



# Technical Safety



## RADIATION PROCEDURES MANUAL

### Procedure Cover Sheet

Procedure Title: Transportation of Radioactive Material

Procedure Number: TSO-00-55-REV 0

Effective Date: March 2, 2010

Approved by:   
Technical Safety Office Director

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## A. INTRODUCTION

Radioactive materials of any kind may be transported on public roads on or off University property only if packaged and labeled in compliance with U.S. Department of Transportation (DOT) regulations. Radioactive materials may be shipped from the University to another organization or individual only after verification by the Technical Safety Office that all transfer, packaging, labeling and transportation requirements have been met. No Radioactive Material may be transported in private vehicles.

To assure that all requirements for shipment are met, and that appropriate records are maintained, a written authorization form and one or more check lists must be prepared by the Technical Safety Office before the shipment is made. The instructions and forms for various applications are contained in the Radiation Procedures and Records related to those applications. Transportation of Limited Quantities of Radioactive Materials is covered in RPR14.

## B. PURPOSE

This procedure identifies pertinent regulations and provides guidelines and checklists to assure compliance with federal and state regulations during transportation of radioactive materials on or off University property and when preparing radioactive materials for shipment to another organization or individual.

## C. REQUIRED MATERIAL(S)

Forms: RPR14-1  
RPR14-2  
RPR14-3 (if applicable)  
RPR55-1 (if applicable)  
RPR55-2 (if applicable)  
RPR55-3 (if applicable)  
RPR55-4 (if applicable)

## **DEFINITIONS** (from 49CFR)

### Definitions and Abbreviations [49CFR171.8]

**Carrier:** A person engaged in the transportation of passengers or property by:  
(1) Land or water, as a common, contract, or private carrier, or (2) Civil aircraft.

**Designated Facility:** A hazardous waste treatment, storage, or disposal facility that has been designated on the manifest by the generator.

**Hazardous Material:** A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property when transported in commerce, and which has been so designated. (All radioactive materials except homogenous substances with specific activities of less than 2 nCi/g are considered hazardous materials.)

**Hazardous Waste:** Hazardous wastes are defined by the EPA in 40CFR 161.3. For transportation purposes, a hazardous waste is any material that is subject to the Hazardous Waste Manifest Requirements of the EPA specified in 40CFR 262. 40CFR262.11 states that a person who generates a solid waste should first determine if the waste is excluded from regulation. Section 40CFR261.4, Exclusions, states: "(a) The following are not solid wastes for purpose of this part:" Under (a), only one subparagraph is relevant:

"(4) Source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011 et seq." 10CFR20.3(a)(3) defines byproduct material as any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material. 10CFR61.2 states: "Waste" means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility.

(According to these definitions, low-level radioactive wastes are not "hazardous wastes" by EPA definition, although the definitions do not include accelerator-produced or naturally occurring radioactive materials. To avoid confusion, the term "waste" should not be used on the manifest or shipping papers for low-level radioactive wastes.)

**Limited Quantity:** The maximum amount of hazardous material for which there is a specific labeling and packaging exception.

**N.O.S. or n.o.s:** Not otherwise specified.

**Shipping Paper:** A shipping order, bill of lading, manifest or other shipping document serving a similar purpose and containing the information required by 49CFR172.202, 49CFR172.203 and 49CFR172.204.

Subpart I – Radioactive Materials – Definition [49CFR173.403]:

**Contamination Limits:** Removable contamination on the surfaces of any package or vehicle shall be determined by wiping an area of 300 cm<sup>2</sup>; the measured activity on the wipe shall not exceed 3 nCi (6600 dpm) of beta emitters, natural uranium or thorium, or 0.3 nCi (660) dpm for other alpha emitters. (49CFR173.443)

**Type A Quantities:** A<sub>1</sub> is the maximum activity of “special form” material and A<sub>2</sub> is the maximum activity for any other radioactive material that may be shipped in a Type A package. Values of A<sub>1</sub> and A<sub>2</sub> for selected radionuclides are listed in 49CFR173.436 or Table 1 or this procedure.

**Exclusive Use:** The sole use of a conveyance by a single consignor, and for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. Any loading or unloading must be performed by personnel having radiological training and resources appropriate for safe handling of the consignment. Specific instructions for maintenance of exclusive use shipment controls must be issued in writing and included with the shipping paper information provided to the carrier by the consignor.

**Fissile Material:** Any material containing one or more of the fissile nuclides Pu-238, Pu-239, Pu-241, U-233 and U-235. For controls see 49CFR173.455; for exclusions see 49CFR173.453

**Highway Route Controlled Quantity:** A single package which contains 3,000 times the relevant A<sub>1</sub> or A<sub>2</sub> quantity or 30,000 curies, whichever is least. Any package containing highway route controlled quantity must bear a “Radioactive Yellow-III” label regardless of external dose rates.

**Limited Quantities:** Packages that are exempt from the specific packaging and labeling requirements because they contain no more than the following:

**Solids:** 0.001 A<sub>1</sub> or A<sub>2</sub>

**Liquids:** 0.0001 A<sub>2</sub>

**Gases:** 0.001 A<sub>1</sub> or A<sub>2</sub>

Additional limits for tritiated water, tritium gas and for instruments and devices are provided in 173.423.

**Low Specific Activity (LSA):** The following materials are classified as LSA:

- U or Th ores and concentrations
- Unirradiated natural U or Th
- Depleted U
- Tritiated oxide in aqueous solutions not exceeding uniformly distributed, and with a concentration not exceeding :

0.001 mCi/g if A<sub>2</sub> is not more than 0.05 Ci.

0.005 mCi/g if  $A_2$  is between 0.05 Ci and 1 Ci  
0.3 mCi/g if  $A_2$  is more than 1 Ci.

**Radioactive Material:** Any material having a specific activity greater than 70 Bq/g (0.002 mCi/g), in accordance with 49CFR173.403. Also, non-radioactive material (activity less than 70 Bq/g) with surface contamination (both fixed and non-fixed/removable) that, when averaged over each 300 cm<sup>2</sup> of all surfaces, is equal to or greater than 0.4 Bq/cm<sup>2</sup> ( $10^{-5}$  mCi/cm<sup>2</sup>) for Beta and Gamma emitters and low-toxicity Alpha emitters; and equal to or greater than 0.04 Bq/cm<sup>2</sup> ( $10^{-6}$  mCi/cm<sup>2</sup>) for all other Alpha emitters.

**Specific Activity:** Activity means the activity of the radionuclide per unit mass of the nuclide. For a material in which the radionuclide is essentially uniformly distributed, specific activity means the activity per unit mass of the material.

**Transport Index:** A dimensionless number derived from the maximum dose rates at 1 meter from the package surface expressed in mrem/hr and rounded upward to the nearest 0.1 mrem/hr.

**Type A Package:** One designed to retain the integrity of containment and shielding under normal Conditions of transport as demonstrated by tests specified in 173.465 and 173.466. Standard requirements for all packages are contained in 173.24 and the specifications for Type A packages are defined by Specification 7A in 178.350.

**Type B Package:** Meets special test requirements for normal and hypothetical accident conditions of transport as specified in 10CFR71.51, 71 and 83. Any quantity of radioactive material exceeding the  $A_1$  or  $A_2$  quantities is a Type B quantity.

## D. PROCEDURE

### LOCAL TRANSPORTATION PROCEDURES

**Transportation Authorization:**

Transportation of radioactive materials between individuals or facilities within the University is permitted only if authorized in advance by the TSO.

**Original packages from vendors:**

Packages containing radioactive materials received by common carrier may be transported in the original, unopened container. If the package has been

opened, care must be taken to assure that it has been resealed and that no contamination is present before it can be reused.

**Non-specification containers:**

Many of the radioactive materials that are transported locally, such as radioactive wastes, meet the definitions of Limited Quantities or Low Specific Activity. For these materials, non-specification containers may be used provided that they are strong and tight. For Limited Quantities, the transport vehicle does not require placarding; however, placarding is required for LSA materials in an exclusive-use vehicle. Arrangements for transportations of any radioactive material on public roads must be made in advance with the TSO.

**Transfer and Shipment Records:**

Each transfer of radioactive material, even locally, must be accompanied by an appropriate record, which also serves as a shipping paper. Shipments of limited quantities of radioisotopes are recorded on "RADIOISOTOPE LIMITED QUANTITY CHECKLIST" (RPR-14). All other transfers or shipments are to be recorded on the forms attached to this procedure.

**AIRBORNE SHIPMENTS**

The only radioactive materials that may be transported on a passenger-carrying aircraft are those intended for use in, or incident to, research or medical diagnosis or treatment. Detailed regulations for air shipments of materials requiring Yellow-II or Yellow-III labels are contained in 175.700.

**SHIPPING PROCEDURES**

1. Obtain shipping information /data from the requester, documented on form RPR14-1 "REQUEST FOR SHIPMENT OF RADIOACTIVE MATERIAL".
2. Classify the material, and document the process on form RPR 14-2 "CLASSIFICATION OF SHIPMENT OF LIMITED QUANTITY OF RADIOACTIVE MATERIAL".
3. Determine packaging, marking, labeling of the proposed shipment.
4. Determine routing, as necessary.
5. Select carrier, as necessary.
6. Obtain packaging as needed/requested.
7. Retain requester-supplied shipment information, used to classify material, with hazardous material shipping records.
8. Verify shipment compliance using the checklist for radioactive material, RPR55-1  
NOTE: Shipments exempted from packaging, marking, labeling, and shipping papers do not require the use of a checklist.
9. Determine that radiological surveys have been conducted, and radiation, contamination, and activity are within classification and packaging limits.
10. Ensure that the quality control requirements of 49CFR173.475 have been met prior to the shipment of radioactive material (see def.) using checklist RPR55-2.

11. Verify that material is properly loaded in the packaging, per applicable regulations.
12. Prepare necessary shipping documentation:
  - a. DOT shipping papers
  - b. Dangerous Goods Declaration
  - c. Special shipping instructions, if applicable
  - d. Shipping checklist (RPR 55-1).
13. Provide carrier with shipping papers, exclusive use instructions RPR 55-3, emergency response guide, or other documents, as warranted.
14. Inspect each hazardous material shipment prior to departure to ensure compliance to DOT, or ICAO regulations, as applicable.
15. Verify the vehicle is appropriate and in proper conditions, such as operating lights, turn signals, mirrors, tires, and brake lights; and that the vehicle contamination limits are not exceeded (RPR 55-3).
16. Ensure shipment is properly configured, segregated, and blocked, braced, or secured.
17. Verify the driver has proper credentials.
18. Offer placards, when required by DOT.
19. Ensure that the consignee is authorized (license/contract number, and isotope and quantity) or receive radioactive material.
20. If containers are authorized by an NRC Certificate of Compliance (CofC), verify the CofC is valid, and ISU is a registered user.
21. Ensure that TSO has a current copy of the CofC, upon request.
22. Ensure that Type A and Type B packages have properly applied tamper-indicating device (TID).
23. Obtain a compliance review by a second TSO shipper. Document this review by signing the checklist.

## REFERENCES

49CFR  
40CFR  
10CFR



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**REVISION TRACKER**

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Original Procedure