

Chapter 8. Transportation of Radioactive Material.

8-1. Purpose.

This chapter is intended to introduce containment, control, and communication requirements when transporting radioactive material. This chapter is not an exhaustive review of all regulatory requirements which pertain to shipping radioactive material.

8-2. Applicability.

This chapter applies to all personnel who ship or transport radioactive material and all personnel who supervise operations which involve shipments or transportation of radioactive material.

8-3. Regulations.

a. The transportation of radioactive material is regulated jointly at the Federal level by the DOT and the NRC. The division of responsibilities between DOT and NRC is specified in a memorandum of understanding. DOT regulates shippers, carriers, Type A packages and LOW SPECIFIC ACTIVITY (LSA) packages, and it issues Certificates of Competent Authority for International Shipments. Relevant DOT regulations may be found in 49 CFR 170-189.

b. NRC regulates Type B and fissile packages; it is responsible for transportation safeguards; it investigates accidents/incidents, and it is a technical advisor to DOT. Relevant NRC regulations may be found in 10 CFR 71. It is worth noting that 10 CFR 71.5 requires NRC licensees to comply with 49 CFR 170-189.

c. DOE controls and regulates shipments of U.S. Government program related nuclear materials. DOE requires shippers and carriers of non-weapons under their authority to conform to DOT and NRC regulations.

d. U.S. Postal Service (USPS) regulations for mailable radioactive material may be found in USPS Publication 6, latest edition (March 1990)- "Radioactive Material." Mailable packages are limited to those meeting DOT requirements in 49 CFR 173.421 and 173.422 for Limited Quantities and Instruments and Articles EXCEPT THAT the radioactivity content in the package is further limited to one-tenth of DOT limits in Table 7, 49 CFR 173.423.

e. For purposes of transportation, radioactive material is defined as any material which has a specific activity greater than 0.002 $\mu\text{Ci/g}$ (70 Bq/gm) [49 CFR 173.403 and 10 CFR 71.10(a)].

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f. Hazardous material is defined by DOT as any substance, including mixtures and solutions of substances, which the Secretary of Transportation has determined to be capable of posing an unreasonable risk to health, safety and property when transported in commerce (49 CFR 171.8). Radioactive material is considered hazardous material by DOT's definition.

8-4. Procedures.

a. Nuclear transportation regulations ensure safety by effective containment of the material; effective control of the radiation emitted from the package; preventing-criticality for fissile radioactive material; and adequate dissipation of any heat generated in a package. Primarily, safety in transport is accomplished by proper packaging of the radioactive material and by accurately communicating any associated hazards.

b. Hazard communication is achieved through correct marking, labeling, placarding, manifesting, and emergency response information.

8-5. Packaging.

a. In general, there are four types of packages used to transport radioactive material:

(1) Strong, tight containers (STC);

(2) Industrial packagings (IP-1, IP-2, and IP-3);

(3) Type A packages; and

(4) Type B packages.

b. The package required for a particular shipment of radioactive material is determined by the activity or quantity of the shipment. DOT categorizes quantities of radioactive material into five subtypes:

(1) EXCEPTED QUANTITIES which includes:

(a) Limited Quantities (173.421), must be in a STC;

(b) Instruments and Articles (173.424), must be in a STC;

(c) Manufactured Articles of U, DU, or Th (173.426), must be in a STC; and

(d) Empty Packages (173.428), must be in a STC.

(2) LSA QUANTITIES and SURFACE CONTAMINATED OBJECTS (173.427), in an industrial package, in a DOT Spec 7A Type A package, or in a STC;

(3) TYPE A QUANTITIES (p A₁ or A₂ values in 173.435), must be in a Type A package;

(4) TYPE B QUANTITIES (p A₁ or A₂ values in 173.435), must be in a Type B package; and

(5) HIGHWAY ROUTE CONTROLLED QUANTITIES (3000 X A₁ or A₂ values in 173.435, or exceed 27,000 Ci.), must be in a Type B package.

c. When preparing a shipment, a person should first determine the DOT subtype involved. Then, the person can determine the type of package required either by referring to the information and regulatory citations given above or by referring to column 5 of the Hazardous Materials Table (172.101).

d. Each shipper of a DOT Specification 7A package (a Type A package) must maintain on file for at least one year after the latest shipment, and shall provide to DOT on request, DOT package performance test records [49 CFR 173.415(a)].

e. Any shipper of a Type B package that has been approved by NRC in accordance with 10 CFR 71 shall be registered with the NRC as a party to the approval and the shipment must be made in compliance with the approval (49 CFR 173.471).

f. Anyone needing to ship radioactive material, but who has little experience doing so,

should seek assistance from a qualified professional.

8-6. Marking.

a. Packages containing radioactive material must be marked according to 49 CFR 172.300. Proper marking includes:

(1) The proper shipping name and the identification number as shown in 49 CFR 172.101 for packages which are less than 110 gallons;

(2) If transferred to another carrier, the name and address of the shipper (consignor) or the receiver (consignee);

(3) The gross mass if greater than 110 pounds;

(4) "Type A" or "Type B" in ½ inch letters for these types of packages;

(5) "This End Up p" for liquids;

(6) "USA" for international shipments; and

(7) "RQ" for reportable quantities (172.101, App. A).

(8) Shipments where the term "radioactive material" does not appear in the proper shipping name on the manifest and shipments not requiring a manifest must be marked

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"Radioactive Material"

b. The markings must be durable, legible, in English, and printed on or firmly affixed to the package. The markings must be displayed on a background of a sharply contrasting color. Markings must be located away from other markings, such as advertising, that could substantially reduce the noticeability of the marking. Markings must not be covered or obscured by labels or attachments.

8-7. Labeling.

a. Packages containing radioactive material must be labeled according to 49 CFR 172.400. DOT specifies three categories of labels for packages containing radioactive material: Radioactive White-I, Radioactive Yellow-II, and Radioactive Yellow-III. The label required for a package depends on the radiation level at the package surface and at 1 meter from the package surface [the radiation level measured at 1 meter, in mrem/hr, and listed without units is also known as the transport index (TI)]. Each label must include the name of the radionuclide, the activity (in SI units followed by curie units in parentheses), and the TI (Radioactive Yellow-II and -III labels only). Proper labeling includes:

(1) Labels on two opposite sides excluding the bottom;

(2) Labels affixed near the markings (same side) and oriented in the same direction as the markings; and

(3) Label must be durable and able to withstand color change for 30 days.

b. Packages of Limited Quantities, Instruments and Articles, and Manufactured Articles of U, depleted uranium (DU), or Th are exempt from labeling requirements. EXCEPTED QUANTITIES prepared for shipment must have a notice (as written below) enclosed in or on the package, included with the packing list, or otherwise forwarded with the package. Limited Quantity packages and Manufactured Articles of U, DU, or Th packages must have the word "Radioactive" on the inner packaging. Empty packages must have an "Empty" label. LOW SPECIFIC ACTIVITY packages must have a "Radioactive-LSA" label.

c. Excepted quantities notice. The notice must include the name of the consignor or consignee and the statement "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN 2910; 49 CFR 173.422 for excepted

radioactive material, instruments and articles, UN 2911; 49 CFR 173.424 for excepted radioactive material, articles manufactured from natural or depleted uranium or natural thorium UN 2909; or 40 CFR 173.427 for excepted radioactive material, empty packages, UN 2908" as appropriate.

8-8. Placarding.

a. A vehicle transporting a package labeled Radioactive Yellow-III or a vehicle transporting exclusively LOW SPECIFIC ACTIVITY packages and surface contaminated objects in accordance with 173.427(b)(3) must be placarded. The shipper must provide the carrier with all necessary placards. Proper placarding includes:

(1) Placards must be displayed on the front, rear and both sides of the vehicle;

(2) Placards must be durable, legible, and readily visible and must be at least three inches from other markings; and

(3) Placards must conform to the shape, size, color and design requirements specified 49 CFR 172.500.

b. Placarding is also required for vehicles transporting HIGHWAY ROUTE

CONTROLLED QUANTITIES; however, the placard must be placed on a square background.

8-9. Manifesting.

a. Persons shipping other than EXCEPTED QUANTITIES of radioactive material must describe the material on a shipping paper as per 49 CFR 172.200.

b. A shipping paper must contain the following:

(1) A hazardous material entry which must consist of and/or appear as follows:

(a) Appear as the first entry on the shipping paper;

(b) Be designated by an "X" in the hazardous material column ("RQ" may be used in the case of hazardous substances); or

(c) Be highlighted or entered in a contrasting color.

(2) A shipping description which must include:

(a) The basic description - the proper shipping name, hazard class, and identification number (in that order);

(b) The total quantity;

(c) The name of each radionuclide (abbreviations are

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authorized);

(d) Physical and chemical form (if the material is not in special form);

(e) Activity per package measured in SI units followed by curie units in parentheses;

(f) Category of label applied (for example, Radioactive White-I);

(g) TI on Radioactive Yellow-II and Radioactive Yellow-III labels;

(h) For a shipment of fissile materials, see 172.203(d)(7);

(I) Type B package - Certificate of Approval from NRC or DOE, package identification;

(j) Import/export shipments - U.S. Certificate of Competent Authority number;

(k) "Highway Route Controlled Quantity" entered with the basic description for such shipments;

(l) "Limited Quantity" or "Ltd Qty" entered with the basic description for such shipments;

(m) An indication that the shipment is consigned as exclusive use for such shipments;

(n) LSA-I, LSA-II, LSA-III, SCO-I, or SCO-II for such shipments; and

(o) An emergency response telephone number (see paragraph 8-11c).

(3) Each entry must be separated from the next by a comma. The shipping paper must include a shipping certification statement worded exactly as described in 49 CFR 172.204(a). The certification must also include additional clauses for some materials and modes of transportation as described in 49 CFR 172.204. The shipping paper must be signed by the shipper.

(4) When transported by public highway, a shipping paper shall be within the driver's immediate reach while he/she is restrained by the lap belt and either readily visible to a person entering the driver's compartment (that is, NOT in the glove compartment) or in a holder which is mounted to the inside of the door on the driver's side of the vehicle.

8-10. Hazardous Waste Manifesting.

For a shipment of hazardous waste, which includes radioactive waste, a hazardous waste manifest must be prepared according to 40 CFR 262. The RCRA definition of hazardous

waste includes mixed waste but not radioactive waste (see Chapter 9 for a definition of mixed waste).

8-11. Emergency Response Information.

a. Persons shipping other than EXCEPTED QUANTITIES of radioactive material must supply emergency response information as required in 49 CFR 172.600. This emergency information must contain:

(1) The basic description as required by 49 CFR 172.202;

(2) The immediate health hazards;

(3) The risk of fire or explosion;

(4) Precautions to be taken in the event of an accident;

(5) Methods for handling fires;

(6) Methods for handling spills or leaks; and

(7) First aid measures.

b. The information must be in English and be located away from the package containing the radioactive material. The information required must be presented on a shipping paper, in a separate document (for example, a material safety data

sheet), or in a guidance document [40 CFR 172.602(b)]. The information must be accessible to persons entering the vehicle.

c. A 24-hour emergency response telephone number must be on the shipping paper. The emergency response number must be manned by a person who is either knowledgeable of the radioactive material and knows the proper emergency response procedures or has immediate access to someone who does. The emergency number must be for either the person making the radioactive material shipment or for a company willing to accept the responsibility for emergency response. The person making the shipment must ensure that the company is capable of performing the emergency response necessary.

8-12. Hazmat Employee Training.

a. A hazmat employer is defined by DOT as a person who uses one or more of its employees in connection with, among other things, transporting hazardous materials in commerce. A hazmat employer directly affects hazardous materials transportation safety. It is a hazmat employer's responsibility to ensure that each of its hazmat employees receives training such that hazmat employees can recognize

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and identify hazardous materials, know how to respond in an emergency situation, know self-protection measures, and know accident prevention methods (49 CFR 172.700).

b. Hazmat employees shall receive the training at least once every two years. Training provided by employers to comply with OSHA regulations (29 CFR 1910.120) or EPA regulations (40 CFR 311.1) may be used to satisfy DOT's hazmat employee training requirements if the topics specified in the preceding paragraph are covered.

c. Subpart I, "Radiation protection program." of 49 CFR 172 requires that a hazmat employee's annual effective

dose equivalent of occupational radiation exposure not exceed 1.25 rem per three months or five rem per 12 months (0.125 rem per three months or 0.5 rem per 12 months for workers under the age of eighteen).

8-13. Exceptions.

Exceptions exist for nearly all DOT regulations. These exceptions are listed in Title 49 near each applicable part. One major exception of importance is that the International Air Transport Association (IATA) Dangerous Goods Regulations may be used in place of Title 49 for any shipment where at least one leg of the shipment will be by air. IATA is similar to, but much simpler than, Title 49.