

(1) Except as otherwise provided in this subchapter, there will be no identifiable (without the use of instruments) release of hazardous materials to the environment;

(2) The effectiveness of the package will not be substantially reduced; for example, impact resistance, strength, packaging compatibility, etc. must be maintained for the minimum and maximum temperatures encountered during transportation;

(3) There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, significantly reduce the effectiveness of the packaging.

(c) Authorized packagings. A packaging is authorized for a hazardous material only if—

(1) The packaging is prescribed or permitted for the hazardous material in a packaging section specified for that material in Column 8 of the §172.101 table and conforms to applicable requirements in the special provisions of Column 7 of the §172.101 table and, for specification packagings (but not including UN standard packagings manufactured outside the United States), the specification requirements in parts 178 and 179 of this subchapter; or

(2) The packaging is permitted under, and conforms to, provisions contained in §§171.11, 171.12, 171.12a, 173.3, 173.4, 173.5, 173.7, 173.27, or 176.11 of this subchapter.

(d) *Specification packagings and UN standard packagings manufactured outside the U.S.:*—(1) *Specification packagings.* A specification packaging, including a UN standard packaging manufactured in the United States, must conform in all details to the applicable specification or standard in part 178 or part 179 of this subchapter.

(2) UN standard packagings manufactured outside the United States. A UN standard packaging manufactured outside the United States, in accordance with national or international regulations based on the UN Recommendations on the Transport of Dangerous Goods, may be imported and used and is considered to be an authorized packaging under the provisions of paragraph (c)(1) of this section, subject to

the following conditions and limitations:

(i) The packaging fully conforms to applicable provisions in the UN Recommendations on the Transport of Dangerous Goods and the requirements of this subpart, including reuse provisions;

(ii) The packaging is capable of passing the prescribed tests in part 178 of this subchapter applicable to that standard; and

(iii) The competent authority of the country of manufacture provides reciprocal treatment for UN standard packagings manufactured in the U.S.

(e) *Compatibility.* (1) Even though certain packagings are specified in this part, it is, nevertheless, the responsibility of the person offering a hazardous material for transportation to ensure that such packagings are compatible with their lading. This particularly applies to corrosivity, permeability, softening, premature aging and embrittlement.

(2) Packaging materials and contents must be such that there will be no significant chemical or galvanic reaction between the materials and contents of the package.

(3) *Plastic packagings and receptacles.* (i) Plastic used in packagings and receptacles must be of a type compatible with the lading and may not be permeable to an extent that a hazardous condition is likely to occur during transportation, handling or refilling.

(ii) Each plastic packaging or receptacle which is used for liquid hazardous materials must be capable of withstanding without failure the procedure specified in appendix B of this part ("Procedure for Testing Chemical Compatibility and Rate of Permeation in Plastic Packagings and Receptacles"). The procedure specified in appendix B of this part must be performed on each plastic packaging or receptacle used for Packing Group I materials. The maximum rate of permeation of hazardous lading through or into the plastic packaging or receptacles may not exceed 0.5 percent for materials meeting the definition of a Division 6.1 material according to §173.132 and 2.0 percent for other hazardous materials, when subjected to a temperature no lower than—

(A) 18 °C (64 °F) for 180 days in accordance with Test Method 1 in appendix B of this part;

(B) 50 °C (122 °F) for 28 days in accordance with Test Method 2 in appendix B of this part; or

(C) 60 °C (140 °F) for 14 days in accordance with Test Method 3 in appendix B of this part.

(iii) Alternative procedures or rates of permeation are permitted if they yield a level of safety equivalent to or greater than that provided by paragraph (e)(3)(ii) of this section and are specifically approved by the Associate Administrator for Hazardous Materials Safety.

(4) Mixed contents. Hazardous materials may not be packed or mixed together in the same outer packaging with other hazardous or nonhazardous materials if such materials are capable of reacting dangerously with each other and causing—

(i) Combustion or dangerous evolution of heat;

(ii) Evolution of flammable, poisonous, or asphyxiant gases; or

(iii) Formation of unstable or corrosive materials.

(5) Packagings used for solids, which may become liquid at temperatures likely to be encountered during transportation, must be capable of containing the hazardous material in the liquid state.

(f) Closures. (1) Closures on packagings shall be so designed and closed that under conditions (including the effects of temperature and vibration) normally incident to transportation—

(i) Except as provided in paragraph (g) of this section, there is no identifiable release of hazardous materials to the environment from the opening to which the closure is applied; and

(ii) The closure is secure and leak-proof.

(2) Except as otherwise provided in this subchapter, a closure (including gaskets or other closure components, if any) used on a specification packaging must conform to all applicable requirements of the specification.

(g) Venting. Venting of packagings, to reduce internal pressure which may develop by the evolution of gas from the contents, is permitted only when—

(1) Transportation by aircraft is not involved;

(2) Except as otherwise provided in this subchapter, the evolved gases are not poisonous, likely to create a flammable mixture with air or be an asphyxiant under normal conditions of transportation;

(3) The packaging is designed so as to preclude an unintentional release of hazardous materials from the receptacle; and

(4) For shipments in bulk packagings, venting is authorized for the specific hazardous material by a special provision in the §172.101 table or by the applicable bulk packaging specification in part 178 of this subchapter.

(h) Outage and filling limits—(1) *General*. When filling packagings and receptacles for liquids, sufficient ullage (outage) must be left to ensure that neither leakage nor permanent distortion of the packaging or receptacle will occur as a result of an expansion of the liquid caused by temperatures likely to be encountered during transportation. Requirements for outage and filling limits for non-bulk and bulk packagings are specified in §§173.24a(d) and 173.24b(a), respectively.

(2) *Compressed gases and cryogenic liquids*. Filling limits for compressed gases and cryogenic liquids are specified in §§173.301 through 173.306 for cylinders and §§173.314 through 173.319 for bulk packagings.

(i) Air transportation. Packages offered or intended for transportation by aircraft must conform to the general requirements for transportation by aircraft in §173.27, except as provided in §171.11 of this subchapter.

[Amdt. 173-224, 55 FR 52610, Dec. 21, 1990, as amended by Amdt. 173-227, 56 FR 49989, Oct. 2, 1991; 56 FR 66265, Dec. 20, 1991; Amdt. 173-238, 59 FR 38064, July 26, 1994; Amdt. 173-241, 59 FR 67491, Dec. 29, 1994; Amdt. 173-242, 60 FR 26805, May 18, 1995]

**§ 173.24a Additional general requirements for non-bulk packagings and packages.**

(a) *Packaging design*. Except as provided in §172.312 of this subchapter:

(1) *Inner packaging closures*. A combination packaging containing liquid hazardous materials must be packed so

that closures on inner packagings are upright.

(2) *Friction.* The nature and thickness of the outer packaging must be such that friction during transportation is not likely to generate an amount of heat sufficient to alter dangerously the chemical stability of the contents.

(3) *Securing and cushioning.* Inner packagings of combination packagings must be so packed, secured and cushioned to prevent their breakage or leakage and to control their movement within the outer packaging under conditions normally incident to transportation. Cushioning material must not be capable of reacting dangerously with the contents of the inner packagings or having its protective properties significantly weakened in the event of leakage.

(4) *Metallic devices.* Nails, staples and other metallic devices shall not protrude into the interior of the outer packaging in such a manner as to be likely to damage inner packagings or receptacles.

(5) *Vibration.* Each non-bulk package must be capable of withstanding, without rupture or leakage, the vibration test procedure specified in §178.608 of this subchapter.

(b) *Non-bulk packaging filling limits.* (1) A single or composite non-bulk packaging may be filled with a liquid hazardous material only when the specific gravity of the material does not exceed that marked on the packaging, or a specific gravity of 1.2 if not marked, except as follows:

(i) A Packing Group I packaging may be used for a Packing Group II material with a specific gravity not exceeding the greater of 1.8, or 1.5 times the specific gravity marked on the packaging, provided all the performance criteria can still be met with the higher specific gravity material;

(ii) A Packing Group I packaging may be used for a Packing Group III material with a specific gravity not exceeding the greater of 2.7, or 2.25 times the specific gravity marked on the packaging, provided all the performance criteria can still be met with the higher specific gravity material; and

(iii) A Packing Group II packaging may be used for a Packing Group III material with a specific gravity not ex-

ceeding the greater of 1.8, or 1.5 times the specific gravity marked on the packaging, provided all the performance criteria can still be met with the higher specific gravity material.

(2) Except as otherwise provided in this section, a non-bulk packaging may not be filled with a hazardous material to a gross mass greater than the maximum gross mass marked on the packaging.

(3) A single or composite non-bulk packaging which is tested and marked for liquid hazardous materials may be filled with a solid hazardous material to a gross mass, in kilograms, not exceeding the rated capacity of the packaging in liters, multiplied by the specific gravity marked on the packaging, or 1.2 if not marked. In addition:

(i) A single or composite non-bulk packaging which is tested and marked for Packing Group I liquid hazardous materials may be filled with a solid Packing Group II hazardous material to a gross mass, in kilograms, not exceeding the rated capacity of the packaging in liters, multiplied by 1.5, multiplied by the specific gravity marked on the packaging, or 1.2 if not marked.

(ii) A single or composite non-bulk packaging which is tested and marked for Packing Group I liquid hazardous materials may be filled with a solid Packing Group III hazardous material to a gross mass, in kilograms, not exceeding the rated capacity of the packaging in liters, multiplied by 2.25, multiplied by the specific gravity marked on the packaging, or 1.2 if not marked.

(iii) A single or composite non-bulk packaging which is tested and marked for Packing Group II liquid hazardous materials may be filled with a solid Packing Group III hazardous material to a gross mass, in kilograms, not exceeding the rated capacity of the packaging in liters, multiplied by 1.5, multiplied by the specific gravity marked on the packaging, or 1.2 if not marked.

(4) Packagings tested as prescribed in §178.605 of this subchapter and marked with the hydrostatic test pressure as prescribed in §178.503(a)(5) of this subchapter may be used for liquids only when the vapor pressure of the liquid conforms to one of the following:

(i) The vapor pressure must be such that the total pressure in the packaging (i.e., the vapor pressure of the liquid plus the partial pressure of air or other inert gases, less 100 kPa (15 psi)) at 55 °C (131 °F), determined on the basis of a maximum degree of filling in accordance with paragraph (d) of this section and a filling temperature of 15 °C (59 °F)), will not exceed two-thirds of the marked test pressure;

(ii) The vapor pressure at 50 °C (122 °F) must be less than four-sevenths of the sum of the marked test pressure plus 100 kPa (15 psi); or

(iii) The vapor pressure at 55 °C (131 °F) must be less than two-thirds of the sum of the marked test pressure plus 100 kPa (15 psi).

(5) No hazardous material may remain on the outside of a package after filling.

(c) *Mixed contents.* (1) An outer non-bulk packaging may contain more than one hazardous material only when—

(i) The inner and outer packagings used for each hazardous material conform to the relevant packaging sections of this part applicable to that hazardous material;

(ii) The package as prepared for shipment meets the performance tests prescribed in part 178 of this subchapter for the packing group indicating the highest order of hazard for the hazardous materials contained in the package;

(iii) Corrosive materials (except ORM-D) in bottles are further packed in securely closed inner receptacles before packing in outer packagings; and

(iv) For transportation by aircraft, the total net quantity does not exceed the lowest permitted maximum net quantity per package as shown in Column 9a or 9b, as appropriate, of the §172.101 table. The permitted maximum net quantity must be calculated in kilograms if a package contains both a liquid and a solid.

(2) A packaging containing inner packagings of Division 6.2 materials may not contain other hazardous materials, except dry ice.

(d) Liquids must not completely fill a receptacle at a temperature of 55 °C (131 °F) or less.

[Amdt. 173-224, 55 FR 52611, Dec. 21, 1990, as amended at 56 FR 66265, Dec. 20, 1991; 57 FR 45460, Oct. 1, 1992; 58 FR 51532, Oct. 1, 1993; Amdt. 173-255, 61 FR 50624, Sept. 26, 1996]

**§ 173.24b Additional general requirements for bulk packagings.**

(a) *Outage and filling limits.* (1) Except as otherwise provided in this subchapter, liquids and liquefied gases must be so loaded that the outage is at least five percent for materials poisonous by inhalation, or at least one percent for all other materials, of the total capacity of a cargo tank, portable tank, tank car (including dome capacity), multi-unit tank car tank, or any compartment thereof, at the following reference temperatures—

(i) 46 °C (115 °F) for a noninsulated tank;

(ii) 43 °C (110 °F) for a tank car having a thermal protection system, incorporating a metal jacket that provides an overall thermal conductance at 15.5 °C (60 °F) of no more than 10.22 kilojoules per hour per square meter per degree Celsius (0.5 Btu per hour per square foot per degree F) temperature differential; or

(iii) 41 °C (105 °F) for an insulated tank.

(2) Hazardous materials may not be loaded into the dome of a tank car. If the dome of the tank car does not provide sufficient outage, vacant space must be left in the shell to provide the required outage.

(b) *Equivalent steel.* For the purposes of this section, the reference stainless steel is stainless steel with a guaranteed minimum tensile strength of 51.7 deka newtons per square millimeter (75,000 psi) and a guaranteed elongation of 40 percent or greater. Where the regulations permit steel other than stainless steel to be used in place of a specified stainless steel (for example, as in §172.102 of this subchapter, special provision B30), the minimum thickness for the steel must be obtained from one of the following formulas, as appropriate:

(i) The vapor pressure must be such that the total pressure in the packaging (i.e., the vapor pressure of the liquid plus the partial pressure of air or other inert gases, less 100 kPa (15 psi)) at 55 °C (131 °F), determined on the basis of a maximum degree of filling in accordance with paragraph (d) of this section and a filling temperature of 15 °C (59 °F)), will not exceed two-thirds of the marked test pressure;

(ii) The vapor pressure at 50 °C (122 °F) must be less than four-sevenths of the sum of the marked test pressure plus 100 kPa (15 psi); or

(iii) The vapor pressure at 55 °C (131 °F) must be less than two-thirds of the sum of the marked test pressure plus 100 kPa (15 psi).

(5) No hazardous material may remain on the outside of a package after filling.

(c) *Mixed contents.* (1) An outer non-bulk packaging may contain more than one hazardous material only when—

(i) The inner and outer packagings used for each hazardous material conform to the relevant packaging sections of this part applicable to that hazardous material;

(ii) The package as prepared for shipment meets the performance tests prescribed in part 178 of this subchapter for the packing group indicating the highest order of hazard for the hazardous materials contained in the package;

(iii) Corrosive materials (except ORM-D) in bottles are further packed in securely closed inner receptacles before packing in outer packagings; and

(iv) For transportation by aircraft, the total net quantity does not exceed the lowest permitted maximum net quantity per package as shown in Column 9a or 9b, as appropriate, of the §172.101 table. The permitted maximum net quantity must be calculated in kilograms if a package contains both a liquid and a solid.

(2) A packaging containing inner packagings of Division 6.2 materials may not contain other hazardous materials, except dry ice.

(d) Liquids must not completely fill a receptacle at a temperature of 55 °C (131 °F) or less.

[Amdt. 173-224, 55 FR 52611, Dec. 21, 1990, as amended at 56 FR 66265, Dec. 20, 1991; 57 FR 45460, Oct. 1, 1992; 58 FR 51532, Oct. 1, 1993; Amdt. 173-255, 61 FR 50624, Sept. 26, 1996]

**§ 173.24b Additional general requirements for bulk packagings.**

(a) *Outage and filling limits.* (1) Except as otherwise provided in this subchapter, liquids and liquefied gases must be so loaded that the outage is at least five percent for materials poisonous by inhalation, or at least one percent for all other materials, of the total capacity of a cargo tank, portable tank, tank car (including dome capacity), multi-unit tank car tank, or any compartment thereof, at the following reference temperatures—

(i) 46 °C (115 °F) for a noninsulated tank;

(ii) 43 °C (110 °F) for a tank car having a thermal protection system, incorporating a metal jacket that provides an overall thermal conductance at 15.5 °C (60 °F) of no more than 10.22 kilojoules per hour per square meter per degree Celsius (0.5 Btu per hour per square foot per degree F) temperature differential; or

(iii) 41 °C (105 °F) for an insulated tank.

(2) Hazardous materials may not be loaded into the dome of a tank car. If the dome of the tank car does not provide sufficient outage, vacant space must be left in the shell to provide the required outage.

(b) *Equivalent steel.* For the purposes of this section, the reference stainless steel is stainless steel with a guaranteed minimum tensile strength of 51.7 deka newtons per square millimeter (75,000 psi) and a guaranteed elongation of 40 percent or greater. Where the regulations permit steel other than stainless steel to be used in place of a specified stainless steel (for example, as in §172.102 of this subchapter, special provision B30), the minimum thickness for the steel must be obtained from one of the following formulas, as appropriate:

*Formula for metric units*

$$e_1 = (12.74e_0) / (Rm_1 A_1)^{1/3}$$

*Formula for non-metric units*

$$e_1 = (144.2e_0) / (Rm_1 A_1)^{1/3}$$

where:

$e_0$  = Required thickness of the reference stainless steel in millimeters or inches respectively;

$e_1$  = Equivalent thickness of the steel used in millimeters or inches respectively;

$Rm_1$  = Specified minimum tensile strength of the steel used in deka-newtons per square millimeter or pounds per square inch respectively; and

$A_1$  = Specified minimum percentage elongation of the steel used multiplied by 100 (for example, 20 percent times 100 equals 20). Elongation values used must be determined from a 50-mm or 2 inch test specimen.

(c) Air pressure in excess of ambient atmospheric pressure may not be used to load or unload any lading which may create an air-enriched mixture within the flammability range of the lading in the vapor space of the tank.

(d) A bulk packaging may not be loaded with a hazardous material that:

(1) Is at a temperature outside of the packaging's design temperature range; or

(2) Except as otherwise provided in this subchapter, exceeds the maximum weight of lading marked on the specification plate.

[Amdt. 173-224, 55 FR 52612, Dec. 21, 1990, as amended at 56 FR 66266, Dec. 20, 1991; Amdt. 173-234, 58 FR 51532, Oct. 1, 1993; Amdt. 173-243, 60 FR 40038, Aug. 4, 1995; Amdt. 173-252, 61 FR 28676, June 5, 1996; Amdt. 173-255, 61 FR 50624, Sept. 26, 1996]

**§ 173.25 Authorized packagings and overpacks.**

(a) Authorized packages containing hazardous materials may be offered for transportation in an overpack as defined in §171.8 of this subchapter, if all of the following conditions are met:

(1) The package meets the requirements of §§ 173.21 and 173.24 of this subchapter.

(2) The overpack is marked with the proper shipping name and identification number, and labeled as required by this subchapter for each hazardous material contained therein unless markings and labels representative of each

hazardous material in the overpack are visible.

(3) Each package subject to the orientation marking requirements of §172.312 of this subchapter is packed in the overpack with its filling holes up and the overpack is marked with package orientation marking arrows on two opposite vertical sides of the overpack with the arrows pointing in the correct direction of orientation.

(4) The overpack is marked with a statement indicating that the inside (inner) packages comply with prescribed specifications when specification packagings are required, unless specification markings on the inside packages are visible.

(5) Packages containing Class 8 (corrosive) materials in Packing Group I or Division 5.1 (oxidizing) materials in Packing Group I may not be overpacked with any other materials.

(b) Shrink-wrapped or stretch-wrapped trays may be used as outer packagings for inner packagings prepared in accordance with the limited quantity provisions or consumer commodity provisions of this subchapter, provided that—

(1) Inner packagings are not fragile, liable to break or be easily punctured, such as those made of glass, porcelain, stoneware or certain plastics; and

(2) Each complete package does not exceed 20 kg (44 lbs) gross weight.

(c) Hazardous materials which are required to be labeled POISON may be transported in the same motor vehicle with material that is marked or known to be foodstuffs, feed or any edible material intended for consumption by humans or animals provided the hazardous material is marked, labeled, and packaged in accordance with this subchapter, conforms to the requirements of paragraph (a) of this section and is overpacked as specified in §177.841(e) of this subchapter or in an overpack which is a UN 1A2, IB2, or 1N2 drum tested and marked for a Packing Group II or higher performance level.

[Amdt. 173-165, 48 FR 28099, June 20, 1983, as amended by Amdt. 173-224, 55 FR 52612 Dec. 21, 1990; 56 FR 66266, Dec. 20, 1991; Amdt. 173-234, 58 FR 51532, Oct. 1, 1993; Amdt. 173-214, 59 FR 67491, Dec. 29, 1994; 64 FR 10776, Mar. 5, 1999]

Aluminum drum: 1B1 or 1B2  
 Metal drum other than steel or aluminum:  
   IN1 or IN2  
 Plastic drum: 1H1 or 1H2  
 Fiber drum: 1G  
 Steel jerrican: 3A1 or 3A2  
 Plastic jerrican: 3H1 or 3H2  
 Aluminum jerrican: 3B1 or 3B2  
 Steel box with liner: 4A  
 Aluminum box with liner: 4B  
 Natural wood box, sift proof: 4C2  
 Plastic receptacle in steel, aluminum, plywood, fiber or plastic drum: 6HA1, 6HB1, 6HD1, 6HG1 or 6HH1  
 Plastic receptacle in steel, aluminum, wooden, plywood or fiberboard box: 6HA2, 6HB2, 6HC, 6HD2 or 6HG2  
 Glass, porcelain or stoneware in steel, aluminum, plywood or fiber drum: 6PA1, 6PB1, 6PD1 or 6PG1  
 Glass, porcelain or stoneware in steel, aluminum, wooden or fiberboard box: 6PA2, 6PB2, 6PC or 6PG2  
 Glass, porcelain or stoneware in expanded or solid plastic packaging: 6PH1 or 6PH2  
 [Amdt. 173-224, 55 FR 52643, Dec. 21, 1990, as amended at 56 FR 66271, Dec. 20, 1991; 57 FR 45463, Oct. 1, 1992; Amdt. 173-241, 59 FR 67511, 67518, Dec. 29, 1994; Amdt. 173-261, 62 FR 24734, May 6, 1997]

**§ 173.212 Non-bulk packagings for solid hazardous materials in Packing Group II.**

(a) When § 172.101 of this subchapter specifies that a solid hazardous material be packaged under this section, only non-bulk packagings prescribed in this section may be used for its transportation. Each package must conform to the general packaging requirements of subpart B of part 173, to the requirements of part 178 of this subchapter at the Packing Group I or II performance level, and to the requirements of the special provisions of column 7 of the § 172.101 table.

(b) The following combination packagings are authorized:

*Outer packagings:*  
 Steel drum: 1A1 or 1A2  
 Aluminum drum: 1B1 or 1B2  
 Metal drum other than steel or aluminum:  
   IN1 or IN2  
 Plywood drum: 1D  
 Fiber drum: 1G  
 Plastic drum: 1H1 or 1H2  
 Wooden barrel: 2C2  
 Steel jerrican: 3A1 or 3A2  
 Plastic jerrican: 3H1 or 3H2  
 Aluminum jerrican: 3B1 or 3B2  
 Steel box: 4A  
 Aluminum box: 4B

Natural wood box: 4C1 or 4C2  
 Plywood box: 4D  
 Reconstituted wood box: 4F  
 Fiberboard box: 4G  
 Solid plastic box: 4H2

*Inner packagings:*  
 Glass or earthenware receptacles  
 Plastic receptacles  
 Metal receptacles  
 Glass ampoules

(c) Except for transportation by passenger aircraft, the following single packagings are authorized:

Steel drum: 1A1 or 1A2  
 Aluminum drum: 1B1 or 1B2  
 Plywood drum: 1D  
 Plastic drum: 1H1 or 1H2  
 Fiber drum: 1G  
 Metal drum other than steel or aluminum:  
   IN1 or IN2  
 Wooden barrel: 2C1 or 2C2  
 Steel jerrican: 3A1 or 3A2  
 Plastic jerrican: 3H1 or 3H2  
 Aluminum jerrican: 3B1 or 3B2  
 Steel box: 4A  
 Steel box with liner: 4A  
 Aluminum box: 4B  
 Aluminum box with liner: 4B  
 Natural wood box: 4C1  
 Natural wood box, sift proof: 4C2  
 Plywood box: 4D  
 Reconstituted wood box: 4F  
 Fiberboard box: 4G  
 Expanded plastic box: 4H1  
 Solid plastic box: 4H2  
 Bag, woven plastic: 5H1, 5H2 or 5H3  
 Bag, plastic film: 5H4  
 Bag, textile: 5L1, 5L2 or 5L3  
 Bag, paper, multiwall, water resistant: 5M2  
 Plastic receptacle in steel, aluminum, plywood fiber or plastic drum: 6HA1, 6HB1, 6HD1, 6HG1 or 6HH1  
 Plastic receptacle in steel aluminum, wood, plywood or fiberboard box: 6HA2, 6HB2, 6HC, 6HD2 or 6HG2  
 Glass, porcelain or stoneware in steel, aluminum, plywood or fiber drum: 6PA1, 6PB1, 6PD1 or 6PG1  
 Glass, porcelain or stoneware in steel, aluminum, wooden or fiberboard box: 6PA2, 6PB2, 6PC or 6PG2  
 Glass, porcelain or stoneware in expanded or solid plastic packaging: 6PH1 or 6PH2

[Amdt. 173-224, 55 FR 52634, Dec. 21, 1990, as amended by Amdt. 173-241, 59 FR 67511, 67518, Dec. 29, 1994; Amdt. 173-261, 62 FR 24734, May 6, 1997]

**§ 173.213 Non-bulk packagings for solid hazardous materials in Packing Group III.**

(a) When § 172.101 of this subchapter specifies that a solid hazardous material be packaged under this section,

only non-bulk packagings prescribed in this section may be used for its transportation. Each package must conform to the general packaging requirements of subpart B of part 173, to the requirements of part 178 of this subchapter at the Packing Group I, II or III performance level, and to the requirements of the special provisions of column 7 of the §172.101 table.

(b) The following combination packagings are authorized:

*Outer packagings:*

- Steel drum: 1A1 or 1A2
- Aluminum drum: 1B1 or 1B2
- Metal drum other than steel or aluminum: 1N1 or 1N2
- Plywood drum: 1D
- Fiber drum: 1C
- Plastic drum: 1H1 or 1H2
- Wooden barrel: 2C2
- Steel jerrican: 3A1 or 3A2
- Plastic jerrican: 3H1 or 3H2
- Aluminum jerrican: 3B1 or 3B2
- Steel box: 4A
- Aluminum box: 4B
- Natural wood box: 4C1 or 4C2
- Plywood box: 4D
- Reconstituted wood box: 4F
- Fiberboard box: 4G
- Solid plastic box: 4H2

*Inner packagings:*

- Glass or earthenware receptacles
- Plastic receptacles
- Metal receptacles
- Glass ampoules

(c) The following single packagings are authorized:

- Steel drum: 1A1 or 1A2
- Aluminum drum: 1B1 or 1B2
- Plywood drum: 1D
- Fiber drum: 1C
- Plastic drum: 1H1 or 1H2
- Metal drum other than steel or aluminum: 1N1 or 1N2
- Wooden barrel: 2C1 or 2C2
- Steel jerrican: 3A1 or 3A2
- Plastic jerrican: 3H1 or 3H2
- Aluminum jerrican: 3B1 or 3B2
- Steel box with liner: 4A
- Steel box: 4A
- Aluminum box with liner: 4B
- Natural wood box: 4C1
- Natural wood box, sift proof: 4C2
- Plywood box: 4D
- Reconstituted wood box: 4F
- Fiberboard box: 4G
- Expanded plastic box: 4H1
- Solid plastic box: 4H2
- Bag, woven plastic: 5H1, 5H2 or 5H3
- Bag, plastic film: 5H4
- Bag, textile: 5L1, 5L2 or 5L3
- Bag, paper, multiwall, water resistant: 5M2

Plastic receptacle in steel, aluminum, plywood, fiber or plastic drum: 6HA1, 6HB1, 6HD1, 6HG1 or 6HH1

Plastic receptacle in steel, aluminum, wooden, plywood or fiberboard box: 6HA2, 6HB2, 6HC, 6HD2 or 6HG2

Glass, porcelain or stoneware in steel, aluminum, plywood or fiber drum: 6PA1, 6PB1, 6PD1 or 6PG1

Glass, porcelain or stoneware in steel, aluminum, wooden or fiberboard box: 6PA2, 6PB2, 6PC or 6PG2

Glass, porcelain or stoneware in expanded or solid plastic packaging: 6PH1 or 6PH2

[Amdt. 173-224, 55 FR 52634, Dec. 21, 1990, as amended by Amdt. 173-241, 59 FR 67511, 67518, Dec. 29, 1994; Amdt. 173-261, 62 FR 24734, May 6, 1997]

**§ 173.214 Packagings which require approval by the Associate Administrator for Hazardous Materials Safety.**

When §172.101 of this subchapter specifies that a hazardous material be packaged under this section, packagings and method of shipment must be approved by the Associate Administrator for Hazardous Materials Safety prior to the first shipment.

**§ 173.216 Asbestos, blue, brown or white.**

(a) Asbestos, blue, brown or white, includes each of the following hydrated mineral silicates: chrysolite, crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, actinolite asbestos, and every product containing any of these materials.

(b) Asbestos which is immersed or fixed in a natural or artificial binder material (such as cement, plastic, asphalt, resins or mineral ore); and manufactured products containing asbestos are not subject to the requirements of this subchapter.

(c) Packagings for asbestos must conform to the general packaging requirements of subpart B of this part but need not conform to the requirements of part 178 of this subchapter. Asbestos must be offered for transportation and transported in—

(1) Rigid, leaktight packagings, such as metal, plastic or fiber drums, portable tanks, hopper-type rail cars, or hopper-type motor vehicles;

(2) Bags or other non-rigid packagings in closed freight containers, motor vehicles, or rail cars that are

used. Drums may not be stacked (double decked) within the transport vehicle. Shipments must be from one origin to one destination only without any intermediate pickup or delivery.

[Amdt. 173-224, 55 FR 52643, Dec. 21, 1990, as amended at 56 FR 66274, Dec. 20, 1991; 57 FR 45463, Oct. 1, 1992; Amdt. 173-236, 58 FR 50236, Sept. 24, 1993; Amdt. 173-138, 59 FR 49134, Sept. 26, 1994]

**§ 173.228 Bromine pentafluoride or bromine trifluoride.**

(a) When the §172.101 table specifies that a hazardous material be packaged under this section, only non-bulk packagings prescribed in paragraph (b) of this section are authorized for its transportation. Each packaging must conform to the general packaging requirements of subpart B of this part, to the specification requirements of part 178 of this subchapter and to the requirements of the special provisions of column 7 of the §172.101 table.

(b) Specification 3A150, 3AA150, 3B240, 3BN150, 4B240, 4BA240, 4BW240 and 3E1800 cylinders are authorized. Each valve outlet must be sealed by a threaded cap or threaded plug. Cylinder valves must be protected as specified for corrosive gases in §173.301(g). No cylinder may be equipped with any pressure relief device. Specification 3E1800 cylinders must be packaged in accordance with the requirements of §173.301(k).

**§ 173.229 Chloric acid solution or chlorine dioxide hydrate, frozen.**

When the §172.101 table specifies that a hazardous material be packaged in accordance with this section, only 4C fiberboard boxes, with inner packagings of polyethylene or other suitable material, are authorized. Fiberboard boxes must be reinforced and insulated and sufficient dry ice must be used to maintain the hydrate or acid in a frozen state during transportation. Each packaging must conform to the general packaging requirements of subpart B of part 173, and to the requirements of part 178 of this subchapter at the Packing Group I performance level. Transportation is authorized only by private or contract carrier by motor vehicle.

**Subpart F—Bulk Packaging for Hazardous Materials Other Than Class 1 and Class 7**

**§ 173.240 Bulk packaging for certain low hazard solid materials.**

When §172.101 of this subchapter specifies that a hazardous material be packaged under this section, only the following bulk packagings are authorized, subject to the requirements of subparts A and B of part 173 of this subchapter and the special provisions specified in column 7 of the §172.101 table.

(a) *Rail cars:* Class DOT 103, 104, 105, 109, 111, 112, 114, 115, or 120 tank car tanks; Class 106 or 110 multi-unit tank car tanks; and metal non-DOT specification, sift-proof tank car tanks and sift-proof closed cars.

(b) *Motor vehicles:* Specification MC 300, MC 301, MC 302, MC 303, MC 304, MC 305, MC 306, MC 307, MC 310, MC 311, MC 312, MC 330, MC 331, DOT 406, DOT 407, and DOT 412 cargo tank motor vehicles; non-DOT specification, sift-proof cargo tank motor vehicles; and sift-proof closed vehicles.

(c) *Portable tanks and closed bulk bins:* DOT 51, 52, 53, 56, 57 and 60 portable tanks; IMO type 1, 2 and 5, and IM 101 and IM 102 portable tanks; marine portable tanks conforming to 46 CFR part 64; and sift-proof non-DOT specification portable tanks and closed bulk bins.

(d) *Intermediate bulk containers.* Intermediate bulk containers are authorized subject to the conditions and limitations of this paragraph and paragraph (d)(2) of this section provided they conform to the requirements in subpart O of part 178 of this subchapter at the Packing Group performance level specified in column 5 of the §172.101 table of this subchapter for the material being transported.

(1) The following are authorized:

(i) Composite: 11HZ1, 11HZ2, 21HZ1, 21HZ2, 31HZ1, or 31HZ2. For composite intermediate bulk containers, the letter "Z" must be replaced with a capital letter which indicates the material of construction of the outer packaging. For example 21HA1 is a composite intermediate bulk container with a metal outer packaging (see §178.702 of this subchapter);

(ii) Fiberboard: 11G;

- (iii) Flexible: 13H1, 13H2, 13H3, 13H4, 13H5, 13L1, 13L2, 13L3, 13L4, or 13M2;
- (iv) Metal: 11A, 11B, 11N, 21A, 21B, 21N, 31A, 31B, or 31N;
- (v) Rigid plastic: 11H1, 11H2, 21H1, 21H2, 31H1, or 31H2; or
- (vi) Wooden intermediate bulk containers: 11C, 11D, or 11F.

(2) The following conditions and limitations apply to the use of intermediate bulk containers:

- (i) Flexible, fiberboard and wooden intermediate bulk containers are intended for the transport of solids only and may not be used for liquids or materials that may become liquid during transportation; or
- (ii) Flexible, fiberboard, or wooden intermediate bulk containers containing materials in Packing Group II must be packed in a closed freight container or a closed transport vehicle.

[Amdt. 173-224, 55 FR 52663, Dec. 21, 1990, as amended at 56 FR 66274, Dec. 20, 1991; Amdt. 173-238, 59 FR 38067, July 26, 1994; Amdt. 173-252, 61 FR 28676, June 5, 1996]

**§ 173.241 Bulk packagings for certain low hazard liquid and solid materials.**

When § 172.101 of this subchapter specifies that a hazardous material be packaged under this section, only the following bulk packagings are authorized, subject to the requirements of subparts A and B of part 173 of this subchapter and the special provisions specified in column 7 of the § 172.101 table.

- (a) *Rail cars*: Class DOT 103, 104, 105, 109, 111, 112, 114, 115, or 120 tank car tanks; Class 106 or 110 multi-unit tank car tanks and AAR Class 203W, 206W, and 211W tank car tanks.
- (b) *Cargo tanks*: DOT specification MC 300, MC 301, MC 302, MC 303, MC 304, MC 305, MC 306, MC 307, MC 310, MC 311, MC 312, MC 330, MC 331, DOT 406, DOT 407, and DOT 412 cargo tank motor vehicles; and non-DOT specification cargo tank motor vehicles suitable for transport of liquids.
- (c) *Portable tanks*: DOT 51, 52, 56, 57 and 60 portable tanks; IMO type 1, 2 and 5, and IM 101 and IM 102 portable tanks; marine portable tanks conforming to 46 CFR part 64; and non-DOT specification portable tanks suitable for transport of liquids.

(d) *Intermediate bulk containers*. (1) Intermediate bulk containers are authorized subject to the conditions and limitations of this paragraph and paragraph (d)(2) of this section provided they conform to the requirements in subpart O of part 178 of this subchapter at the Packing Group performance level specified in column 5 of the § 172.101 table of this subchapter for the material being transported.

(i) The following are authorized for liquids or solids:

- (A) Composite: 31HZ1 or 31HZ2: For each composite intermediate bulk container, the letter "Z" must be replaced with a capital letter which indicates the material of construction of the outer packaging. For example, 31HA1 is a composite intermediate bulk container with a metal outer packaging (see § 178.702 of this subchapter);
- (B) Metal: 31A, 31B, or 31N; or
- (C) Rigid plastic: 31H1 or 31H2.

(ii) The following are authorized for solids only:

- (A) Composite: 11HZ1, 11HZ2, 21HZ1, or 21HZ2. For each composite intermediate bulk container, the letter "Z" must be replaced with a capital letter which indicates the material of construction of the outer packaging. For example, 21HA1 is a composite intermediate bulk container with a metal outer packaging (see § 178.702 of this subchapter);
- (B) Fiberboard: 11G;
- (C) Flexible: 13H1, 13H2, 13H3, 13H4, 13H5, 13L1, 13L2, 13L3, 13L4, or 13M2;
- (D) Metal: 11A, 11B, 11N, 21A, 21B, or 21N;
- (E) Rigid plastic: 11H1, 11H2, 21H1, or 21H2; or
- (F) Wooden: 11C, 11D, or 11F.

(2) The following conditions and limitations apply to the use of intermediate bulk containers:

- (i) Flexible, fiberboard and wooden intermediate bulk containers are intended for the transport of solids only and may not be used for liquids or materials that may become liquid during transportation;
- (ii) Only liquids with a vapor pressure less than or equal to 110 kPa (16 psig) at 50 °C (122 °F), or 130 kPa (18.9 psig) at 55 °C (131 °F), are authorized in metal intermediate bulk containers; or

bursting, or other functioning elements unless of a type and design which has been approved by the Associate Administrator for Hazardous Materials Safety.

(c) Tear gas grenades, tear gas candles, and similar devices must be packaged in one of the following packagings conforming to the requirements of part 178 of this subchapter at the Packing Group II performance level:

(1) In UN 4C1, 4C2, 4D, or 4F metal-strapped wooden boxes. Functioning elements not assembled in grenades or devices must be in a separate compartment of these boxes, or in inner or separate outer boxes, UN 4C1, 4C2, 4D, or 4F, and must be so packed and cushioned that they may not come in contact with each other or with the walls of the box during transportation. Not more than 50 tear gas devices and 50 functioning elements must be packed in one box, and the gross weight of the outer box may not exceed 35 kg (77 pounds).

(2) In a UN 1A2 metal drum. Functioning elements must be packed in a separate inner packaging or compartment. Not more than 24 tear gas devices and 24 functioning elements must be packed in one outer drum, and the gross weight of the drum may not exceed 35 kg (77 pounds).

(3) In a UN 4G fiberboard box with inside tear gas devices meeting Specifications 2P or 2Q. Each inside packaging must be placed in fiberboard tubes fitted with metal ends or a fiber box with suitable padding. Not more than 30 inner packagings must be packed in one outer box, and the gross weight of the outer box may not exceed 16 kg (35 pounds).

(4) In other packagings of a type or design which has been approved by the Associate Administrator for Hazardous Materials Safety.

(d) Tear gas devices may be shipped completely assembled when offered by or consigned to the U.S. Department of Defense, provided the functioning elements are so packed that they cannot accidentally function. Outer packagings must be UN 4C1, 4C2, 4D, or 4F metal-strapped wooden boxes.

[Amdt. 173-224, 55 FR 52669, Dec. 21, 1990]

### Subpart H [Reserved]

### Subpart I—Class 7 (Radioactive) Materials

SOURCE: Amdt. 173-244, 60 FR 50307, Sept. 28, 1995, unless otherwise noted.

#### § 173.401 Scope.

(a) This subpart sets forth requirements for the packaging and transportation of Class 7 (radioactive) materials by offerors and carriers subject to this subchapter. The requirements prescribed in this subpart are in addition to, not in place of, other requirements set forth in this subchapter for Class 7 (radioactive) materials and those of the Nuclear Regulatory Commission in 10 CFR part 71.

(b) This subpart does not apply to:

(1) Class 7 (radioactive) materials produced, used, transported, or stored within an establishment other than during the course of transportation, including storage in transportation.

(2) Class 7 (radioactive) materials contained in a medical device, such as a heart-pacemaker, which is implanted in a human being or live animal.

(3) Class 7 (radioactive) materials that have been injected into, ingested by, or are otherwise placed into, and are still in human beings or live animals.

#### § 173.403 Definitions.

For purposes of this subpart—

A<sub>1</sub> means the maximum activity of special form Class 7 (radioactive) material permitted in a Type A package.

A<sub>2</sub> means the maximum activity of Class 7 (radioactive) material, other than special form, LSA or SCO, permitted in a Type A package. These values are either listed in § 173.435 or derived in accordance with the procedure prescribed in § 173.433.

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

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

through" type, and must limit access from top, sides, and bottom.

*Containment system* means the assembly of components of the packaging intended to retain the radioactive contents during transportation.

*Conveyance* means:

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

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

(3) For transport by aircraft, any aircraft.

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

*Exclusive use* (also referred to in other regulations as "sole use" or "full load") means sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must 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 definition does not apply to unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that has been irradiated in a thermal reactor. Certain additional exceptions are provided in § 173.453.

*Fissile material, controlled shipment* means any shipment that contains one or more packages that have been assigned, in accordance with § 173.457, nu-

clear criticality control transport indices greater than 10.

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

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

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

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

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

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

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

(i) *LSA-I*.

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

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

(iii) Class 7 (radioactive) material, other than fissile material, for which the  $A_2$  value is unlimited; or

(iv) Mill tailings, contaminated earth, concrete, rubble, other debris,

and activated material in which the Class 7 (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 TBq/liter (20.0 Ci/liter); or

(ii) Material in which the Class 7 (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 (e.g., consolidated wastes, activated materials) that meet the requirements of § 173.468 and which:

(i) The Class 7 (radioactive) material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.); and

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

(iii) The average specific activity of the solid does not exceed  $2 \times 10^{-3}A_2/g$ .

*Low toxicity alpha emitters are:*

(1) Natural uranium, depleted uranium, and natural thorium;

(2) Ores, concentrates or tailings containing uranium-235, uranium-238, thorium-232, thorium-228 and thorium-230; or

(3) Alpha emitters with a half-life of less than 10 days.

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

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

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

*Non-fixed radioactive contamination* means radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in § 173.443.

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

*Package* means, for Class 7 (radioactive) materials, the packaging together with its radioactive contents as presented for transport.

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

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

(3) "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 this part when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR part 71.

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

(ii) "Type B(M) package" means a Type B packaging, together with its radioactive contents, that for international shipments requires multilateral approval of the package design,

and may require approval of the conditions of shipment. Type B(M) packages are those Type B package designs which have a maximum normal operating pressure of more than 700 kilopascals per square centimeter (100 pounds per square inch) gauge or a relief device which would allow the release of Class 7 (radioactive) material to the environment under the hypothetical accident conditions specified in 10 CFR part 71.

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

- (i) "Industrial package Type 1 (IP-1)";
- (ii) "Industrial package Type 2 (IP-2)"; or
- (iii) "Industrial package Type 3 (IP-3)";

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

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

TABLE 1—NEUTRON FLUENCE RATES TO BE REGARDED AS EQUIVALENT TO A RADIATION LEVEL OF 0.01 MSV/H (1 MREM/H) <sup>1</sup>

Energy of neutron	Flux density equivalent to 0.01 mSv/h (1 mrem/h) neutrons per square centimeter per second (n/cm <sup>2</sup> /s)
Thermal (2.510E-8)MeV .....	272.0
1 keV .....	272.0
10 keV .....	281.0
100 keV .....	47.0
500 keV .....	11.0
1 MeV .....	7.5
5 MeV .....	6.4
10 MeV .....	6.7

<sup>1</sup> Flux densities equivalent for energies between those listed in this table may be obtained by linear interpolation.

**Radioactive contents** means a Class 7 (radioactive) material, together with any contaminated liquids or gases within the package.

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

**Radioactive material** means any material having a specific activity greater than 70 Bq per gram (0.002 microcurie per gram) (see definition of "specific activity").

**Special form Class 7 (radioactive) material** means Class 7 (radioactive) material which satisfies the following conditions:

- (1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
- (2) The piece or capsule has at least one dimension not less than 5 millimeters (0.2 inch); and
- (3) It satisfies the test requirements of § 173.469. Special form encapsulations designed in accordance with the requirements of § 173.389(g) in effect on

June 30, 1983 (see 49 CFR part 173, revised as of October 1, 1982), and constructed prior to July 1, 1985 and special form encapsulations designed in accordance with the requirements of § 173.403 in effect on March 31, 1996 (see 49 CFR part 173, revised as of October 1, 1995), and constructed prior to April 1, 1997, may continue to be used. Any other special form encapsulation must meet the requirements of this paragraph.

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

*Surface Contaminated Object (SCO)* means a solid object which is not itself radioactive but which has Class 7 (radioactive) material distributed on any of its surfaces. 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<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 Bq/cm<sup>2</sup> (10<sup>-4</sup> microcurie/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm<sup>2</sup> (10<sup>-5</sup> microcurie/cm<sup>2</sup>) for alpha emitters;

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

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

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

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

*Transport index (TI)* means the dimensionless number (rounded up to the next tenth) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is determined as follows:

(1) For nonfissile material packages, the number determined by multiplying the maximum radiation level in milliSievert(s) per hour at one meter (3.3 feet) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 feet)); or

(2) For fissile material packages, the number determined by multiplying the maximum radiation level in milliSievert per hour at one meter (3.3 feet) from any external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 feet)) or, for criticality control purposes, the number obtained by dividing 50 by the allowable number of packages which may be transported together, whichever number is larger.

*Type A quantity* means a quantity of Class 7 (radioactive) material, the aggregate radioactivity which does not exceed A<sub>1</sub> for special form Class 7 (radioactive) material or A<sub>2</sub> for normal form Class 7 (radioactive) material,