

# NRC INSPECTION MANUAL

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## INSPECTION PROCEDURE 86730

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### TRANSPORTATION OF RADIOACTIVE MATERIALS (49 CFR PARTS 100-179 AND 10 CFR PART 71)

PROGRAM APPLICABILITY: 2515

#### 86730-01 INSPECTION OBJECTIVE

To evaluate reactor licensees' transportation programs for implementing the Department of Transportation (DOT) and NRC transportation regulations for preparation and shipment of radioactive materials.

#### 86730-02 INSPECTION REQUIREMENTS

This procedure is to be implemented to independently assess licensee conclusions regarding extent of condition of issues, when selected as a part of supplemental inspections using IP 95002, "Supplemental Inspection For One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area."

02.01 Training and Qualifications of Personnel. Review the training, knowledge, and performance of radiation protection technicians (RPTs), radwaste workers and supervisors in the transportation area.

- a. Determine whether the licensee's employee training program and continuing retraining programs for RPTs, radwaste workers, and supervisors adequately address the transportation regulations. 49 CFR Part 172, Subpart H, requires that each hazmat employer provide initial and periodic training to its hazmat employees. Review the training modules, qualifications of instructors, and the exams taken and grades received. Focus on the following topics:
  1. LSA and SCO hazards, definitions, and requirements.
  2. Placarding, labeling, and marking of vehicles and packages.
  3. The fissile transport index system of criticality control of package arrays, conveyance package limits, and the special controls exercised or arranged by the shipper for

fissile material packages that have been assigned a criticality transport index of greater than 10 (49 CFR 173.457).

- b. Determine whether the training provided to regular and contract RPTs, radwaste workers and supervisors, and occupationally exposed workers, covers their responsibilities with respect to: (1) processing and packaging of LSA material and SCO for transportation, (2) preparation or review of shipping papers, labels, and other functions where SI units are required, and (3) special controls over the shipment of fissile material, as applicable.
- c. Determine, by observation, if possible, whether RPTs and other radwaste workers are performing their duties safely and in accordance with licensee training and procedures.

02.02      Transportation of LSA Materials and SCO

- a. Review the licensee's procedures for the processing and packaging of LSA material and SCO. Review procedures for determining degree of uniformity of LSA material. Review procedures for leaching test requirement for LSA-III material (49 CFR 173.468 and 10 CFR 71.77 specify a leach test required to demonstrate that LSA-III material is relatively insoluble as required by its definition).
- b. Determine whether management and supervisory oversight are effective with respect to training; procedure generation, maintenance, and implementation; follow-up and correction of deficiencies noted in event reports; engendering effective communications between work groups and supervisory and management levels concerning processing and packaging of LSA materials and SCO.
- c. Review the licensee's plans for the use of packaging for shipments of LSA material and SCO. Review the licensee's written justification for the planned use of industrial packages, strong tight packages, Type A packages, or Type B packages, based on the characteristics of the waste mix and the limitations that must be applied to the package as prepared for transport.
- d. Review several shipping papers associated with shipments of LSA material or SCO already completed. Determine if the licensee's procedures comply with the applicable regulations, and if the shipping records indicate the shipment was made in accordance with the licensee's procedures.
- e. If possible, observe a shipment of LSA materials being prepared for shipment and loaded into a shipping container. Can the radioactive component of the materials be reasonably described as "essentially uniformly distributed" or as "distributed throughout," depending on the requirement imposed?

- f. If possible, observe a fully loaded LSA material package being checked to verify the calculation that shows compliance with the regulatory limit on the unshielded external radiation level of 10 mSv/h (1 rem/hr) at 3 meters. Evaluate the written procedure and its basis. Verify that computer codes, where utilized, are consistent with the current NRC/DOT regulations. Review the backup procedures for use in case the computer codes are unavailable or appear to provide incorrect results.
- g. If possible, observe the sampling and analysis of at least one waste stream which may be shipped as LSA material (e.g., spent dewatered resin). Follow up by examining shipping papers for that or a similar shipment to see if the requirements of 49 CFR 173.433 are satisfied as to the radionuclides that must be entered on shipping papers and labels.
- h. Select a shipping container used by the licensee (Type A or B) and review the current certificate of compliance (COC). Verify that all applicable COC requirements are properly incorporated into the licensee's implementing procedures for handling, loading and unloading.

02.03      Radionuclide List and Use of Scaling Factors

- a. To assure that packages do not exceed their allowable radioactivities, audit selected  $A_1$  and  $A_2$  values to verify that the correct values are used in licensee procedures. Suggested radionuclides include: Cs-137, Co-60, Zn-65, Rb-86, and some transuranics.
- b. Review the licensee's procedures for identification of nuclei (e.g., scaling factors and sampling plans) to verify that the waste streams have been adequately characterized. Verify that this information has been incorporated into implementation of the "95% rule" for listing radionuclides on shipping papers (§173.433).

02.04      Classification of Fissile Material

- a. Review the licensee's procedures for the use of the transport index and special controls for the prevention of criticality in transportation of fissile material to assure they are consistent with the fissile material requirements. Ensure that all COC requirements have been properly included in the licensee's implementing procedures for each cask used to ship fissile materials.
- b. Review, if possible, several sets of shipping papers associated with shipments of fissile material already completed. Focus on the identification of fissile material and on the transport index and special controls assigned for its control during transport.

- c. Discuss any changes (since the last inspection) to the computer codes for calculating the assigned transport index for criticality control during transport.

## 86730-03 INSPECTION GUIDANCE

### General Guidance

The central focus of this procedure is to ensure that licensees' programmatic controls implement the requirements of 49 CFR Parts 100-179 and 10 CFR Part 71.

### Specific Guidance

03.01 Training and Qualifications of Personnel. For contract or vendor employees not specifically covered by the licensee's radiation protection program, NRC Generic Letter 95-09, "Monitoring and Training of Shippers and Carriers of Radioactive Materials," provides additional guidance. This Generic Letter states that licensees can accept, as adequate, training received by carriers under requirements imposed by the DOT relative to shipments of radioactive material. A carrier's certification of that training should suffice.

### 03.02 Transportation of LSA Materials and SCO.

- a. 1. Surface contaminated objects (SCO) are by definition objects which are not themselves radioactive, but have radioactive materials distributed on their surfaces. The implication of this definition is that objects that are radioactive themselves (e.g., activated objects) and are also contaminated cannot be classified as SCO. Such objects may, however, be regarded as LSA material insofar as the requirements specified in the LSA definition are complied with.
2. For an object to qualify as LSA material it is necessary to ascertain that the licensee complies with the applicable limits on estimated average specific activity. In assessing the average specific activity, all radioactive material attributed to the object, i.e., both the distributed activity and the activity of the surface contaminations, needs to be included. As appropriate, additional requirements applicable to LSA material need to also be satisfied in order for the objects to qualify as LSA material.
3. Examples of inaccessible surfaces are:
  - (a) Inner surfaces of pipes, the ends of which can be securely closed by simple methods.

- (b) Inner surfaces of maintenance equipment for nuclear facilities.
  - (c) Glove boxes with access ports blocked-off for disposal.
4. If the SCO contamination limits are exceeded, a Type A or Type B package would be needed, depending on the  $A_2$  fraction in the package.
  5. Absorbent materials (e.g., wipes and towels) would generally be treated as LSA material, not SCO.
  6. When mixing SCO and LSA materials in a single package, both materials should meet their respective definitions before being mixed together, and then the container could be considered to be LSA.
  7. Pre-shipment processing of materials may change the category of material. For example, if contaminated pieces of tubing were collected and compacted, reducing the internal void spaces, a material which would be SCO if uncompact could be better characterized as LSA after compaction. Incineration is another, more obvious example of pre-shipment processing. Some judgement on the part of the licensee and inspectors will be necessary in this area.
- b. No Specific guidance.
  - c. Several authorized packages exist for shipments of LSA/SCO material (49 CFR 173.427).

If the requirement of 49 CFR 173.427(a)(1), for the unshielded dose rate limit, is satisfied, non-accident-resistant packages may be used. According to 49 CFR 173.427(e), LSA or SCO that exceeds the packaging limits in § 173.427 (i.e., unshielded dose rate limit), must be packaged in accordance with 10 CFR Part 71 (i.e., in accident-resistant, Type B packages). Note that 10 CFR 71.52 contained an exemption for LSA/SCO material transported as exclusive use. However, that exemption, (which is the 10 CFR 71.51 requirements to make Type B packages accident resistant) expired April 1, 1999. These non-accident-resistant packages may no longer be used for the transport of LSA/SCO material which cannot satisfy the unshielded dose rate criteria.

NRC certified packages for LSA materials are listed in the "Directory of Certificates of Compliance for Radioactive Materials Packages," NUREG-0383. The authorized contents specified on these certificates are based on the LSA definitions from the old rules. NRC revised the certificates for these packages to: (1) show an expiration date of April 1, 1999; and (2) to limit the specific activity allowed to correspond to that of the old rules (i.e., basically 0.1  $\mu\text{Ci/g}$  for nuclides with an  $A_2 \leq 0.05 \text{ Ci}$ ; 5  $\mu\text{Ci/g}$  if  $0.05 < A_2$

$\leq 1$  Ci; or 0.3 mCi/g for nuclides with an  $A_2$  greater than 1 Ci). Licensees must have a copy of the revised certificates before using an NRC certified package to ship LSA material or SCO (and must ship in compliance with the revised Certificate).

The non-accident resistant packages identified in 49 CFR 173.427 include: the industrial packages (§§ 173.410 and 173.411); and for domestic use only, the Type A packages, including Spec 7A packages (§§ 173.410, 173.412, and 173.415); the strong tight packages (§§ 173.410 and 173.24); and the NRC approved LSA packages (§ 173.427(e) and § 71.52, see the above paragraph). Note that the exemption from labeling and marking of LSA packages (§173.427(a)(6)(vi)) applies only to packages designated as strong tight containers in exclusive-use, domestic shipments, where the quantity per package is less than one  $A_2$ ; or to bulk packaging of LSA-I and SCO-I for which shipment is performed pursuant to § 173.427(c).

d. Communications requirements include, in part:

1. § 172.203(d)(10) requires that "Exclusive use shipment" be added on the shipping paper, if appropriate.
2. Note that the group notation (LSA-I, LSA-II, LSA-III, SCO-I, or SCO-II) must appear on the shipping paper, but is not part of the proper shipping names from § 172.101.

e. In the definition of LSA, a distinction is made between the terms "essentially uniformly distributed" and "distributed throughout." The term "essentially uniformly distributed" is intended to be more restrictive than "distributed throughout." Both terms are intended to disallow LSA classification for a material with very high radioactivity (such as a leaking sealed source) in one location and a large quantity of non-radioactive material surrounding it, thereby reducing the average concentration to within specified limits. If, in such a case, the packaging were destroyed during transport, and the high activity portion were separated from the non-radioactive portion, it could cause substantial radiation exposure, either from direct radiation or through a pathway (e.g., inhalation). The IAEA models justifying the special rules applied to LSA shipments, assume uniform distribution of any LSA material released from the package.

Because the distribution of the radioactivity in the LSA material is an important factor in meeting the LSA definitions, each licensee must be able to demonstrate that the radioactive component of his LSA material is "essentially uniformly distributed" to a reasonable extent, or that it is "distributed throughout" the LSA material, depending on the requirement imposed. A quantitative standard has not been developed, and NRC and DOT are currently considering guidance development. There is some advisory material in IAEA Safety Series No 37 (Ref. 6), as amended 1990, but NRC and DOT have

not determined the general applicability of this advisory material.

- f. The appropriate packaging requirements (i.e., NRC certification or not) will be determined by the 1 rem/hr dose rate limit at 3 meters from the unshielded contents. The inspector should review the licensee's procedures for making this determination. Licensees generally base the determination on measured dose rates from the package surfaces; and prior knowledge about the package contents through routine sampling (for process wastes), or through specific sampling of the contents (e.g., for objects/components). A back-calculation can then be performed which effectively removes all packaging (including liners) from the contents. It is expected that licensees may develop or purchase systematic procedures or programs which relate measured dose rates, frequently used package types, and waste stream information, to the unshielded dose rate at 3 meters. The technical bases for these procedures should be reviewed. Independent verification (through measurement) of the unshielded dose rates by inspectors may not be practical; and qualitative, bounding evaluations may be necessary. As a quick point of reference, for a cylindrical volume of 130 cubic feet, 1 rem/hr at 3 meters could be on the order of 5A<sub>1</sub> quantities of gamma emitters (Co-60). Inspectors should also review the licensee procedures relative to ALARA program requirements.

g. No specific guidance.

h. No specific guidance.

#### 03.03 Radionuclide List and Changes in Radionuclide Limits

a. No specific guidance.

b. No specific guidance.

#### 03.04 Classification of Fissile Material

- a. The *Transport Index* for fissile materials packages is the maximum of (1) the radiation level (to the nearest tenth), in mrem/hr, at 1 meter from any surface, or (2) a number "50/N", rounded up to the nearest tenth. "N" in (2), above, is a calculated number (during package certification) such that: 5N water reflected undamaged packages would be subcritical with nothing between them, and 2N damaged packages (i.e., subjected to hypothetical accident conditions in § 71.73) would be subcritical with optimum interdispersed hydrogenous moderation and reflection.

b. No specific guidance.

c. No specific guidance.

86730-04 Resource Estimate. It is anticipated that 25 to 35 inspector-hours on-site will be needed to complete the requirements

of this procedure. Multi-unit sites sharing a single transportation service require the same amount of time.

#### 86730-05 REFERENCES

Regulations for the Safe Transport of Radioactive Material, 1985 Edition (As Amended 1990), Safety Series #6, International Atomic Energy Agency, Vienna, Austria.

Explanatory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition (As Amended 1990), Safety Series No 7, International Atomic Energy Agency, Vienna, Austria.

Radiation Protection Guidance to Federal Agencies for Occupational Exposure: Recommendations Approved by the President, (January, 1987); U.S. Environmental Protection Agency, Washington, DC 20460.

Hazardous Materials Transportation Regulations; Compatibility with Regulations of the International Atomic Energy Agency; Notice of Final Rule Making, 60 FR 50292; United States Department of Transportation; Published 9/28/95.

Compatibility With the International Atomic Energy Agency (IAEA); Notice of Final Rulemaking, 60 FR 50248; United States Nuclear Regulatory Commission; Published 9/28/95.

Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition (As Amended 1990), Safety Series No 37, International Atomic Energy Agency, Vienna, Austria.

#### Appendix:

A. EFFECTIVE DATES OF DOT-NRC TRANSPORTATION AMENDMENTS  
PUBLISHED ON SEPTEMBER 28, 1995

END

APPENDIX A

EFFECTIVE DATES OF DOT - NRC TRANSPORTATION AMENDMENTS  
PUBLISHED ON SEPTEMBER 28, 1995  
60 FR 50292

A: U.S. Department of Transportation Regulations 49 CFR Parts 170-189

1. November 1, 1995 - Voluntary compliance date of all amendments.
2. April 1, 1996 - General effective date of amendments.
3. April 1, 1997 - Mandatory use of SI (International Systems) units.
4. April 1, 1997 - Final date for authorized use of Specification 7A packagings designed in accordance with § 178.350 which was in effect on June 30, 1983 (§ 173.415).
5. October 1, 1997 - Mandatory compliance with 49 CFR Part 172, Subpart I - Radiation Protection Program.

B: U.S. Nuclear Regulatory Commission Regulations 10 CFR Part 71

1. August 31, 1987 - Final date to complete fabrication of a package the design of which was approved by NRC but without the designation B(U) or B(M) in its assigned identification number. Packages fabricated after that date cannot be used under the NRC general license in 10 CFR 71.12.
2. April 1, 1996 - General effective date of amendments.
3. March 1, 1998 - Date for mandatory compliance with Uniform Low-Level Radioactive Waste Manifest rule (Appendix G, Section I, to 10 CFR Part 20), unless disposal facility implements this rule prior to this date.
4. April 1, 1999 - 10 CFR 71.52 (LSA exception from Type B requirements) expires. After this date, packages for LSA/SCO shipments, where the external radiation level at 3 m from the unshielded material exceeds 10 mSv/h (1 rem/h) (see LSA exemption in § 71.10(b)(2)), can be approved by NRC only if they satisfy all Type B package requirements.
5. April 1, 1999 - Final date to complete fabrication of a package with a design approved by NRC but without the designation "-85" in its assigned identification number. Packages fabricated after that date cannot be used under the NRC general license in 10 CFR 71.12.

END