What Should Be Included in Operating Procedures for Packages*

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INTRODUCTION

There is a wide variation in the operating procedures currently used for shipping radioactive material to and from various nuclear facilities. This paper gives guidelines which are based on the broad experience that exists in the shipping industry and are consistent with subpart G of 10 CFR 71, and is based on NUREG/CR-4775 (1988). This paper is a very condensed version of the NUREG/CR; the reader should obtain the original for complete information.

Two separate documents related to package operations are usually prepared for shipping packages. The first is a section of the SAR, usually Section 7.0, which provides information on package operations that is specific to the package. The second document is a detailed manual that is used by the package operators and handlers. It comprises all information included in the operating procedures in the SAR (in greater detail), plus all additional information necessary for package operations which is not package specific.

1.0 OPERATING PROCEDURES IN SAFETY ANALYSIS REPORTS

1.1 Summary of Operating Requirements and Restrictions

This section is intended to alert the reader to all requirements and restrictions related to package operations. Each section of the SAR (i.e., thermal, structures, containment, criticality, shielding, etc.) should provide input to this section. All requirements and restrictions related to package operations should be briefly listed in this summary.

1.2 General Information

The operating procedures in the SAR should include appropriate quantitative and qualitative criteria for determining that important activities have been satisfactorily accomplished.

1.3 Package Loading

The operating procedures in the SAR provide instructions on package loading.

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1.4 Shipment Preparation

The operating procedures in the SAR must provide instructions on shipment preparation.

1.5 Package Receipt

The operating procedures in the SAR should give instructions to the package recipient on at least the following items: ensuring that radiological surveys and safety inspections of both the packaging and the transport vehicle are made, and verifying that the contents are properly identified and in what form they are shipped.

1.6 Package Unloading

The operating procedures in the SAR provide instructions for package unloading.

1.7 Inspection and Maintenance

This section of the operating procedures in the SAR refers to Chapter 8 of the SAR, titled "Acceptance Tests and Maintenance Program."

1.8 Records and Reporting Requirements

1.8.1 Records

Title 10 CFR 71.91 requires the licensee to maintain for a period of two years after shipment a record of each shipment of licensed material, and gives a list of information that is to be recorded. Title 10 CFR 20.401(b) gives additional record keeping requirements including survey and monitoring requirements. Title 10 CFR 21.51 also requires the maintenance of records.

1.8.2 Reports

Incident reporting requirements are given in 10 CFR 71.95, 10 CFR 20.402, 10 CFR 20.403, 10 CFR 20.405, 49 CFR 171.15, 49 CFR 171.16, 49 CFR 171.17, and 49 CFR 174 through 177.

2.0 DETAILED OPERATING PROCEDURES MANUALS

This section addresses the detailed operating procedures manual which is written for the package handlers and operators, and this manual is based, in large part, on the operating procedures section of the SAR.

2.1 Summary of Operating Requirements and Restrictions

This section is intended to alert the reader to all requirements and restrictions related to package operations. All such requirements and restrictions delineated in the SAR should be listed. This list will include drawing and revision numbers for all package components; a description of the form and fissile load of the contents; any handling restrictions (such as lifting height limits or dual load path requirements); any neutron poison, moderator, and gap requirements; expected gamma and neutron radiation level, and locations of any streaming paths; and any closure and component testing requirements.

2.2 General Information

2.2.1 Planning

Operating procedures should stress the importance of planning each operation carefully, before any action is taken.

2.2.2 Personnel Qualifications

The operating procedures should describe the required training for a particular shipping package system.

2.2.3 Equipment

All equipment required for each aspect of shipping package operations should be listed at the front of each section where the equipment is discussed in the operating procedures.

2.2.4 Quality Assurance

The operating procedures should include appropriate quantitative and qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished, per the requirements of 10 CFR 71.111.

2.3 Package Loading

2.3.1 Package Preparation

Operating procedures for loading radioactive material packaging should require at least the following checks before the payload is placed within the package:

1. That the CofC permits the radioactive material to be shipped within the particular package used.

2. That package sealing surfaces have been properly prepared and protected so that the package will seal reliably.

3. That all required rigging and hoists are available and rated adequately for their intended use.

4. That all payload treatment processes performed subsequent to package loading are appropriate for the particular payload in question, and that process equipment operators are familiar with both the processing procedures and the package operating procedures.

5. That packaging interior contamination levels are not excessive so that significant contamination could be imparted to the payload itself.

6. That any check valves operate as designed.

7. That any other non-passive systems, such as cooling or closure systems, operate properly and without undue force.

8. That all closure fasteners and devices are of the proper material and grade, and that they operate properly.

9. That all required parts of the packaging, processing equipment, and shoring (if required) are available and ready for use.

10. That all seals which will not be disturbed during the loading or package closure process have been properly leak-tested since their last disturbance, if such a test is required by the package CofC or SAR.

2.3.2 Contents Insertion

Procedures for contents insertion will vary greatly depending on the particular use of the packaging. In some cases, as in a multi-use package used to transport various types of low-level waste from a power plant to a disposal site, the operating procedures for the packaging should reference payload-specific procedures for the insertion process, and should delineate all pertinent operational limits or cautions that should be addressed by those procedures.

Loading requirements to ensure criticality safety should be explicitly stated. Other chemical and physical hazards of the payload should also be stated as well as what measures should be taken to avoid exposing personnel to hazardous situations.

2.3.3 Closure Placement, Package Assembly, and Leak Testing

If any interim closure measures are to be employed following package loading, operating procedures should give direction on readying the package for final closure.

To ensure proper closure, operating procedures should describe all inspections necessary immediately prior to closure placement.

If the package must be vented to allow proper placement of closure devices (as with a bore seal), the procedure should be described. The procedure should anticipate possible closure problems and give suggested methods of overcoming them.

Operating procedures should direct the order of installation of all closure devices and fasteners as well as any torque requirements placed on closure fasteners.

Operating procedures should direct the proper order of assembling of various package parts such as overpacks.

2.3.4 Closing and Sealing

The step-by-step procedures on closing and sealing should have sufficient precautions for cleanliness, gasket condition, proper preload on lid fasteners, venting, purging (if required), and any other necessary requirements for the specific package.

2.3.5 Package Transfer or Handling

Operating procedures for transfer of the packaging from the loading site to the transport vehicle should reflect considerations similar to those expressed in Section 2.3.1.

2.3.6 Decontaminating

The exterior surfaces of a shipping package and the transport vehicle should be essentially free of removable radioactive contamination. The contamination levels should be ALARA and shall not exceed regulatory limits.

2.4 Shipment Preparation

2.4.1 Requirements Prior to Shipment

Prior to each shipment of licensed material, the shipper must ensure that the requirements of 49 CFR 173.475 and 10 CFR 71.87 have been satisfied.

In addition, the shipper must ensure that the requirements of 10 CFR 71.85, giving determinations required prior to first use, have been satisfied and documented. Also, the shipper must ensure that the records required by 10 CFR 71.91 are complete. The shipper should ensure that the requirements of 10 CFR Part 73 have been taken into account.

2.4.2 Testing

The specific testing required for any package depends on the design and the payload the package is carrying. The required testing that should be referenced or described in the operating procedure can be found in the applicable regulatory guide, such as NRC Regulatory Guide 7.4 for leak testing, and in the CofC and SAR for the specific package.

2.4.3 Surveying

Prior to releasing the package for shipment, the package and surrounding area must undergo a complete radiation and radiological contamination survey. The surveys at the time of shipment are required by 49 CFR 173.441, 49 CFR 173.443, 10 CFR 71.47, and 10 CFR 71.87(i).

2.4.4 Marking and Labeling

The marking and labeling of the package depends on the type of package and the payload. Permanent labeling basically consists of that information required by 10 CFR 71.85.

The detailed labeling of the packaging is shipment-specific. The separate procedure should require the package and vehicle to be labeled per 49 CFR 173.444 and 49 CFR 173.471.

2.4.5 Securing to Vehicle

The system by which the package is secured to the transport vehicle must meet all applicable DOT requirements. The operating procedures should indicate proper tie-down configuration(s), which are in agreement with the tiedown analysis presented in the SAR. Elements of the tie-down system not structurally part of the package are covered by applicable DOT (49 CFR 177.842(d) and 49 CFR 393.100, 102, and 104) and industry standards, such as ANSI N14.2 and N14.25, and not by 10 CFR 71. The configuration of the tie-downs, however, is germaine to the SAR analysis and, therefore, must be carefully respected, e.g., load paths which are assumed present in the SAR actually are present, and load paths which are not specifically noted in the SAR are not present.

2.4.6 Preparation of Empty Package for Transport

After the contents have been removed safely, a reusable package should be inspected per the requirements of 49 CFR 173.427 to determine its suitability for shipment as an empty radioactive material package. If it is determined that the package interior does not meet the requirements of 49 CFR 173 for empty radioactive material packaging, then operating procedures should require that the package either is decontaminated or is prepared for shipment as a Type A or B package.

2.4.7 Shipping Documents and Notifications

The operating procedures should cover the various types of payloads that could be shipped and the required documentation and notifications. The CofC and the SAR should be checked to ensure that the proposed shipment is allowed for the specific package.

2.5 Package Receipt

2.5.1 General

The written procedures should, at a minimum, reference the surveys and inspections that are required by law immediately upon receipt of the package and prior to opening or handling. The NRC and the DOT regulations are primarily concerned with the assurance that the receiver is properly licensed, that the written procedures have been provided for the use of the package, and that the surveys and inspections performed on the package indicate that it was properly used. The majority of these functions are covered under 10 CFR 20.205.

The technical aspects of receiving a package vary from package to package and are highly dependent on the nature of the package and the payload. However, some items are the same for all packages. These include: insuring that appropriate paperwork is available for handling operations; verifying what the contents are and in what form they are shipped; and insuring that radiological surveys and safety inspections are made of both the package and the transport vehicle.

2.5.2 Inspections and Surveys

The most important surveys to be performed on the package are contamination and radiation surveys. These surveys should be performed and reported in accordance with 10 CFR 20.205. The operating procedure should provide a check list of survey locations and sequence. When various auxiliary features of the packages are disassembled (e.g., sun shields, impact limiters, and personnel barriers), surveys should be performed.

2.5.3 Removal from Vehicle (if required)

Normally the removal of any package from a transport vehicle requires some type of lifting or rigging of the package. As in any lifting or rigging operation, a carefully planned procedure using correct equipment is the best way to ensure a safe operation.

Other considerations involve proper disconnection of the package from the vehicle. All the connections must be disengaged completely. This includes any auxiliary equipment such as sunshields that may interface with the removal of the package. Conversely, none of the closure connections that actually retain the lids should be inadvertently disconnected.

When the package is lifted, additional surveys and swipes should be taken to ensure that there is no contamination that may have been trapped under the package.

2.5.4 Cleaning and Flushing

The package should be cleaned of road dirt, snow, etc., prior to opening, when practical. This will reduce the amount of material that would have to be treated as contaminated material. In particular, the area around seal areas should be cleaned to reduce the chance of any spread of contamination.

2.6 Package Unloading

2.6.1 Transfer Preparations

Writing the procedures for transfer preparation calls for careful attention to all of the options that the package may have and to the various payloads that it may be carrying. More than one procedure may be required, depending on the various options available. Depending on the possible configurations of the package and payload, the package may need special cleaning, flushing, and purging, or special tools and handling equipment.

2.6.2 Closure Removal

Operating procedures should define which fasteners should be removed and in what order they should be removed. A check list of all required fastener operations should be available to ensure that these operations are completed prior to any actual movement of closures. Special instructions should be provided where special handling considerations exist. These may include procedural methods of minimizing stress on sensitive parts, minimizing the potential for seal damage, minimizing decontamination problems, and alleviating ALARA concerns, e.g., clearing the area of unnecessary personnel.

Provision should be made for the possibility of internal pressure or vacuum being present within containment. Some cases will require pressure equalization prior to or during closure removal operations. Operating procedures should clearly indicate the proper method for equalizing pressure, and what precautions should be taken regarding the escape of radioactive gases.

Because the internal surfaces of closures may be severely contaminated, they should be surveyed as soon after removal as possible. It may be necessary to provide shielded storage areas for the closures.

2.6.3 Contents Removal

Procedures for the removal of package contents may vary depending on the type of contents and the type of package. Some packages will require very detailed instructions for removal of contents. Other packages, typically those designed for a wide variety of payloads, must have removal instructions written allowing for more operator latitude.

Operating procedures should require that the interior of the empty packaging be inspected for damage or the presence of loose debris, after contents are removed. Such debris should be removed and disposed of properly, with regard for its possible level of contamination.

2.7 Inspection and Maintenance

Seals and gaskets are to be inspected before and after each shipment and replaced whenever damage is detected. Damage may include nicks, gouges, scratches, chemical damage, and damage due to overcompression.

2.8 Records and Reporting Requirements

2.8.1 Records for Each Shipment

Title 10 CFR 71.91 requires the licensee to maintain a record of each shipment of licensed material, and gives a list of information which is to be recorded. Title 10 CFR 20.401(b) gives additional record keeping requirements including survey and monitoring requirements. Title 10 CFR 21.51 also requires the maintenance of records.

2.8.2 Reports

The licensee should follow all notification requirements of 10 CFR 73.27, as well as 10 CFR 73.71, 73.72, 73.73, 73.74, and 10 CFR 21.

Incident reporting requirements are given in 10 CFR 71.95, 10 CFR 20.402, 10 CFR 20.403, 10 CFR 20.405, 49 CFR 171.15, 49 CFR 171.16, 49 CFR 171.17, and 49 CFR 174 through 177.

REFERENCES

Witte, M.C., *Guide for Preparing Operating Procedures for Shipping Packages*, NUREG/CR-4775, UCID-20820, Lawrence Livermore National Laboratory, (1988).

Title 10, Code of Federal Regulations, Part 71, Packaging and Transportation of Radioactive Material, Office of the Federal Register, Washington, DC.

Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation, Office of the Federal Register, Washington, DC.

Title 49, Code of Federal Regulations, Part 173, Shippers–General Requirements for Shipments and Packagings, Office of the Federal Register, Washington, DC.