10 CFR PART 71 AND 49 CFR PARTS 171 - 178
TRANSPORTATION OF RADIOACTIVE MATERIAL

A. PURPOSE

This CFR Guide provides a summary of the changes to the transportation regulations in 49 CFR Parts 171 - 178 and 10 CFR Part 71 as a result of adoption of recent final rules and that are effective on October 1, 2004. The purpose of this guide is to supplement existing NRC Manual Chapters within the Inspection Manual until they are revised and updated to reflect the content of this guide.

B. BACKGROUND

This CFR Guide pertains to implementation of the revised 49 CFR Parts 171 - 178 and 10 CFR Part 71. On January 26, 2004, the U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission (NRC) jointly published final rules on Compatibility with the International Atomic Energy Agency Transportation Safety Standards (TS-R-1). Both rules have an effective date of October 1, 2004. As a means of correcting errors found in the January 26, 2004, final rules, both DOT and NRC published correction final rules on September 13, 2004, and September 29, 2004, respectively. DOT also published an additional correction rule on October 1, 2004. The changes which occurred as a result of these correction rules are incorporated in this guide. Based on the changes to the transportation regulations, licensees will need to update their procedures and operations. Several major changes are included in this revision. A summary of the changes follows.

C. DISCUSSION

Both DOT and NRC made several major changes to their respective transportation regulations. These changes impact licensees in different ways, as summarized below. Note within this guide that Appendix A provides a detailed section-by-section review of all of the changes adopted by DOT, Appendix B provides a detailed section-by-section review of all of the changes adopted by NRC, and Appendices C, D, E, F, G, and H include summary sheets for topical areas of packaging, radiation limits, contamination limits, and communication requirements based on the transportation regulations.

1. Industrial and Medical Licensees.

a. Use of The Table of Exempt Material Activity Concentrations and Exempt Consignment Activity Limits for Radionuclides in 49 CFR 173.436 or 10 CFR Part 71 Appendix A, Table A-2 to define material as radioactive for transport.

(1). For over 30 years, licensees have used the single value of 70 Bq/gram (0.002 uCi/gram) to define material as radioactive for transport.

(2). On October 1, 2004, the single value is replaced with the exempt material activity concentrations and exempt consignment activity limits for radionuclides found in 49 CFR 173.436 or 10 CFR Part 71 Appendix A, Table A-2.

(3). When both the exempt material activity concentration and the exempt consignment activity limit are exceeded, the material is regulated in transportation.

(4). The values and limits adopted in DOT and NRC regulations establish a consistent dose-based model for minimizing public exposure.

b. Use of new A_1 and A_2 values.

(1). The A_1 and A_2 values are updated to reflect the results of the IAEA's updated Q-system.

(2). The Q-system includes incorporation of data from metabolic uptake studies, including the pathways of external photon dose, external beta dose, inhalation dose, skin and ingestion dose from contamination, and dose from submersion in gaseous radionuclides.

(3). The new A_1 and A_2 values reflect the radiological assessment for each radionuclide of potential exposures to an individual should a Type A package of radioactive material be involved in an accident during transport.

(4). Some of the A_1 and A_2 values are raised, while some are lowered, but overall the reference dose is still the same.

(5). The new values are located in 49 CFR 173.435 and 10 CFR Part 71 Appendix A, Table A-1.

c. Use of new proper shipping names and UN identification numbers from the Hazardous Materials Table (49 CFR 172.101).

(1). The proper shipping names and UN identification numbers may be required to be placed on shipping papers and on certain packages of radioactive materials.

(2). The new Class 7 (radioactive) material entries in the Hazardous Materials Table (49 CFR 172.101) are consistent with TS-R-1.

(3). The entries that allow for domestic transport only (indicated by a “D” in Column 1 of the HazMat Table) are removed.

(4). Each new proper shipping name includes the words “Radioactive material” as part of the name and therefore no longer needs to be added to the shipping papers as a separate entry.

d. Use of UN Identification numbers for excepted packages in accordance with 49 CFR 173.422(a).

(1). As the name implies, excepted packages of Class 7 (radioactive) material typically are allowed certain exceptions to the transportation requirements (e.g., no shipping papers, markings, or labels) when compared to other types of radioactive materials.

(2). Excepted packages of Class 7 (radioactive) material have been required to include a certification statement for the particular excepted quantity being shipped (i.e., limited quantity, instrument or article, manufactured article of uranium depleted uranium or thorium, and empty packaging).

(3). With the adoption of this final rule, each excepted package of Class 7 (radioactive) material is required to be marked with the UN identification number that is located in Column 4 of the HazMat Table, and the certification statement is no longer required.

e. Use of new and revised definitions in 49 CFR 173.403 and 10 CFR 71.4.

(1). Within each final rule, several terms are revised and new terms added.

(2). It is appropriate to ensure that licensees are using these new terms and have included them as part of their transportation program.

f. Marking of Industrial and Type B packages.

(1). The marking of industrial packages as “TYPE IP-1”, “TYPE IP-2”, or “TYPE IP-3” and Type B packagings as “TYPE B(U)” or “TYPE B(M)” is a new requirement in 49 CFR 172.310(b).

(2). Letters must be at least 13 mm (0.5 inches) high and legibly and durably marked on the outside of the package.

g. Time line associated with DOT Specification (6M, 20WC, 21WC, 1A2) and NRC Type B ( ) packages.

(1). Both NRC and DOT have elected to phase out packages that do not meet 1973 or later NRC or IAEA performance requirements.

(2). These packages can continue to be used until October 1, 2008.

2. Decommissioning Licensees. In addition to the items in Section 1 above (a through g), Decommissioning licensees should be aware of the following:

a. New LSA-I definition.

(1). Within the definition for LSA-I material, the category which refers to mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed 10^{-6} A_2/g is removed.

(2). Within the new LSA-I definition, paragraph (1)(i) includes a category of uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides.

(3). Within the new LSA-I definition, paragraph (1)(iv) includes a category of other radioactive material, excluding fissile material in quantities not excepted under § 173.453, in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in § 173.436, or 30 times the default values listed in Table 8 of § 173.433.

b. Transport of unpackaged shipments of LSA-I or SCO-I material.

(1). Within the revised § 173.427, DOT includes conditions which allow for transporting unpackaged LSA-I or SCO-I material.

(2). The conditions include:

(a) Under conditions normally incident to transport there will be no escape of the radioactive contents from the conveyance nor will there be any loss of shielding;

(b) Conveyances must be under exclusive use, except for SCO-I on which the contamination levels must be minimized, and;

(c) If non-fixed contamination levels on inaccessible surfaces are too high, measures must be taken to ensure there is no release to the conveyance or environment.

3. Fissile material licensees. In addition to the items in Sections 1 and 2 above Fissile material licensees should be aware of the following:

a. Use of criticality safety index (CSI) in accordance with 49 CFR 173.403 and 10 CFR 71.4.

(1). The current definition for Transport Index (TI) includes requirements for assessing both the dose rate at 1 meter from non-fissile packages of radioactive material (radiation exposure) and for fissile packages (criticality control) of radioactive material.

(2). Within these final rules, the current definition of TI is revised such that the TI is used to provide only control over radiation exposure.

(3). The other portion of the TI definition is renamed as the Criticality Safety Index (CSI) and is an assessment of the criticality safety of a fissile package or group of fissile packages as determined in accordance with 10 CFR 71.22, 71.23 or 71.59.

(4). The CSI is placed on a new FISSILE label as required by 49 CFR 172.403(e).

b. Use of FISSILE labels.

(1). For packages that contain fissile material, the assigned CSI must be placed on the FISSILE label in accordance with 49 CFR 172.403(e).

(2). Each package of fissile material is required to bear two FISSILE labels in accordance with 49 CFR 172.402(d)(2).

(3). FISSILE labels must comply with 49 CFR 172.441.

c. Removal of Pu-238 as fissile material.

(1). Within the definition of fissile material, Pu-238 is removed, because Pu-238 is fissionable, not fissile.

d. Use of fissile material exemptions.

(1). New fissile material exemptions are reflected in 49 CFR 173.453 and 10 CFR 71.15.

(2). Both references are revised by providing mass-ratio based limits in classifying fissile excepted material.

(3). New mass-ratio exemptions exist in paragraphs (a), (b), and (c) of each section.

(4). Although not new, additional exceptions also exist in each section in paragraphs (d), (e), and (f) for uranium enriched in U-235, liquid solutions of uranyl nitrate enriched in U-235, and packages containing plutonium.

e. Use of General license for fissile material.

(1). The existing general licenses for fissile material found in 10 CFR 71.18, 71.20, 71.22, and 71.24 are combined into new 71.22.

(2). The mass-based limits and the CSI are applied.

(3). The values contained in new Tables 71-1 and 71-2 are used in determining the CSI (as required by new paragraph (e)).

(4). A DOT Type A package and an NRC Subpart H Quality Assurance program is required.

f. Use of General license for Plutonium-Beryllium special form material.

(1). New 10 CFR 71.23 consolidates requirements contained in existing §§ 71.18 and 71.22 Plutonium-Beryllium (Pu-Be) for special form material.

(2). The new § 71.23 reduces the maximum quantity of fissile Pu-Be sealed sources that could be shipped on a single conveyance to 1000 grams through changes in mass limits and the calculation of the CSI.

(3). The CSI is increased from 10 to 100 for exclusive use and must be determined in accordance with the formula in paragraph (e) of this section.

END

Appendix A

Section-by-section Description of new DOT Transportation Regulations

Changes in 49 CFR Parts 171 - 178:

1. General Information, Regulations, and Definitions. Within 49 CFR Part 171, the following changes have occurred:

   a. 49 CFR 171.7 Reference material.

      (1). The Table of material incorporated by reference is updated to remove outdated references and to include the IAEA Regulations for the Safe Transport of Radioactive Material, No. TS-R-1 (1996), two ISO standards, and a US Enrichment Corporation Good Handling Practices for Uranium Hexafluoride document.

      (2). In paragraph (a)(3), the heading of the table is corrected to read “49 CFR reference”.

   b. 49 CFR 171.11 Use of ICAO Technical Instructions.

      (1). The language in § 171.11(d)(6)(i) is updated to remove the reference to § 172.203(d)(4) and replace it with § 172.203 (d)(10) to reflect the new separate paragraph for the description of a Highway Route Controlled Quantity of radioactive material on a shipping paper.

      (2). The language in § 171.11(d)(6)(iv) is updated to remove the reference to § 173.428. This paragraph is also expanded to include the actual name of the other excepted packages (i.e., radioactive material, instruments or articles, or articles containing natural uranium or thorium).

   c. 49 CFR 171.12 Import and export shipments.

      (1). Reference to IAEA Safety Series No. 6, 1985 edition in § 171.12(d)(4) is replaced with TS-R-1, 1996 edition.

      (2). The reference to the single value of 70 Bq/g (0.002 uCi/g) in § 171.12(d)(7) is removed.

2. Communications. Within 49 CFR Part 172, the following changes have occurred:

   a. 49 CFR 172.101 Hazardous Materials Table.

(1). The hazardous material descriptions and proper shipping names for radioactive material that are for domestic transport only (indicated by letter D in Column 1 of the Table) are removed and replaced with entries that are consistent with TS-R-1.

(2). The proper shipping names from TS-R-1 include new identification numbers.

(3). Collectively, 15 entries are removed and 18 new or revised entries are added.

(4). For the entry "Radioactive material, excepted package – instruments *or* articles", the references in column 8 are corrected to include 422 and 424.

(5). The entry "Radioactive material, surface contaminated objects (SCO-I *or* SCO-II) non fissile or fissile excepted" is corrected to italicize the words "non fissile or fissile-excepted".

(6). For the entry "Radioactive material, transported under special arrangement, fissile" the UN identification number in column 4 is corrected to "UN 3331".

(7). The entry "Radioactive material, Type A package, fissile *non-special form*" is corrected.

b. <u>49 CFR 172.203 Additional description requirements</u>.

(1). In existing paragraph (d) of this section, the requirement that the words "Radioactive material" be entered on the shipping paper unless already contained in the proper shipping name is removed because each new proper shipping name contains these words.

(2). In paragraph (d)(1), the reference to § 173.433(f) is corrected to § 173.433(g).

(3). When used, paragraph (d)(3) requires that customary units (Ci, mCi, etc.) be in parentheses following the SI units.

(4). In paragraph (d)(3), Pu-238 is removed from the listing of fissile radionuclides.

(5). For a package containing fissile material, paragraph (d)(6) requires the criticality safety index for that package.

(6). In existing paragraph (d)(10) of this section, the requirement to provide the appropriate group notation for low-specific

activity material (LSA) or surface contaminated object (SCO) when shipped in category LSA-I, LSA-II, LSA-III, SCO-I, or SCO-II is removed because the new proper shipping names include this information.

(7). The requirement to include the words “Highway route controlled quantity” or “HRCQ” on a shipping paper is moved to paragraph (d)(10).

c. 49 CFR 172.310 Class 7 (radioactive) materials.

(1). Paragraph (a) requires that each package be marked with the gross mass and the unit of measure (abbreviations are authorized).

(2). In addition to markings required on Type A, Type B(U) or Type B(M) packages, a new requirement in paragraph (b) includes that industrial packagings be marked as “Type IP-1”, “Type IP-2”, or “Type IP-3”, as appropriate.

(3). In accordance with paragraph (c), each IP-1, IP-2, IP-3, and Type A packaging must be marked on the outside with the international vehicle registration code of the country of origin of design.

(a) For packages designed by a United States company the international vehicle registration code is “USA”.

(4). The radiation symbol marking required for Type B(U) and B(M) packages in accordance with Appendix B of Part 172 must be marked by embossing, stamping, or other resistant means and be resistant to the effects of fire and water, in accordance with paragraph (d).

d. 49 CFR 172.400 General labeling requirements.

(1). The Label design chart in paragraph (b) is updated to include the new FISSILE label.

e. 49 CFR 172.402 Additional labeling requirements.

(1). In accordance with paragraph (d)(2), each package or overpack containing fissile material, other than fissile excepted, is required to bear two FISSILE labels affixed to opposite sides of the package, and adjacent to the radioactive labels.

f. 49 CFR 172.403 Class 7 (radioactive) materials.

(1). A new paragraph (e) is added to require that each FISSILE label be completed to include the CSI assigned in the NRC or DOE package design approval for special arrangement or in the certificate of approval for the package design issued by the Competent Authority for import and export shipments.

(2). For overpacks and freight containers that require the FISSILE label, the CSI must be the sum of all the packages contained in the overpack or freight container.

(3). In paragraph (g)(1), the reference to § 173.433(f) is corrected to § 173.433(g). Additionally, this paragraph is updated to include that for LSA-I material, the contents entry of "LSA-I" is authorized on the RADIOACTIVE labels (instead of listing all the radionuclides contained in the material).

(4). When used, paragraph (d)(2) requires that customary units (Ci, mCi, etc.) be in parentheses following the SI units.

(5). Pu-238 is removed from the listing of fissile radionuclides and is no longer included in paragraph (g)(2).

(6). The requirements for labeling of overpacks (§ 173.448(g)) are added to this section in new paragraph (h).

(7). In new paragraph (h)(4), the references (c)(3) and (c)(4) for determining the TI for an overpack are removed and replaced with (h)(3).

g. 49 CFR 172.441 FISSILE label.

(1). The new FISSILE label is described in § 172.441.

3. Shippers - General Requirements for Shipments and Packagings. Within Part 173 Subpart I, the following changes have occurred:

a. 49 CFR 173.401 Scope.

(1). The regulations in this subpart do not apply to

(a) Materials that have been implanted or incorporated into, and are still in, a person or live animal for diagnosis or treatment.

(b) Material that is an integral part of the means of transport (e.g., thoriated metallic engine parts, depleted uranium counterweights, tritium exit signs

that are routinely used in the normal operation of a transport vehicle).

(c) Class 7 (radioactive) material in natural material and ores containing naturally occurring radionuclides provided the material does not exceed 10 times the exemption values listed in § 173.436.

b. 49 CFR 173.403 Definitions.

(1). The definitions for “Non-fixed radioactive contamination” and “Fissile material, controlled shipment” are removed.

(2). The following definitions are revised:

(a) A_1
(b) A_2
(c) Containment system
(d) Exclusive use
(e) Fissile material
(f) Low Specific Activity material
(g) Low toxicity alpha emitters
(h) Maximum normal operating pressure
(i) Multilateral approval
(j) Package
(k) Radioactive contents
(l) Radioactive material
(m) Special form Class 7 (radioactive) material
(n) Surface Contaminated Object
(o) Transport index
(p) Unilateral approval
(q) Unirradiated uranium
(r) Uranium - natural, depleted, or enriched

(3). The following definitions are added:

(a) Consignment
(b) Contamination
(c) Criticality Safety Index (CSI)
(d) Deuterium
(e) Exemption value
(f) Fissile material package
(g) Fixed radioactive contamination
(h) Graphite
(i) Quality assurance

c. 49 CFR 173.411 Industrial packagings.

(1). This section is updated to include new paragraphs (4), (5), (6), and (7) for use of tank containers, tanks, freight

containers, and metal intermediate bulk containers as industrial packagings (IP-2 or IP-3), respectively.

d. 49 CFR 173.415 Authorized Type A packages.

(1). Within this section, an outdated transitional date in existing paragraph (a) for use of certain Type A packages is removed.

(2). Reference to Type B packagings (i.e., packagings which do not meet 1973 or later NRC or IAEA performance standards) is removed from paragraph (c).

(3). Reference to Safety Series No. 6 in paragraph (d) is removed and replaced with TS-R-1.

(4). The language in paragraph (d) is corrected to allow foreign-made packagings to be used for domestic and export shipments.

e. 49 CFR 173.416 Authorized Type B packages.

(1). Type B (i.e., any Type B packaging which does not meet 1973 or later IAEA or NRC performance requirements) as an authorized Type B packaging is removed from paragraphs (a) and (b) of this section.

(2). Use of DOT Specification 6M, 20WC, and 21WC packagings as authorized Type B packagings will end October 1, 2008.

f. 49 CFR 173.417 Authorized fissile materials packages.

(1). Use of DOT Specification 6L, 6M, and 1A2 as authorized fissile materials packagings will end on October 1, 2008.

(2). Tables 2, 4, and 5 are removed, and Tables 3 and 6 are redesignated as Tables 2 and 3, respectively.

g. 49 CFR 173.420 Uranium hexafluoride (fissile, fissile excepted, and non-fissile).

(1). New performance packaging requirements are introduced in paragraph (a)(3) for packages of UF_6, including:

(a) Hydraulic test at an internal pressure of at least 1.4 MPa (200 psi) without leakage;

(b) Drop test (§ 173.465(c)) without loss or dispersal; and

(c) Thermal test (10 CFR 71.73(c)(4)) without rupture of the containment system.

(2). In accordance with new paragraph (d), quantities of less than 0.1 kg of non-fissile UF_6 may be shipped in packagings that meet §§ 173.24, 173.24a, and 173.410.

h. 49 CFR 173.421 Excepted packages for limited quantities of Class 7 (radioactive) materials.

(1). Limited quantities of Class 7 (radioactive) materials must be marked with the UN identification number marking found in Column 4 of the Hazardous Materials Table (49 CFR 172.101) in accordance with § 173.422(a).

(2). Excepted packages containing radioactive materials no longer require a certification statement.

(3). Paragraph (a) is updated to reflect that Table 7 is renamed as Table 4.

i. 49 CFR 173.422 Additional requirements for excepted packages containing Class 7 (radioactive) materials.

(1). Excepted packages must be marked with the UN identification number found in Column 4 of the Hazardous Materials Table (49 CFR 172.101).

j. 49 CFR 173.424 Excepted packages for radioactive instruments and articles.

(1). Excepted packages for radioactive instruments and articles must be marked with the UN identification number found in Column 4 of the Hazardous Materials Table (49 CFR 172.101).

(2). In paragraphs (b) and (c), existing Table 7 is renamed Table 4.

(3). A new paragraph (e) is added that requires that the active material be completely enclosed by non-active components.

(4). Excepted packages containing radioactive instruments or articles no longer require a certification statement.

k. 49 CFR 173.425 Table of activity limits - excepted quantities and articles.

(1). References to Table 7 are revised to read Table 4 - Activity Limits for Limited Quantities, Instruments, and Articles.

l. 49 CFR 173.426 Excepted packages for articles containing natural uranium or thorium.

(1). Excepted packages containing natural uranium or thorium must be marked with the UN identification number found in Column 4 of the Hazardous Materials Table (49 CFR 172.101).

(2). Excepted packages containing natural uranium or thorium no longer require a certification statement.

m. 49 CFR 173.427 Transport requirements for low specific activity (LSA) Class 7 (radioactive) materials and surface contaminated objects (SCO).

(1). The definition of LSA-I in § 173.403 is revised and includes new considerations for ores.

(2). Within paragraph (a), the following revisions are made:

(a) The paragraph is updated to remove a duplicative phrase and to specify the purpose of paragraphs (b), (c), and (d).

(b) Table 9 is renamed Table 5 - Conveyance Activity Limits for LSA and SCO.

(c) LSA and SCO material may be either packaged or unpackaged.

(d) Table 8 is renamed Table 6 - Industrial Package Integrity Requirements for LSA Material and SCO.

(e) Transportation by aircraft is prohibited except when transported in an industrial package or in an authorized Type A or Type B package.

(f) In paragraph (a)(6), the words “required by this section” are removed.

(3). Within paragraph (b), the following revisions are made:

(a) In paragraph (b)(2), the domestic use only provision is removed for use of a DOT Specification 7A Type A package.

(b) The reference to Type B packages in paragraph (b)(3) is removed.

(c) Paragraph (b)(4) is updated to reflect that for domestic exclusive use transportation only, shipments that are less than an A_2 quantity may be placed in a packaging that meets the requirements of §§ 173.24, 173.24a, and 173.410.

(d) Paragraph (b)(5) indicates that for exclusive use transport of LSA-I liquid, tank cars or tank motor vehicles are authorized.

(4). Paragraph (c) authorizes LSA-I and SCO-I material to be transported unpackaged under the following conditions:

(a) The material must not escape from the conveyance and there must not be any loss of shielding;

(b) Each conveyance must be exclusive use, except for SCO-I which does not exceed contamination limits of 4.0 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters and 0.4 Bq/cm^2 for all other alpha emitters on the accessible and inaccessible surfaces of the material.

(c) For SCO-I material, if it is suspected that the non-fixed contamination on the inaccessible surfaces exceeds the permitted levels, measures must be initiated to ensure that the radioactive material is not released to the conveyance or the environment.

(5). Within paragraph (d), the reference to 10 CFR 20.2005 is removed because the exemption activity concentrations for tritium (H-3) and carbon-14 adopted in this final rule are greater than the concentrations previously excepted.

(6). Paragraph (e) is renamed paragraph (d).

n. <u>49 CFR 173.428 Empty Class 7 (radioactive) materials packaging</u>.

(1). Empty packagings must be marked with the UN identification number found in Column 4 of the Hazardous Materials Table (49 CFR 172.101).

(2). Empty packagings no longer require a certification statement.

(3). New paragraph (c) requires that the outer surface of any uranium or thorium in its structure is covered with an inactive sheath made of metal or other substantial material.

o. <u>49 CFR 173.431 Activity limits for Type A and Type B packages</u>.

(1). Reference to Type B packages in paragraph (b) is removed.

p. 49 CFR 173.433 Requirements for determining basic radionuclide values, and for the listing of radionuclides on shipping papers and labels.

(1). In paragraph (a), the radionuclide-specific exemption values (§ 173.436) are referenced.

(2). Table 10 is renamed Table 7 - General Values for A_1 and A_2.

(3). New Table 8 - General Exemption Values is added at the end of this section.

(4). For radionuclides which are not listed in the tables for A_1 and A_2 or the Exemption Values, the default values in Table 7 or Table 8 may be used, as appropriate

(5). A sum of the fraction equation is added to paragraph (d)(3) and is provided for a mixture of special form and normal form material in the same package.

(6). An equation is provided in paragraph (d)(6) and is used to determine the exempt activity concentration for mixtures of radionuclides, and the phrase associated with the equation is corrected.

(7). An equation is provided in paragraph (d)(7) for the activity limit for an exempt consignment for mixtures of radionuclides.

q. 49 CFR 173.435 Table of A_1 and A_2 values for radionuclides.

(1). The Table of A_1 and A_2 values for radionuclides is updated to include values from TS-R-1.

(2). For domestic use, the A_2 value for molybdenum-99 is 0.74 TBq (20 Ci).

(3). For domestic use, californium-252 has an A_1 value of 0.1 TBq (2.7 Ci) and an A_2 value of 0.001 TBq (0.027 Ci).

(4). Footnote b is added to the A_1 and A_2 Curie columns, and is included at the end of the table to indicate that the Curie values are approximate values and for information only, and that the regulatory standard units are Terabecquerels (TBq).

r. 49 CFR 173.436 Exempt material activity concentrations and exempt consignment activity limits.

(1). The Table of Exempt material activity concentrations and exempt consignment activity limits for radionuclides is used to determine if a material is regulated in transport.

(2). A radioactive material offered for transport is regulated as a Class 7 hazard only if both the activity concentration and the consignment activity are greater than the exemption values determined for that material.

s. 49 CFR 173.441 Radiation level limitations and exclusive use provisions.

(1). A new paragraph (d) is added which includes the total transport index (TI) restrictions for non-exclusive use and exclusive use shipments of Class 7 material.

t. 49 CFR 173.443 Contamination control.

(1). Existing Table 11 is revised to include the true non-fixed contamination limits for the outer surfaces of a package (as opposed to the contamination on the wipe material/smear).

(2). In calculating the contamination level from the activity measured on the wipe material, the true wipe efficiency must be used or a default efficiency of 0.10 assumed.

(3). Existing Table 11 is renamed Table 9.

u. 49 CFR 173.447 Storage during transportation - general requirements.

(1). In accordance with paragraph (a), during storage, the number of packages and overpacks bearing FISSILE labels must be limited so that the total sum of the CSIs in any individual group does not exceed 50.

(2). Paragraph (a) also requires that groups of such packages must be stored so as to maintain spacing of at least 6 meters (20 feet) from all other groups of such packages.

(3). Paragraph (b) indicates that vessel stowage requirements are added and described in 49 CFR Part 176 Subpart M.

v. 49 CFR 173.448 General transportation requirements.

(1). The requirements in paragraph (g)(1) for labeling overpacks of radioactive materials are relocated to § 172.403(h).

w. 49 CFR 173.453 Fissile materials - exceptions.

(1). DOT has incorporated the per package exemptions for fissile material from 10 CFR 71.15. New exemptions include:

(a) # 2 grams of fissile material.

(b) # 15 grams of fissile material with a ratio of nonfissile to fissile material of 200 : 1.

(c) # 180 grams of fissile material with a ratio of nonfissile to fissile material of 2,000 : 1.

(2). For 1(b) and (c) above, 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.

(3). Three additional exemptions also exist based on uranium enrichment, liquid solutions of uranyl nitrate, and plutonium shipments, but they are not new.

x. <u>49 CFR 173.457 Transportation of fissile material packages -- specific requirements.</u>

(1). Packages containing fissile radioactive material must be assigned a criticality safety index (CSI) and a transport index (TI).

(a) The CSI is determined in accordance with 10 CFR 71.22, 71.23, or 71.59.

(2). The CSI for any package or overpack may not exceed 50 (nonexclusive use). Packages with a CSI greater than 50 must be transported by exclusive use.

(3). The total sum of CSI's in a freight container or on a conveyance may not exceed 50 (non-exclusive use).

(4). The total sum of CSI's in a freight container or on a conveyance may not exceed 100 (exclusive use).

(5). Fissile material packages and conveyances transporting fissile material packages must meet the radiation levels in §173.441, and exclusive use shipments of fissile material packages must satisfy § 173.441(b).

(6). The number of packages, overpacks, and freight containers containing fissile material stored in any one storage area must be limited so that the total sum of the CSI's does not

exceed 50. Separation distances of a least 6 m (20 feet) apply.

(7). New paragraph (h) indicates that for shipment by vessel, the provisions of §§ 176.700 - 176.720 apply.

y. 49 CFR 173.459 Mixing of fissile material packages with non-fissile or fissile-excepted material packages.

(1). Mixing of fissile material packages with other types of Class 7 (radioactive) material during transport or storage is authorized only if the transport index (TI) of any single package does not exceed 10, the criticality safety index (CSI) on any single package does not exceed 50, and the requirements in § 173.441 (radiation level limits) and § 173.457 (transportation of fissile material packages) are satisfied.

z. 49 CFR 173.465 Type A packaging tests.

(1). Table 12 is revised to be Table 10 - Free Drop Distance for Testing Packages to Normal Conditions of Transport.

aa. 49 CFR 173.469 Tests for special for Class 7 (radioactive) materials.

(1). The reference for the alternate leak test methods in paragraph (a)(4)(ii) are revised to ISO 9978-1992(E).

(2). The leaching assessment methods for indispersible solid material and encapsulated material are revised in paragraph (c) for clarity.

(3). Paragraph (d)(1) is revised to include the restriction that the sealed capsule and contents have a mass less than 200 grams.

bb. 49 CFR 173.471 Requirements for U.S. Nuclear Regulatory Commission approved packages.

(1). This introductory text is updated to remove the Type B package as an NRC approved package.

cc. 49 CFR 173.473 Requirements for foreign-made packages.

(1). The introductory text is revised to include the types of foreign-made packages that require certification and to include reference to TS-R-1 instead of Safety Series No. 6.

dd. 49 CFR 173.476 Approval of special form Class 7 (radioactive) materials.

(1). In this section, paragraph (c)(4) is revised to specify what the required quality assurance program should cover.

(2). New paragraph (c)(5) is added to require that a description of any planned pre-shipment actions for use in the consignment of special form radioactive material be included in an application for a U.S. Competent Authority Certificate for Special Form Material.

ee. 49 CFR 173.477 Approval of packagings containing greater than 0.1 kg of non-fissile or fissile-excepted uranium hexafluoride.

(1). This is a new section in 49 CFR and defines the approval requirements for packagings containing more than 0.1 kg of UF_6.

(2). Paragraph (a) requires that each offeror of a package containing more than 0.1 kg of uranium hexafluoride must maintain on file for at least one year after the latest shipment a complete safety analysis, including tests, that demonstrates the package meets the requirements of § 173.420.

(3). Paragraph (b) requires that prior to the first shipment of such material, the offeror shall obtain a U.S. Competent Authority Certificate for the packaging design.

(4). Paragraph (b) also requires that for packagings manufactured outside the United States, each offeror shall comply with § 173.473 for foreign-made packages.

(5). Submission requests and content requirements for U.S. Competent Authority Certificates are contained in paragraph (c) of this section.

4. 49 CFR Part 174 - Carriage by rail. Within Part 174, the following changes have occurred:

a. 49 CFR 174.700 Special handling requirements for Class 7 (radioactive) materials.

(1). Paragraph (b) is revised to reflect that other than for exclusive use shipments, the number of packages of radioactive material that may be transported by rail car or stored at any single location is limited to a total transport index and a total criticality safety index of not more than 50 each.

(2). New paragraph (d) is added to require that each shipment of fissile material packages must conform to §§ 173.457 and 173.459.

5. 49 CFR Part 175 - Carriage by aircraft. Within Part 175, the following changes have occurred:

a. 49 CFR 175.700 Special limitations and requirements for Class 7 (radioactive) materials.

(1). Paragraph (a)(2) is added to reflect that no person may transport aboard a passenger-carrying aircraft a package required to be labeled with FISSILE labels unless the CSI does not exceed 3.0.

(2). The total sum of the TIs of all packages in an aircraft may not exceed 50 (paragraph (a)(5)).

(3). The total sum of the CSIs of all packages in an aircraft may not exceed 50 (paragraph (a)(6)).

(4). Note that the Section-by-section analysis includes words for a new paragraph (e), but it does not appear in the regulatory text associated with the rule.

b. 49 CFR 175.702 Requirements for carriage of packages containing Class 7 (radioactive) materials in a cargo aircraft only.

(1). Paragraph (b) is revised to reflect that no person may transport in a cargo aircraft only a package required to be labeled with RADIOACTIVE YELLOW-II, RADIOACTIVE YELLOW-III, or FISSILE labels unless -

(a) The total TI for all of the packages does not exceed 50, the total CSI for all packages does not exceed 50, and the packages are carried in accordance with § 175.701(a); or

(b) The total TI for all the packages is greater than 50 but does not exceed 200, the total CSI for all the packages does not exceed 100.

(c) Any package having a CSI greater than 50 must be transported under exclusive use, and

(i) The TI for any group of packages does not exceed 50;

(ii) Each group of packages is separated from every other group in the aircraft by not less than 6 meters (20 feet); and

(iii) The separation distance between the surfaces of the packages and any space occupied by humans is at least 9 meters (30 feet) and live animals is at least 0.5 meters (20 inches) for journeys not exceeding 24 hours and at least 1.0 meters (39 inches) for journeys longer than 24 hours.

c. 49 CFR 175.703 Other special requirements for the acceptance and carriage of packages containing Class 7 (radioactive) materials.

(1). Paragraph (b) is revised to indicate that packages of Class 7 (radioactive) materials that are contained in overpacks must be prepared for shipment in accordance with § 172.403(h).

(2). Paragraph (c) is revised to reflect the general requirements for fissile material packages and to indicate that each shipment of fissile material packages must conform to §§ 173.457 and 173.459.

(3). Paragraph (e) is revised to specify that packages with radiation levels higher than those allowed by the regulations may be transported by air under special arrangements approved by the Associate Administrator.

6. 49 CFR Part 176 - Carriage by vessel. Within Part 176, the following changes have occurred:

a. 49 CFR 176.700 General stowage requirements.

(1). Paragraph (c) of this section is removed, and paragraphs (d) and (e) are redesignated as (c) and (d), respectively.

(2). The 6 meter (20 feet) stowage separation requirement for groups of radioactive material packages containing fissile material is moved to § 176.704.

b. 49 CFR 176.704 Requirements relating to transport indices and criticality safety indices.

(1). The title of this section is changed to reflect the applicability of the TI and CSI for vessels.

(2). This section uses Table IIIA - TI Limits for Freight Containers and Conveyances to establish the total sum of TIs in a single freight container or aboard a conveyance.

(3). This section uses Table IIIB - CSI Limits for Freight Containers and Conveyances to establish the total sum of CSIs in a single freight container or aboard a conveyance.

(4). Paragraph (e) indicates that each group of fissile Class 7 (radioactive) material packages containing a sum of CSIs no greater than 50 (non-exclusive use) or no greater than 100 (exclusive use) must be separated form all other groups containing fissile material packages by a distance of at least 6 meters (20 feet) at all times.

(5). Although not discussed in the Section-by-section analysis for this rule, a new paragraph (f) is added to indicate that certain limits do not apply when the entire vessel is reserved for use by a single offeror under exclusive use conditions.

c. 49 CFR 176.708 Segregation distances.

(1). This section is revised to include requirements of the International Maritime Dangerous Goods (IMDG) Code on dose rate guidance aboard vessels.

7. 49 CFR Part 177 - Carriage by public highway. Within Part 177, the following changes have occurred:

a. 49 CFR 177.842 Class 7 (radioactive) material.

(1). Paragraph (f) is updated to reflect the applicability of the CSI and to indicate that -

(a) The sum of the CSIs for a non-exclusive use transport vehicle may not exceed 50.

(b) The sum of the CSIs for groups of fissile packages in loading and storage areas may not exceed 50.

(c) Groups of fissile material packages must be separated by a distance of at least 6 meters (20 feet) from all other such groups.

(d) The requirements of §§ 173.457 and 173.459 apply.

(2). Paragraph (g) is updated to include that the sum of the CSIs for packages containing fissile material may not exceed 100 in an exclusive use vehicle.

8. Specifications for Packagings. Within Part 178, the following changes have occurred:

a. 178.350 Specification 7A; general packaging, Type A.

(1). Each Specification 7A packaging must be marked on the outside “USA DOT 7A Type A.”

(2). New paragraph (c) requires that each specification 7A packaging must comply with the marking requirements of 178.3.

b. 178.352 and 178.352-1 through 178.352-6.

(1). These sections are removed in their entirety due to discontinued use of DOT Specification 6L metal packagings as an authorized fissile material packaging.

c. 178.354 and 178.354-1 through 178.354-5.

(1). These sections are removed in their entirety due to discontinued use of DOT Specification 6M metal packagings as an authorized Type B and fissile material packaging.

d. 178.362 and 178.362-1 through 178.362-7.

(1). These sections are removed in their entirety due to discontinued use of DOT Specification 20WC wooden protective jacket as an authorized Type B packaging.

e. 178.364 and 178.364-1 through 178.364-6.

(1). These sections are removed in their entirety due to discontinued use of DOT Specification 21WC wooden-steel protective overpack as an authorized Type B packaging.

Appendix B

Section-by-section Description of new NRC Transportation Regulations

Changes in 10 CFR Part 71:

1. Redesignation of Sections.

   a. Within 10 CFR Part 71, the following section references were changed:

New section number	Existing section number
§ 71.8	§ 71.11
§ 71.9	New section
§ 71.10	New section
§ 71.11 (Reserved)	NA
§ 71.12	§ 71.8
§ 71.13	§ 71.9
§ 71.14	§ 71.10
§ 71.15	§ 71.53
§ 71.16 (Reserved)	NA
§ 71.17	§ 71.12
§ 71.18 (Reserved)	NA
§ 71.19	§ 71.13
§ 71.20	§ 71.14
§ 71.21	§ 71.16
§ 71.22	§ 71.18
§ 71.23	§ 71.20
§ 71.24 (Reserved)	§ 71.22 (Section removed)
§ 71.25 (Reserved)	§ 71.24 (Section removed)
§ 71.53 (Reserved)	§ 71.53 (Section redesignated)

2. 10 CFR Part 71 Subpart A -- General Provisions.

   a. 10 CFR 71.0 Purpose and scope.

      (1). Administrative changes are made to this section including -

         (a) Paragraph (d) is reformatted into three paragraphs to indicate that (1) general licenses are issued in new §§ 71.20 through 71.23; (2) an application for a package approval must be completed in accordance with subpart D; (3) requires licensees transporting or delivering material to a carrier for transport to meet applicable portions of subparts A, G, and H.

(b) New paragraph (e) is added to indicate that persons who hold or apply for a certificate of compliance are within the scope of Part 71 regulations.

(c) Existing paragraph (e) is redesignated as paragraph (f) with no change to the text.

(d) Existing paragraph (f) is redesignated as paragraph (g) and is revised to reflect the redesignation of § 71.11 to § 71.8.

b. 10 CFR 71.1 Communications and records.

(1). Paragraph (a) is revised to indicate that documents submitted to the NRC should be addressed to the attention of the "Document Control Desk" (not the Director of NMSS).

(2). Paragraph (a) is corrected to include steps should a submission date fall on a non-workday.

c. 10 CFR 71.4 Definitions.

(1). The following definitions are revised:

(a) A_1
(b) Fissile material
(c) Low Specific Activity (LSA) material
(d) Package
(e) Transport Index

(2). The following definitions are added:

(a) A_2
(b) Certificate of Compliance
(c) Consignment
(d) Criticality Safety Index (CSI)
(e) Deuterium
(f) U.S. Department of Transportation
(g) Graphite
(h) Spent Fuel
(i) Unirradiated uranium

d. 10 CFR 71.5 Transportation of licensed material.

(1). In this section, paragraph (a) is corrected to clarify DOT requirements in 49 CFR applicable to a licensee who transports licensed material.

e. 10 CFR 71.6 Information collection requirements.

(1). This section is redesignated from Subpart B to Subpart A of this Part.

(2). Paragraph (b) is updated to reflect the addition of new information collection requirements.

(3). Appendix A, Paragraph II is re-added to paragraph (b), as it was previously omitted.

f. 10 CFR 71.7 Completeness and accuracy of information.

(1). This section is redesignated from Subpart B to Subpart A of this Part.

(2). The terms “certificate holder” and “applicant for a CoC” are added to this section.

g. 10 CFR 71.8 Deliberate misconduct.

(1). This section is redesignated from Subpart B to Subpart A of this Part.

(2). Current § 71.11 is redesignated as § 71.8 with no change to the text.

h. 10 CFR 71.9 Employee protection.

(1). Requirements relating to the protection of employees against firing or other discrimination when the employee engages in certain “protected activities” are added to Part 71.

(2). Currently, this protection is provided in other parts of Title 10 for specific licensees.

(3). This new section was added to Part 71 to provide the same rights and protection to licensees, certificate holders, applicants for a Commission license or a Certificate of Compliance, or a contractor or subcontractor of any of these.

i. 10 CFR 71.10 Public inspection of application.

(1). This new section is added and indicates that applications and documents related to an application for a package approval that are submitted to the Commission shall be available for public review.

(2). Existing § 71.10 is redesignated § 71.14 with no changes to the text.

j. 10 CFR 71.11 Reserved.

(1). This section is redesignated from Subpart B to Subpart A of this Part, and is reserved.

3. 10 CFR Part 71 Subpart B -- Exemptions.

a. 10 CFR 71.12 Specific exemptions.

(1). Existing § 71.8 is redesignated as § 71.12 with no changes to the text.

(2). Existing § 71.12 is redesignated as § 71.17.

b. 10 CFR 71.13 Exemption of physicians.

(1). Existing § 71.9 is redesignated as § 71.13 with no changes to the text.

(2). Existing § 71.13 is redesignated as § 71.19.

c. 10 CFR 71.14 Exemption for low-level materials.

(1). Existing § 71.10 is redesignated as § 71.14.

(2). Existing § 71.14 is redesignated as § 71.20 with no changes to the text.

(3). Paragraph (a) is revised to remove the single specific activity value 70 Bq/g (0.002 µCi/g).

(4). Paragraph (a) is reformatted to include paragraphs (a)(1) and (a)(2).

(5). Paragraph (a)(1) provides an increased exemption for natural materials and ores containing naturally occurring radionuclides that are not intended to be processed for use of the radionuclides present, provided the activity concentration does not exceed 10 times the values specified in new Table A-2, “Exempt Material Activity Concentrations and Exempt Consignment Activity Limits for Radionuclides”.

(6). New paragraph (a)(2) provides an exemption for radioactive material based on the values in new Table A-2.

(7). Paragraph (b)(3) is revised to consolidate the exemption provisions in existing paragraphs (b)(2) and (c) for LSA and SCO material.

(8). The exemption from classification as fissile material in current § 71.53 is redesignated to § 71.15.

(9). Existing paragraph (b)(3) is removed, but the 0.74 TBq (20 Curie) exemption for special form plutonium - 244 in domestic transport is retained in new paragraph (b)(2).

(10). In accordance with paragraph (a)(2), low-level materials are exempt if the activity concentration is not greater than the activity concentration values in Table A-2, or if the consignment activity is not greater than the exempt consignment limit found in Table A-2.

d. <u>10 CFR 71.15 Exemption from classification as fissile material</u>.

(1). Existing § 71.11 is redesignated as § 71.8, and existing §71.53 is redesignated as § 71.15 and relocated to subpart B.

(2). This section is revised by providing per package mass-ratio based limits for classifying fissile-exempt material.

(3). New exemptions include:

(a) # 2 grams of fissile material per package

(b) # 15 grams of fissile material with a ratio of nonfissile to fissile material of 200 : 1.

(c) # 180 grams of fissile material with a ratio of nonfissile to fissile material of 2,000 : 1.

(3). For 2(b) and (c) above, 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.

(4). Three additional exemptions also exist in paragraphs (d), (e), and (f) based on uranium enrichment, liquid solutions of uranyl nitrate, and plutonium shipments, but they are not new.

e. <u>10 CFR 71.16 Reserved</u>.

(1). This section is redesignated from Subpart C to Subpart B, and is reserved.

(2). Existing § 71.16 is redesignated as § 71.21 with no changes to the text.

4. 10 CFR Part 71 Subpart C - General licenses. Within this subpart, the following changes have occurred:

a. 10 CFR 71.17 General license: NRC-approved package.

(1). Existing § 71.12 is redesignated as § 71.17 with no changes to the text of paragraphs (a) and (b).

(2). Paragraph (c)(3) is revised to reflect that information submitted to the NRC needs to be submitted in accordance with § 71.1.

(3). Paragraph (d) is not changed.

(4). Paragraph (e) is revised to reflect the redesignation of § 71.13 to § 71.19.

b. 10 CFR 71.18 Reserved.

(1). The contents of existing § 71.18 are incorporated into new § 71.22.

c. 10 CFR 71.19 Previously approved package.

(1). Existing § 71.13 is redesignated as § 71.19.

(2). Paragraph (a) indicates that a Type B ( ) package (i.e., designed to Safety Series No. 6 (1967)) may be used under the general license of § 71.17 with the following additional conditions:

(a) Fabrication has been completed by August 31, 1986;

(b) A serial number which uniquely identifies each packaging is assigned to and legibly and durably marked on the outside of the packaging; and

(c) Use of the package is discontinued after October 1, 2008.

(3). Paragraph (b) indicates that a Type B(U), Type B(M), or fissile material package not designated as “-85” in the identification number (i.e., designed to Safety Series No. 6 (1973)) may be used under the general license of § 71.17 with the following additional conditions:

(a) Fabrication of the package is completed by April 1, 1999;

(b) A package used for international shipment is subject to multilateral approval; and

(c) A serial number which uniquely identifies each packaging is assigned to and legibly and durably marked on the outside of the packaging.

(4). In accordance with paragraph (c), a Type B(U), Type B(M), or fissile material package designated as "-85" in the identification number (i.e., designed to Safety Series No. 6 (1985, Amended 1990)) may be used under the general license of § 71.17 with the following additional conditions:

(a) Fabrication of the package must be completed by December 31, 2006; and

(b) After December 31, 2003, a package used for international shipment is subject to multilateral approval.

(5). Based on paragraph (d), NRC will approve modifications to the design and authorized contents of a Type B package or a fissile material package provided that:

(a) Modifications to the Type B package are not significant with respect to the design, operating characteristics, or safe performance of the containment system, when subjected to the tests in §§ 71.71 and 71.73;

(b) Modifications to a fissile material package are not significant with respect to prevention of criticality when the package is subjected to the tests specified in §§ 71.71 and 71.73; and

(c) The modifications satisfy Part 71.

(6). Paragraph (e) indicates that NRC will assign the identification number suffix "-96" after receipt of an application which demonstrates the design meets the current requirements.

d. <u>10 CFR 71.20 General license: DOT specification container</u>.

(1). This section was previously referenced as § 71.14 and is redesignated.

(2). This section allows use of DOT specification packages (e.g., 6M, 20WC, and 21WC) under a general license.

(3). This section expires October 1, 2008.

e. 10 CFR 71.21 General license: Use of foreign approved package.

(1). Existing § 71.16 is redesignated as new § 71.21 with no changes to the text.

f. 10 CFR 71.22 General license: Fissile material.

(1). This section combines the existing fissile general license provisions of §§ 71.18, 71.20, 71.22, and 71.24.

(2). This section uses mass-based limits (rather than concentration-based limits) and a criticality safety index (CSI).

(3). Fissile material shipped under this general license is required to be packaged in a DOT Type A package and meet the requirements of 49 CFR 173.417(a).

(4). The general license applies only to a licensee who has a quality assurance program approved by the Commission as satisfying the provisions of 10 CFR Part 71 Subpart H.

(5). The general license only applies when the package content:

(a) Contains no more than a Type A quantity of radioactive material; and

(b) Contains less than 500 total grams of beryllium, graphite, or hydrogenous material enriched in deuterium.

(6). The general license only applies to packages of fissile material that are labeled with a CSI which:

(a) Has been determined with the CSI formula of this section;

(b) Has a value # 10; and

(c) For a shipment of multiple packages of fissile material, the sum of the CSIs must be # 50 (for shipment on a nonexclusive use conveyance) and # 100 (for shipment on an exclusive use conveyance).

(7). The CSI formula, Table 71-1, and Table 71-2 appear in paragraph (e).

g. <u>10 CFR 71.23 General license: Plutonium-beryllium special form material</u>.

(1). This section consolidates regulations on shipment of Pu-Be sealed sources contained in existing §§ 71.18 and 71.22.

(2). Paragraph (a) indicates that fissile material shipped under this general license is required to be packaged in a DOT Type A package and meet the requirements of 49 CFR 173.417(a).

(3). Paragraph (b) indicates that the general license applies only to a licensee who has a quality assurance program approved by the Commission as satisfying the provisions of 10 CFR Part 71 Subpart H.

(4). Paragraph (c) sets the requirements that the general license applies only when the contents of a package:

(a) Contain no more than a Type A quantity of radioactive material; and

(b) Contains < 1000 grams of plutonium, provided that plutonium-239, plutonium-241, or any combination of these radionuclides makes up < 240 grams of the total quantity of plutonium in the package.

(5). In accordance with paragraph (d), the general license only applies to packages with a CSI which:

(a) Has been determined with the CSI formula of this section;

(b) Has a value # 100; and

(c) For a shipment of multiple packages of Pu-Be sealed sources, the sum of the CSIs must be # 50 (for shipment on a nonexclusive use conveyance) and # 100 (for shipment on an exclusive use conveyance).

(6). The value of the CSI, as determined by the formula in paragraph (e), must be greater than or equal to the number calculated by the CSI equation and must be rounded up to the first decimal place.

h. 10 CFR 71.24 Reserved.

(1). Existing § 71.22 is redesignated as § 71.24.

(2). The contents of § 71.24 is removed and this section is reserved.

i. 10 CFR 71.25 Reserved.

(1). Existing § 71.24 is redesignated as § 71.25.

(2). The contents of § 71.25 is removed and this section is reserved.

5. 10 CFR Part 71 Subpart D - Application for package approval. No changes occurred in this Subpart.

6. 10 CFR Part 71 Subpart E - Package approval standards. Within this subpart, the following changes have occurred:

a. 10 CFR 71.41 Demonstration of compliance.

(1). This section is revised to include the requirement that packages of radioactive material that exceed 10^5 A_2 must meet the deep immersion test in § 71.61.

(2). A new paragraph (d) is added to provide special package authorizations.

b. 10 CFR 71.51 Additional requirements for Type B packages.

(1). A new paragraph (d) is added to require that a package which contains radioactive contents with activity greater than 10^5 A_2 of any radionuclide must also meet the enhanced deep immersion test in § 71.61.

c. 10 CFR 71.53 Reserved.

(1). This section is removed and reserved.

(2). The contents of this section are moved to § 71.15.

d. 10 CFR 71.55 General requirements for fissile material packages.

(1). New paragraphs (f) and (g) are added.

(2). Paragraph (f) specifies designs and testing for fissile material package designs for air transport.

(3). Paragraph (g) addresses the UF_6 criticality exception from § 71.55(b).

(4). Paragraph (b) is updated to reflect new paragraph (g).

e. 10 CFR 71.59 Standards for arrays of fissile material packages.

(1). This section incorporates the CSI for arrays of fissile material packages.

(2). The CSI must be determined by dividing the number 50 by the determined "N" value.

(3). For a fissile material package which is assigned a CSI value-

(a) # 50, may be shipped in a nonexclusive use conveyance provided the sum of the CSIs is limited to # 50.

(b) # 50, may be shipped in an exclusive use conveyance provided the sum of the CSIs is limited to # 100.

(c) > 50, must be transported in an exclusive use conveyance provided the sum of the CSIs is limited to # 100.

f. 10 CFR 71.61 Special requirements for Type B packages containing more than 10^5 A_2.

(1). This section is revised to require an enhanced water immersion test for packages used for radioactive contents with activity greater than 10^5 A_2.

g. 10 CFR 71.63 Special requirement for plutonium shipments.

(1). The requirement for double containment of plutonium is removed.

(2). The contents must be in solid form if the contents contain greater than 0.74 TBq (20 Ci).

7. 10 CFR Part 71 Subpart F - Package, special form, and LSA-III tests. Within this subpart, the following change has occurred:

a. 10 CFR 71.73 Hypothetical accident conditions.

(1). A new paragraph (c)(2) is added to require a crush test for fissile material packages.

8. 10 CFR Part 71 Subpart G - Operating controls and procedures. Within this subpart, the following changes have occurred:

a. 10 CFR 71.88 Air transport of plutonium.

(1). The single specific activity value of 70 Bq/g (0.002 μCi/g) is removed from paragraph (a)(2) and replaced with the activity concentration values specified in Appendix A, Table A-2.

b. 10 CFR 71.91 Records.

(1). The terms “certificate holder” and “applicant for a CoC” are added to Subpart H of this part, and as a conforming change, the terms are also added to this section in paragraphs (b), (c), and (d).

c. 10 CFR 71.93 Inspection and tests.

(1). The terms “certificate holder” and “applicant for a CoC” are added to Subpart H of this part, and as a conforming change, the terms are also added to this section in paragraphs (a), (b), and (c).

(2). As required by paragraph (c), 45 days prior to beginning fabrication of the first packaging under a CoC, the certificate holder and applicant for a CoC must notify the NRC in accordance with § 71.1.

d. 10 CFR 71.95 Reports.

(1). The existing introductory information and paragraphs (a), (b), and (c) are combined into new paragraph (a).

(2). Paragraph (a) requires that licensees, after requesting the certificate holder’s input, to submit a written report to the Commission of -

(a) Instances where there is a significant reduction in the effectiveness of any NRC-approved Type B or AF packaging during use;

(b) Details of any defects with safety significance in any NRC-approved Type B or fissile material packaging, after first use.

(c) Instances in which the conditions of approval in the CoC were not observed in making a shipment.

(3). Paragraph (b) requires the licensee to submit a written report to the Commission of instances in which the conditions of the CoC were not followed during a shipment.

(4). New paragraph (c) establishes requirements for timing (60-day) and submission (in accordance with § 71.1) of the reports.

(5). New paragraph (d) establishes requirements for legibility of the reports required by this section.

e. 10 CFR 71.100 Criminal penalties.

(1). Paragraph (b) of this section is revised to reflect the Part 71 regulations that NRC does not consider as substantive regulations.

(2). Willful violation of, attempted violation of, or conspiracy to violate any of the regulations in paragraph (b) is not subject to possible criminal sanctions.

9. Subpart H Quality assurance.

a. Within §§ 71.101 - 71.137, the following revisions are included:

(1). The terms “certificate holder” and “applicant for a CoC” are added.

(2). New text is added on submitting QA programs in accordance with § 71.1.

(3). A new paragraph (c)(2) is added to § 71.101(c) to provide equivalent requirements on the submission of QA programs for certificate holders and applicants for CoC.

b. The NRC’s ability to enforce nonconformance by “certificate holders” and “applicants for a CoC” will be enhanced by including these two terms/entities in this subpart.

10. Appendix A to Part 71 Determination of A_1 and A_2.

a. Table A-1 A_1 and A_2 values for radionuclides

(1). The Table is updated to include values from TS-R-1.

(2). For domestic use, californium-252 has an A_1 value of 0.1 TBq (2.7 Ci) and an A_2 value of 0.001 TBq (0.027 Ci).

(3). For domestic use, the A_2 value for molybdenum-99 is 0.74 TBq (20 Ci).

(4). In paragraph I, the text is corrected to indicate that the Terabecquerel units are the regulatory standard, and that the Curie values are for information only and not the regulatory standard.

(5). In paragraph IV.b, corrections are made to the value designators below the formula to identify B(i) and the A_2 value.

(6). Columns 4 and 6 of the Table are updated to include footnote b, which identifies that the Curie values are approximate values and for information only, and that the Terabecquerel units are the regulatory standard.

(7). Within the Table, the specific activity values for bismuth - 205, curium-248, and tellurium-132 are corrected.

(8). Within the Table, the A_1 value for europium-150 (long lived) is corrected.

b. Table A-2 Exempt Material Activity Concentrations and Exempt Consignment Activity Limits for Radionuclides

(1). The contents of this Table are used to determine when concentrations of material are not considered radioactive for the purpose of transportation.

(2). When both the activity concentration and the total activity in the consignment exceed the values in the Table, the material is regulated in transportation.

c. Table A-3 - General Values for A_1 and A_2.

(1). Existing Table A-2 is redesignated A-3.

(2). This Table is updated to reflect the updated A_1, A_2, activity concentration for exempt material values, and activity limits for exempt consignments for unlisted radionuclides.

(3). In the 6th column, the value under the “Activity concentration for exempt material (Bq/g)” for the first row “Only beta or gamma emitting radionuclides are known to be present” is corrected to read 1×10^1.

(4). In the 7th column, the value under the “Activity limits for exempt consignments (Bq)” in the first row “Only beta or gamma emitting radionuclides are known to be present” is corrected to read 1×10^4.

d. Table A-4 - Activity-Mass Relationships for Uranium.

(1). Existing Table A-3 is redesignated as new Table A-4 with no other changes to the values.

(2). In the 3rd column, the value under the “Specific activity Ci/g” for the “90” row “Uranium Enriched wt% U-235 present” is corrected to read 5.8×10^{-5}.

END

APPENDIX C

Packaging and Radiation Level
Laminated Sheet

Minimum Required Packaging For Class 7 (Radioactive) Materials

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Packaging Based on Activity[1]

Category	Excepted Quantity[2]	Type A	Type B	Type B - HRCQ
Activity	# Table 4[3]	# A_1 or A_2	>A_1 or A_2	> 3000 A_1 or > 3000 A_2 or > 1000 TBq (whichever is least)
Packaging	Excepted Package[4]	Type A[5]	Type B[6]	Type B[6]

1. Material not defined as Class 7 is not regulated in transport [§173.403]
2. Includes Limited Quantity [§173.421] and Instruments and Articles [§173.424].
3. Activity limits for Limited Quantities and Instruments and Articles [§173.425].
4. Excepted package must meet [§173.410].
5. Except for LSA or SCO, a Type A package may not contain a quantity of radioactive material greater than A_1 or A_2 [§173.431(a)].
6. Type B(U) or Type B(M).

Packaging Options for LSA or SCO # 1 Rem/hour at 3 meters unshielded[7, 8]

Packaging	Unpackaged (LSA-I and SCO-I) only	Minimum Package[2, 3]	Industrial Package[4]	DOT Specification 7A Type A[5]	Type B(U) or B(M)	Specification tank cars[6]
Reference	§173.427(c)[1]	§173.427(b)(4)	§173.427(b)(1)	§173.427(b)(2)	§173.427(b)(3)	§173.427(b)(5)

1. See regulations in §173.427(c) for additional transport controls for unpackaged material.
2. Only for domestic exclusive use and activity less than A_2 quantity.
3. The packaging must meet §173.24, §173.24a, and §173.410.
4. Use of Industrial Package (IP-1, 2, or 3) must be in accordance with Table 6 [§173.427] and must meet §173.411.
5. Except for LSA or SCO, a Type A package may not contain a quantity of radioactive material greater than A_1 or A_2 [§173.431(a)].
6. For exclusive use, LSA-I liquid only, see specifications for tank cars or cargo tanks.
7. For LSA or SCO that exceeds 1 rem/hr at 3 m see 10 CFR 71 and NUREG 1608, Section 4.1.3.
8. LSA and SCO must comply with the conditions of §173.427(a), as appropriate.

Package and Vehicle Radiation Level Limits (49 CFR 173.441)[1]

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Transport Vehicle Use	**Non-Exclusive**	**Exclusive**		
Transport Vehicle Type	Open or Closed	Open (flat-bed)	Open w/Enclosure[2]	Closed
Package (or freight container) **Limits:**				
External Surface	2 mSv/hr **(200 mrem/hr)**	2 mSv/hr **(200 mrem/hr)**	10 mSv/hr **(1000 mrem/hr)**	10 mSv/hr **(1000 mrem/hr)**
Transport Index (TI)[3]	10	No limit		
Criticality Safety Index (CSI)[6]	50	No limit		
Roadway or Railway Vehicle (or freight container) **Limits:**				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr **(200 mrem/hr)**
Vertical planes projected from outer edges		2 mSv/hr **(200 mrem/hr)**	2 mSv/hr **(200 mrem/hr)**	N/A
Top of		load: 2mSv/hr **(200 mrem/hr)**	enclosure: 2 mSv/hr **(200 mrem/hr)**	vehicle: 2 mSv/hr **(200 mrem/hr)**
2 meters from		vertical planes: 0.1 mSv/hr **(10 mrem/hr)**	vertical planes: 0.1 mSv/hr **(10 mrem/hr)**	outer lateral surfaces: 0.1 mSv/hr **(10 mrem/hr)**
Underside		2 mSv/hr **(200 mrem/hr)**		
Occupied position	N/A[4]	0.02 mSv/hr **(2 mrem/hr)**[5]		
Sum of package TI's	50	No limit		
Sum of package CSI's[6, 7]	50	100		

1. The limits in this table do not apply to excepted packages (§§173.421, 173.424, 173.426. 173.428).
2. Securely attached (to vehicle), access-limiting enclosure; package personnel barriers are considered as enclosures.
3. The dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour rounded up to the next tenth (§ 173.403).
4. No dose limit is specified, but separation distances apply to Radioactive Yellow-II, Radioactive Yellow-III, or CSI labeled packages (§ 177.842).
5. Does not apply to carriers if operating under a state or federally regulated radiation protection program and if personnel wear radiation dosimetry devices (§ 173.441(b)(4)).
6. These provisions do not apply to shipment by vessel - see §§176.700-720 for vessel requirements.
7. The number of packages containing fissile material stored in transit in any one storage area must be limited so that the total sum of the CSI's is # 50, and such groups of packages must be spaced at least 6 m (20 ft) from other such groups [§§173.457 and 173.459].

APPENDIX D

Contamination Limits
Laminated Sheet

Package and Vehicle Contamination Limits (49 CFR 173.443)

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm^2.
Sufficient measurements must be taken in the appropriate locations to yield representative assessments.
Wipe efficiency must be determined in accordance with §173.443(a)(1) or assumed to be 0.1.

&(means the sum of beta emitters, gamma emitters, and low-toxicity alpha emitters.
" means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters).

Non-fixed Radioactive Contamination Limits for Packages §173.443(a) (Table 9)	Maximum Permissible Limit		
	&(: 4 Bq/cm^2	$1x10^{-4}$: Ci/cm^2	220 dpm/cm^2
	": 0.4 Bq/cm^2	$1x10^{-5}$: Ci/cm^2	22 dpm/cm^2

Non fixed (removable) contamination must be kept as low as reasonably achievable (ALARA)

The following exceptions from the above limits exist:

Applicable conditions which must be met:

In an exclusive use shipment, contamination on a package:

(1) may not exceed the values in §173.443(a) at the beginning of transport [§173.443(b)].

(2) may not exceed 10 times the values in §173.443(a) during transport [§173.443(b)].

Vehicle must not be returned to service until the radiation level is shown to be # 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination, as specified in §173.443(a) [§173.443(c)].

In a closed transport vehicle used solely for transporting radioactive materials packages, the contamination levels on the packages may not exceed 10 times the values in §173.443(a).
Additional conditions include:
(1) A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft).
(2) Exterior of vehicle must be conspicuously stenciled, “For Radioactive Materials Use Only” in letters at least 76 mm (3 inches) high, on both sides of the exterior.
(3) Vehicle must be kept closed except for loading and unloading [§173.443(d)].

Excepted package-empty packaging [§173.428]
Conditions include:
(1) Internal contamination may not exceed 100 times §173.443(a) (Table 9) [§173.428(c)].
(2) External contamination on the package may not exceed §173.443(a) (Table 9) [§173.428(a)].
(3) Radiation level must be # 0.005 mSv/hr (0.5 mrem/hr) at any external surface [§173.428(a)].
(4) Package must be marked with UN 2908 in accordance with §173.422(a).
(5) Packaging is in unimpaired condition and securely closed to prevent leakage [§173.428(b)].
(6) Labels are removed, obliterated, or covered, and the “Empty” label (§172.450) is affixed to the packaging [§173.428(d)].
(7) The package contains # 15 grams of U-235.

In addition, after any incident involving spillage, breakage, or suspected radioactive contamination, the modal-specific DOT regulations (§174.750(a), railway; §175.700(b), air; and §177.843(c), highway) specify that vehicles, buildings, areas, or equipment have “no significant removable surface contamination,” before being returned to service or routinely occupied. The carrier must also notify offeror at the earliest practicable moment after each incident. In the event of certain hazardous materials incidents, the regulations (§§171.15 and 171.16) specify the criteria for immediate notice and detailed hazardous materials incident reports.

Rev. 1 October 1, 2004

APPENDIX E

Marking
Laminated Sheet

Hazard Communications for Class 7 (Radioactive) Materials

Marking (49 CFR Part 172, Subpart D)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments.
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Markings Always Required

Bulk Packages (i.e., a maximum capacity greater than 119 gallons as a receptacle for liquid; a maximum net mass greater than 882 lbs and a maximum capacity greater than 119 gallons as a receptacle for solid; or a water capacity greater than 1000 lbs as a receptacle for a gas, with no intermediate form of containment) [§171.8]

- U.N. identification number on:
  - orange panels [§172.332(b)]
  - white square-on-point display [§172.336(b)]

Non-Bulk Packages (§ 171.8)

- Proper shipping name [§172.301]
- U.N. identification number [§172.301]
- Name and address of consignor or consignee, *unless*:
  - highway only and no motor carrier transfers, or
  - part of carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee [§172.301(d)]

Excepted Packages

- Limited Quantity
  - UN 2910 [§173.422(a)]
  - "Radioactive" [§173.421(a)(4)]
- Instruments and Articles
  - UN 2911 [§173.422(a)]
- Manufactured Articles containing natural uranium or thorium
  - UN 2909 [§173.422(a)]
  - "Radioactive" [§173.421(a)(4)]
- Empty Packaging
  - UN 2908 [§173.422(a)]

Additional Markings Sometimes Required

Materials-Based Requirements:

- Each package with a gross mass greater than 50 kg (110 lbs), must have its gross mass including the unit of measurement marked on the outside of the package [§172.310(a)]
- If non-bulk combination package containing liquid use, underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 780-1985 marking] [§172.312]

- If a Hazardous substance (§171.8) in non-bulk package, the letters "RQ" in association with the proper shipping name [§173.427(a)(6)(vi) for LSA/SCO or §172.324(b) for other material]

Package-Based Requirements:

- The package type as TYPE IP-1, TYPE IP-2, TYPE IP-3, TYPE A, TYPE B(U) or TYPE B(M), as appropriate in letters 13 mm (0.5 in) high or greater [§172.310(b)]
- "USA DOT 7A Type A" for Specification 7A packagings (§ 178.350 and markings required by § 178.3)
- For NRC approved Type B(U), B(M), or fissile material packages the package identification marking from the CoC (e.g., USA/9166/B(U), USA/9150/B(U)-85) [§173.471(b)]
- For Type B(U) or B(M) the trefoil symbol per 49 CFR Part 172 App. B [§172.310(d)]

- Marked with the international vehicle registration code of the country of origin of the design, for IP-1, IP-2, IP-3, or a Type A package (e.g., USA) [§172.310(c)]
- For NRC certified packages, the model number, gross weight, serial number, and package ID number [10 CFR 71.85]

Administrative-Based Requirements:

- If a DOT exemption is being used, the outside of the package must be marked "DOT-E", followed by the exemption number [§§172.301(c)) and 172.302(c)]
- Each Type B(U), B(M), or fissile material package destined for export, "USA" in conjunction with the specification markings or certificate identification [§172.310(e)]

Optional Markings

- Both the name and address of consignor and consignee are recommended

Special Considerations/Exceptions for Marking

- Markings are required to be: (1) durable, printed in English on a package surface, label, tag, or sign; (2) displayed on a background of sharply contrasting color; (3) unobscured by labels or attachments; and (4) isolated from other marks (such as advertising) [§172.304].
- Shipment of LSA or SCO consigned as exclusive use by §173.427 are excepted from the marking requirements (i.e., proper shipping name and identification number) except that the exterior of each packaged or unpackaged material must be marked "Radioactive-LSA" or "Radioactive-SCO", as appropriate.
- For bulk packages, marking (i.e., orange panels) may be required on more than one side of the package [§172.302(a), §172.331(c)] and must be displayed in proximity to any required placards [§172.334(f)].
- For an overpack, a statement that the contained packages comply with prescribed specifications [§173.25(a)(4)].

Rev. 1 October 1, 2004

APPENDIX F

Labeling
Laminated Sheet

Hazard Communications for Class 7 (Radioactive) Materials

Labeling (49 CFR 172, Subpart E)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments.
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Placement of Radioactive Labels

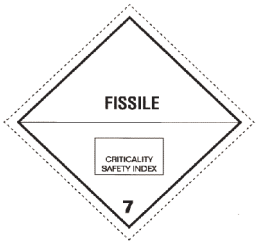
- Labeling is required to be: (1) printed or affixed to the package surface (not the bottom); (2) placed near the proper shipping name marking; (3) multiple labels must be within 150 mm (6 in) of each other; (4) in contrast with its background; (5) unobscured by markings or attachments; (6) within color, design, and size tolerance; and (7) representative of the HAZMAT contents of the package [§172.406, §172.407]
- Packages of radioactive material must have two labels affixed to opposite sides [§172.403]
- For radioactive material, the label to apply must be the highest category required for any of the two determining conditions (i.e., TI and maximum radiation level on package surface). RADIOACTIVE WHITE - I is the lowest category, and RADIOACTIVE YELLOW - III is the highest category.

Determination of Required Label [§172.403]

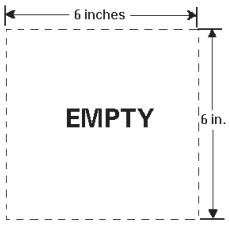
49 CFR 172.436

49 CFR 172.438

49 CFR 172.440



49 CFR 172.441



49 CFR 172.450

WHITE-I	YELLOW-II	YELLOW-III	FISSILE	EMPTY LABEL
Surface Radiation Level	Surface Radiation Level	Surface Radiation Level	Each package containing fissile material (other than fissile excepted) must be labeled with two FISSILE labels, affixed adjacent to the appropriate RADIOACTIVE labels [§172.402(d)(2)]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to §173.428. It must cover any previous labels, or they must be removed or obliterated.
# 0.005 mSv/hr (0.5 mrem/hr)	>0.005 mSv/hr (0.5 mrem/hr), but # 0.5 mSv/hr (50 mrem/hr)	> 0.5 mSv/hr (50 mrem/hr), but # 2 mSv/hr (200 mrem/h) or > 2 mSv/hr (200 mrem/h), but # 10 mSv/hr (1000 mrem/h) must be exclusive use closed transport [§173.441(b)]		
TI = 0 (if the measured TI is # 0.05 the value may be considered to be 0)	TI > 0 but # 1	TI > 1 but # 10 or > 10 [exclusive use]	CSI = As defined by §173.403 and as determined by 10 CFR 71.22, 71.23, and 71.59	

Contents on Radioactive Labels

- RADIOACTIVE and FISSILE labels must contain (entered using a durable, weather-resistant means):
  - (1) Except for LSA-I material, the names of the radionuclides in the package (§§ 172.403(g)(1) and 173.433(g)). The term "LSA-I" may be used in place of the names of radionuclides. Symbols (e.g., Co-60) are acceptable [§172.403(g)]
  - (2) The activity in the package expressed in SI units (e.g., Bq, TBg), or in customary units (e.g., Ci, mCi) in parentheses following SI units. Abbreviations are authorized. The weight in g or kg of fissile radionuclides may be inserted instead of activity units. For Pu-239 and Pu-241 the weight in g of fissile radionuclides may be inserted in addition to activity units [§172.403(g)]
  - (3) The Transport Index (TI) is entered *only* on YELLOW-II and YELLOW-III labels [§172.403(g)]
  - (4) The Criticality Safety Index (CSI) is entered *only* on the FISSILE label [§172.403(e)]

Special Considerations/Exceptions for Labeling

- Any package containing a Highway Route Controlled Quantity must be labeled RADIOACTIVE YELLOW-III [§172.403(c)].
- For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label *may* not be required on opposite sides, but must display the hazard class or division number in the lower corner [§172.402].
- When one or more packages of Class 7 (radioactive) material are placed in an overpack, the overpack must be labeled in accordance with [§172.403(h)].
- Overpacks [§173.403(h)]
  - The contents entry may state "mixed" in place of the names of the radionuclides, unless each inside package contains the same radionuclide(s)
  - The "activity" entry must be determined by adding together the activity of the contained packages
  - The TI may be determined by adding together the TIs of the contained packages or determined by direct measurement
  - A different RADIOACTIVE label may be assigned based on the surface contact reading and TI of the overpack
  - For fissile material, the CSI for the FISSILE label on the overpack is the sum of the CSIs present on the packages in the overpack
- A label is not required on a package of LSA or SCO when transported under §173.427(a)(6)(vi).
- Excepted packages [e.g., Limited quantity (UN 2910), Instruments or Articles (UN 2911), and Manufactured articles of uranium and thorium (UN 2909) are excepted from labeling. However if a limited quantity meets the definition for another hazard, it is re-classed for that hazard. Hazard communication requirements for the other class are required [§173.423].
- Empty packages (UN2908) are required to be labeled "EMPTY" in accordance with §173.428.
- The "Cargo Aircraft Only" label is typically required for radioactive materials packages shipped by air [§172.402(c)].

Rev. 1 October 1, 2004

APPENDIX G

Placarding
Laminated Sheet

Hazard Communications for Class 7 (Radioactive) Materials

Placarding (49 CFR Part 172, Subpart F)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments.
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Visibility and Display of Radioactive Placard

- Placards are required to be displayed:
  - on four sides of the vehicle [§172.504(a)]
  - visible from the direction they face on each side and each end of the vehicle (i.e., four placards) [§172.516(a)]
  - on the front of a motor vehicle instead of, or in addition to on the front of the cargo body (i.e., five placards) [§172.516(b)]
  - securely attached or affixed to the vehicle, or in a holder [§172.516(c))(1)]
  - clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins) [§172.516(c))(2)]
  - so far as practicable, be located so that dirt or water is not directed to it from the wheels of the transport vehicle [§172.516(c))(3)]
  - at least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness [§172.516(c))(4)]
  - upright and on-point such that the words read horizontally, left to right [§172.516(c))(5)]
  - in contrast with the background, or have a solid or dotted line border which contrasts with the background [§172.516(c))(7)]
- Placards must be maintained by carrier to maintain format, color, legibility, and visibility [§172.516(c))(6)]

Conditions Requiring Placarding

- Placards are required for any vehicle containing a package with a RADIOACTIVE Yellow-III label [§172.504(e) Table 1]
- Placards are required for shipment of LSA or SCO consigned as exclusive use [§173.427(a)(6)(v)]
- Placards are required for a Highway Route Controlled Quantity (HRCQ) of radioactive material, and
  - must be displayed on a square background [§§ 172.507 and 172.527]
  - HRCQ packages must be labeled with RADIOACTIVE Yellow III labels [§172.403(c)]

Radioactive Placard

49 CFR 172.556

RADIOACTIVE PLACARD (Domestic)

IAEA TS-R-1 (1996) paras. 546-548

RADIOACTIVE PLACARD (International)

49 CFR 172.527 and 556

RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY
(either domestic or international placard could be in middle)

Special Considerations/Exceptions for Placarding

- Domestically, substitution of the UN ID number for the word "RADIOACTIVE" on the placard is prohibited for Class 7 materials [§172.503]. However, some import shipments may have this substitution in accordance with international regulations [§171.12].
- If placarding for more than one hazard class, both placards must display the hazard class number [§172.519(b)(4)].
- Uranium Hexafluoride (UF_6) shipments $ 454 kg (1001 lbs) gross weight require both RADIOACTIVE and CORROSIVE (Class 8) placards on each side and each end [§172.505(b)].
- For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE - YELLOW III label, vehicle placarding is not required (regardless of the label which must be placed on the camera) [§172.403(h)(5)].
- A placard or placard holder may be hinged provided the required format, color, and legibility of the placard are maintained [§172.516(e)].
- Placards must conform to the specifications in §§172.519 and 172.556.

Rev. 1 October 1, 2004

APPENDIX H

Shipping Papers
Laminated Sheet

Hazard Communications for Class 7 (Radioactive) Materials

Shipping Papers (49 CFR Part 172, Subpart C)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments.
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Entries Always Required

- The basic description, in sequence:
  Proper Shipping Name,
  Hazard Class (7),
  U.N. Identification Number
  [§ 172.202(a)&(b)]
- Proper page numbering
  (i.e., Page 1 of 4) [§172.201(c))]
- 24 hour emergency response telephone number (Use of a number that requires a call back - e.g., answering machine - is not authorized) [§§ 172.201(d) and 172.604]
- The total quantity of the material described (mass, volume, or activity) in appropriate units (lbs, mL . . .) [§172.202(a)(5)]
- The number and type of packages [§172.202(a)(6)]
- The name of each radionuclide (as determined by §173.433(g)). The activity must be in SI units (e.g., Bq, TBq), and may be in customary units (e.g., Ci, mCi) in parentheses following SI units. Abbreviations are authorized. [§172.203(d)(1)&(3)]
- If not special form, a description of chemical and physical form [§172.203(d)(2)]
- For each labeled package:
  - The category of label used;
  - The transport index of each package with a Yellow-II or Yellow-III label [§172.203(d)(5)]
  - The criticality safety index of a package with a Fissile label [§172.203(d)(6)]
- Shipper's certification (not required for private carriers) and signature [§172.204]

Entries Sometimes Required

Materials-Based Requirements:

- If Hazardous substance (§171.8), "RQ" as part of the basic description [§172.203(c))(2)]
- "Highway Route Controlled Quantity" or "HRCQ", entered in association with the basic description [§172.203(d)(10)]
- For a package containing fissile material, the words "Fissile Excepted", if the package is excepted by §173.453 or otherwise the criticality safety index for that package [§ 172.203(d)(6)]
- If the material is considered hazardous waste and the word "waste" does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive material, Type A package, 7, UN2915) [§172.101(c))(9)]

Package-Based Requirements:

- Package identification marking for DOE or NRC certified packages [§172.203(d)(7)]
- IAEA Certificate of Competent Authority ID number for export shipments or shipments using foreign-made packaging (see §173.473) [§172.203(d)(8)]

Administrative-Based Requirements:

- "Exclusive Use-Shipment" [§172.203(d)(9)]
- If a DOT exemption is being used, "DOT-E" followed by the exemption number [§ 172.203(a)]
- "Cargo Aircraft Only" [§ 172.203(f)]
- If subsidiary hazard is present, the hazard class or division number [§ 172.202(a)(2)]

Optional Entries

- Additional information is permitted (e.g., functional description of the product), provided it is not inconsistent with the required basic description [§172.201(a)(4)]
- Except for Pu-239 and Pu-241, the weight in g or kg of fissile radionuclides may be inserted instead of activity units. For Pu-239 and Pu-241 the weight in g of fissile radionuclides may be inserted in addition to activity units [§ 172.203(d)(3)]
- Emergency response information may be entered on the shipping papers, or may be a separate document carried with the shipping papers [§ 172.602(b)]

Special Considerations/Exceptions for Shipping Papers

- Excepted packages, [e.g., Limited quantity (UN 2910), Instruments or Articles (UN 2911), Manufactured articles of uranium and thorium (UN 2909), and Empty packages (UN 2908)] are excepted from shipping papers. For limited quantities, this is only true if the limited quantity is not a hazardous substance (RQ) or hazardous waste [§173.422(e)].
- Shipping paper accessibility - accident or inspection [§177.817(e)].
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column, or be highlighted in a contrasting color [§172.201(a)].
- Instructions for maintenance of exclusive use shipment controls for LSA or SCO material must be included with the shipping papers [§§ 173.403 and 173.427(a)(6)(iv)].
- Shipping paper retention, 375 days [§172.201(e)] for shipper. Each mode of transport has a similar requirement (Rail § 174.24(b); Air § 175.30(a)(2); Vessel § 176.24(b); Highway § 178.817(f)).

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