung absorption)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
(e)					
U-234 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-235 (all lung absorption types) (a),(d),(e),(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (medium lung absorption) (e)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-238 (all lung absorption types) (d),(e),(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U (nat)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (enriched to 20% or less)(g)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (dep)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
V-48	Vanadium (23)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
V-49		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-178 (a)	Tungsten (74)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
W-181		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-185		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
W-187		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
W-188 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-122 (a)	Xenon (54)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Xe-123		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Xe-127		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-131m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{4}$	$2.7X10^{-7}$
Xe-133		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{4}$	$2.7X10^{-7}$
Xe-135		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$
Y-87 (a)	Yttrium (39)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-88		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-90		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Y-91		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-91m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-92		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Y-93		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Yb-169	Ytterbium (79)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Yb-175		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zn-65	Zinc (30)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zn-69		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zn-69m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-88	Zirconium (40)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE A - 2: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Zr-93		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zr-95 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-97 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

NOTES

(a) A_1 and/or A_2 values include contributions from daughter nuclides w/half-lives less than 10 days.

(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209

Th-nat Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)

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

(c) The quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.

(d) These values apply only to compounds of uranium that take the chemical form of UF6, UO2F2, and UO2(NO3)2 in both normal and accident conditions of transport.

(e) These values apply only to compounds of uranium that take the chemical form of UO3, UF4, UCl4, and hexavalent

compounds in both normal and accident conditions of transport.

(f) These values apply to all compounds of uranium other than those specified in (d) and (e), above.

(g) These values apply to unirradiated uranium only.

TABLE A-3: GENERAL VALUES FOR A_1 AND A_2

Contents	A_1		A_2		Activity concentration for exempt material	Activity concentration for exempt material	Activity limits for exempt consignments	Activity limits for exempt consignments
	(TBq)	(Ci)	(TBq)	(Ci)	(Bq/g)	(Ci/g)	(Bq)	(Ci)
Only beta or gamma emitting radionuclides are known to be present	1×10^{-1}	2.7×10^{0}	2×10^{-2}	5.4×10^{-1}	1×10^{1}	2.7×10^{-10}	1×10^{4}	2.7×10^{-7}
Only alpha emitting radionuclides are known to be present	2×10^{-1}	5.4×10^{0}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}
No relevant data are available	1×10^{-3}	2.7×10^{-2}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}

TABLE A-4: ACTIVITY-MASS RELATIONSHIPS FOR URANIUM

Uranium Enrichment[1] wt % U-235 present	Specific Activity	
	TBq/g	Ci/g
0.45	1.8×10^{-8}	5.0×10^{-7}
0.72	2.6×10^{-8}	7.1×10^{-7}
1	2.8×10^{-8}	7.6×10^{-7}
1.5	3.7×10^{-8}	1.0×10^{-6}
5	1.0×10^{-7}	2.7×10^{-6}
10	1.8×10^{-7}	4.8×10^{-6}
20	3.7×10^{-7}	1.0×10^{-5}
35	7.4×10^{-7}	2.0×10^{-5}
50	9.3×10^{-7}	2.5×10^{-5}
90	2.2×10^{-6}	~~25~~.8 $\times 10^{-5}$
93	2.6×10^{-6}	7.0×10^{-5}
95	3.4×10^{-6}	9.1×10^{-5}

[1] The figures for uranium include representative values for the activity of the uranium-234 that is concentrated during the enrichment process.

2010
RATIONALE FOR REVISIONS

PART T
TRANSPORTATION OF RADIOACTIVE MATERIAL

Introduction

Persons who transport radioactive material or deliver radioactive material to a carrier for transport are subject to the requirements for packaging, preparation for shipment and care during shipments. These requirements 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 2010 revision of Part T incorporates changes adopted by the U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) in response to recommendations by the International Atomic Energy Agency (IAEA) in their Transportation Safety Standards TS-R-1 and NRC-initiated changes. 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 IAEA design and performance requirements to the extent considered feasible. The DOT revisions to Title 49 of the Code of Federal Regulations (CFR) Part 171 begin at 60 Federal Register (FR) 50292. The NRC changes to 10 CFR Part 71 begin at 67 FR 21390.

The NRC 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 NRC, Office of State and Tribal Programs Internal Procedure B.7, Compatibility Categories and Health and Safety Identification for NRC Regulations and Other Program Elements.

Changes in the federal regulations to achieve compatibility with IAEA regulations include adoption of radionuclide exemption values in TS-R-1 to assure continued consistency between domestic and international regulations for the basic definition of radioactive material. New A_1 and A_2 values are also adopted, except for molybdenum-99 and californium-252, and 16 radionuclides that do not appear in TS-R-1, in order to retain consistency between domestic and international regulations for radioactive material.

Traditionally, the DOT has used a specific activity threshold for defining a material as radioactive for transportation purposes. During the development of TS-R-1, it was recognized that there is no technical justification for the use of a single activity-based exemption value for all radionuclides. A more rigorous technical approach would be to base radionuclide exemptions on a uniform dose basis, rather than a uniform specific activity. Thus, in accordance with the NRC and DOT adopting this new approach, Table A-2 establishes the exempt material activity concentrations and exempt consignment activity limits for radionuclides.

The DOT has historically used a specific activity threshold of 70 Bq/g (0.002uCi/g) for defining a material as radioactive for transportation purposes. Materials are exempt from DOT's transportation regulations if the specific activity is equal to or below this value. During the development of TS-R-1, it was recognized that there was no technical justification for the use of a single activity-based exemption value for all radionuclides. A more rigorous, technical approach was pursued, basing radionuclide exemptions on a uniform dose basis instead. This is addressed in Section T.4 of Part T and reflected in Appendix A to this Part. This adoption provides consistency between domestic and international regulations for the basic definition of radioactive material.

The maximum activity of radioactive material that is permitted to be transported in a Type A package is known as the A_1 and A_2 values in Table A-1. The A_1 values apply to special form radioactive material, and the A_2 values apply to normal form radioactive material. These values apply as a package content limit. In addition, fractions of these values can be used for a limited quantity of solid radioactive material or multiples of these values to establish a highway route controlled quantity threshold value.

The IAEA adopted new A_1 and A_2 values for radionuclides listed in TS-R-1. These new values were based on calculations which were performed using the latest dosimetric models recommended by the International Commission on Radiation Protection (ICRP) in Publication 60, "1990 Recommendations of the ICRP." Incorporation of data from updated metabolic uptake studies were also included. In addition, several refinements were introduced in the calculation of contributions to the effective dose from each of the pathways considered, i.e., external photon dose, external beta dose, inhalation dose, skin and ingestion dose from contamination, and dose from submersion in gaseous radionuclides. Though a thorough, up-to-date assessment was performed for each radionuclide, the reference doses, which are used to define an acceptable dose in the event of an accident, were unchanged. As an example, if either the A_1 or A_2 value is increased, then the use of the revised dosimetric models just shows that a higher activity of that radionuclide is actually required to produce the same reference dose.

Because the IAEA will be changing its recommended A_1 value for californium-252 back to the previous value in 10 CFR 71 and 49 CFR, neither the NRC or DOT will change this value for californium-252.

Currently, the domestic A_2 value for molybdenum-99 is 0.74TBq (20 Ci). The IAEA proposed value is 0.6 TBq (16.2 Ci). Because this lower value will cause a significant increase in the number of shipments and a corresponding increase in the occupational doses to individuals, both NRC and DOT are retaining the current value for this radionuclide.

Also, the NRC and DOT will not be including the A_1 and A_2 values for 16 radionuclides not included in TS-R-1. This will allow for continued consistency between the international and domestic transportation regulations for radioactive material.

Historically, the transport index (TI) has been used to determine the appropriate safety requirements during transport. It has been used to control the accumulation of packages for both radiological safety and criticality safety purposes and to specify minimum separation distances from persons. The TI has been a single number, which is the larger of two values: the "TI for criticality control purposes" and the "TI for radiation control purposes." Using the larger of the two has ensured

conservatism in limiting the accumulation of packages. The TS-R-1 has introduced a new term, i.e., criticality safety index, which is determined in the same way as the "TI for criticality control purposes."

Specific Provisions

Sec. T.1 - Purpose and Scope. The Purpose and Scope was changed in part to incorporate additional language listed in 10 CFR 71. However, all wording within 10 CFR 71's Purpose and Scope were not incorporated because they are captured by other sections in this Part. The Purpose and Scope also incorporated changes to comply with the format prescribed by the SSRCR Style Manual and to correct references.

Sec. T.2 - Definitions. Minor changes were made throughout to comply with the format prescribed by the SSRCR Style Manual and to correct references. Other definitions were added and/or revised to be compatible with the definitions listed in 10 CFR 71.

The following definitions were added to Part T:

a. "A_1"

b. "A_2"

c. "Certificate of Compliance"

d. "Consignment"

e. "Containment system"

f. "Conveyance

g. "Criticality Safety Index"

h. "Deuterium"

i. "Graphite"

j. "Highway Route Controlled Quantity (HRCQ)"

k. "Package"

l. "Unirradiated uranium"

The definitions of A_1 and A_2 values were changed to conform to a split definition of the two values. This approach is consistent with the standard in TS-R-1.

A definition for "Certificate of Compliance" was added. This is similar to the definition found in 10 CFR 72.3.

The definition of "Criticality Safety Index" was added in line with the adoption of this new term by the NRC in 10 CFR 71.

A definition of "Deuterium" was added to indicate that the definition of deuterium found in 10 CFR 110.2 applies.

A definition of "Package" was added to incorporate changes in package designation, i.e., Type AF, BF, B(U)F, and B(M)F, especially as it relates to a Type A and B package.

It was necessary to add the definition of graphite to indicate that the definition of nuclear grade graphite found in 10 CFR 110.2 applies.

The following definitions were significantly revised:

a. "Fissile material"

b. "Fissile material package"

c. "Low specific activity (LSA) material "

The definition of fissile material was revised by removing plutonium-238 from the list of fissile nuclides in order to clarify that "fissile material" means the fissile nuclides themselves, not materials containing fissile nuclides. The definition of "fissile material package" does not include the new package designations Types AF, BF, B(U)F, or B(M)F. Thus, this is added to the definition.

The definition of "packaging" doesn't appear to merit any change, except adding the reference to 10 CFR 71 in lieu of 49 CFR.

In the definition of "low specific activity", the definition of "LSA-I" was revised to that of the revised 10 CFR 71 and that of "LSA-III" was revised to capture the reference to 10 CFR 71.77.

Changes in the definitions of Type B packages have been adopted.

All other definitions in Section T.2 remain unchanged or the changes were minor (e.g., introduction of SI units or change in federal references).

<u>Sec. T.3 – Requirement for License.</u> There were no changes recommended for this section. There were changes in 10 CFR 71.7 "Completeness and Accuracy of Information; " however, these were not included in Part T. The need was not seen to include this.

<u>Sec. T.4 - Exemptions.</u> There was no change to paragraph "a. " Revisions in 10 CFR 71.10(a), which becomes 10 CFR 71.14(a), are incorporated into paragraph "b. " This change removed the existing single specific activity value and replaced it with "Activity Concentration for Exempt Material" found in Table A-2. The balance of the paragraph was formatted in conformance to 10 CFR 71.14(a).

New paragraphs "c" and "d" were created to incorporate 10 CFR 71 changes which cover exemptions from classifications as fissile material.

Sec. T.5 - Transportation of Licensed Material. This section remains unchanged, except for adding §§ 172.441 which specifies requirements for labeling fissile packages and updating the SSR reference from D.906.e to D.1906e.

It should be noted that in 49 CFR 173.403 the definition of "exclusive use" was changed to require appropriate radiological training and resources by the consignor and carrier to ensure safe handling of the consignment.

Sec. T.6 - General Licenses for Carriers. There was no change to this section.

Sec. T.7 - General License: Nuclear Regulatory Commission-Approved Packages. This section is modified to require a quality assurance program for general license eligibility and to indicate additional information to be submitted to the NRC.

Sec. T.8 - General License: US Department of Transportation Specification Container. The old section (Sec. T.8 - General License: Previously Approved Packages.) was deleted in its entirety. There is no significant change to this section, which is comparable to 10 CFR 71.20, previously designated as 10 CFR 71.14. This section was T.9, but was renumbered with the deletion of the prior section T.8. Also, correction to SR-T reference was incorporated.

Sec. T.9 - General License: Use of Foreign Approved Package. Quality Assurance requirements were added to this section, which is comparable to 10 CFR 71.21, previously designated as 10 CFR 71.16. This section was T.10 but was renumbered with the deletion of the prior section T.8. Also, minor revisions were incorporated to be compatible with NRC regulations.

Sec. T.10 - General License: Fissile Material. This section, which is comparable to the new 10 CFR 71.22, consolidates all general license provisions of T.11 and T.12 for fissile material into this section. The title of this section was changed accordingly. This section was T.11 but was renumbered with the deletion of the prior section T.8.

Instead of concentration-based limits, this section now uses mass-based limits and a criticality safety index (CSI). The general license for plutonium-beryllium sealed sources is now found in section T.12. The values in new Tables I and II are based on new minimum critical mass calculations described in NUREG/CR-5342. The variables in these new tables are used as the variables X, Y, and Z in the equation in paragraph e.

The requirement that fissile material, shipped under this general license, must be contained in a DOT Type A package was added to paragraph a.

Also, the specific gram limits for uranium and plutonium were removed from paragraph c. The paragraph retains the existing Type A quantity limit. Revised gram limits were relocated to new Table I, which are associated with new paragraphs d. and e. A requirement was also added to limit the amount of special moderating materials beryllium, graphite, and hydrogenous material enriched in deuterium present in a package to less than 500 grams.

Previous paragraph d. was removed. Revised gram limits for fissile material mixed with material having a hydrogen density greater than water would be placed in new Table I. A note was added to new Table I to indicate that reduced mass limits apply when more than 15 percent of a mixture of moderating materials contains moderating material with a hydrogen density greater than water.

New paragraph d. was added to require that shipments of packages containing fissile material be labeled with a CSI, that the CSI per package be less than or equal to 10.0, and that the sum of the CSIs in a shipment of multiple fissile material packages is limited to less than or equal to 50.0 for a nonexclusive use conveyance, and to less than or equal to 100.0 for an exclusive use conveyance.

New paragraph e. was added to require that the CSI be calculated via a new equation for any of the fissile nuclides. Guidance on applying the equation and the mass limit input values of Tables I and II is also contained in this paragraph.

Sec. T.11 - General License: Plutonium-Beryllium Special Form Material.

The old section (T.12), "General License: Fissile Material, Limited Moderator Per Package" was deleted in its entirety. A new section (T.11) that is comparable with the new 10 CFR 71.23 was created in its place. The title of the section was also changed accordingly. This new section was renumbered to T.11 with the deletion of the prior section T.8.

This new section consolidates regulations on the shipment of Pu-Be sealed sources, the maximum quantity of fissile plutonium Pu-Be sealed sources that can be shipped on a single conveyance through changes in the mass limits and calculation of the CSI. Previously, a Pu-Be sealed source package could contain up to 400 grams of fissile plutonium with a CSI equal to 10.0. Consequently, the conveyance limits were 4000 grams per shipment for an exclusive-use vehicle and 2000 grams per shipment for a nonexclusive use vehicle. The CSI per package was increased from 10 to 100; however, the maximum quantity of plutonium per conveyance (shipment) was reduced to 1000 grams. The 1000 gram per shipment limit and a 240 gram of fissile plutonium limit are equivalent to those in section T.11. The change in fissile plutonium limit per package was due to the increased confidence that the fissile plutonium within a sealed source capsule would not escape from the capsule during an accident and reconfigure itself into an unfavorable geometry.

Paragraph a. describes the applicability of this section and the requirement to ship Pu-Be sealed sources in DOT Type A packages.

Paragraph b. requires that shipments of Pu-Be sealed sources be made under an NRC-approved QA program.

Paragraph c. requires a 1000 gram per package limit. In addition, plutonium-239 and plutonium-241 may constitute only 240 grams of the 1000 gram limit.

Paragraph d. requires that a CSI be calculated per paragraph e., and the CSI must be less than or equal to 100.0. For shipments of multiple packages, the sum of the CSIs is limited to less than or equal to 50.0 for a nonexclusive use conveyance, and to less than or equal to 100.0 for an exclusive use conveyance.

Paragraph e. provides an equation to calculate the CSI for Pu-Be sources. This equation is based upon the 240 gram mass limit for fissile nuclide plutonium-239 and plutonium-241 in paragraph c.

Sec. T.12 - Exemption from Classification as Fissile Material; This is a new section added to be compatible with 10 CFR 71.15.

Sec. T.13 - Assumptions as to Unknown Properties of Fissile Material. There was no change to this section.

Sec. T.14 - Preliminary Determinations. There was no change to this section.

Sec. T.15 - Routine Determinations. There were no significant changes to this section. "Millisievert" was changed to "mSv" to meet the SSRCR Style Manual.

Sec. T.16 - Air Transport of Plutonium Paragraph b. was revised to remove the 70 becquerel per gram (0.002 uCi/g) specific activity value and substitute activity concentration values for plutonium found in Table A-2.

Sec. T.17 - Opening Instructions. This section was added to be compatible with 10 CFR 71.89.

Sec. T.18 Shipment Records. This section was renumbered T.18 due to the addition of new section T.17. This section remains unchanged, since the items in this section were not altered by the NRC, though couched in paragraph (a) of 10 CFR 71.91. Additional paragraphs exist that address additional requirements on the certificate holder in making records available to the NRC. These requirements were not adopted previously into Part T. The only change was the addition of paragraph (b), which differs little from the existing requirements in this section.

Sec. T.19 - Reports. This section was renumbered T.19 due to the addition of new section T.17. Paragraph a. remains unchanged. Since this was the only part of this section in 10 CFR 71 that was considered adoptable, no further change was offered.

Sec. T.20 - Advance Notification of Transport of Nuclear Waste. This section was renumbered from T.19 due to the addition of new section T.17. There is no significant change to this section. "Terabecquerel" was changed to "TBq" to meet with the SSRCR Style Manual and several SR-T references were corrected.

Sec. T.21 - Quality Assurance Requirements. This section was renumbered from T.20 due to the addition of new section T.17. This section was revised in its entirety to be compatible with 10 CFR 71.101.

Appendix A to 10 CFR 71 was revised in its entirety. Table A-1 was revised to reflect the values for these radionuclides in TS-R-1. A new Table A-2 was added for listing exempt material activity concentrations and exempt consignment activity limits for radionuclides.

The rationale for the major revision to the Appendix was presented in the introduction to the Rationale for Part T. The entire revision in 10 CFR 71 was adopted in its entirety.