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Guide for Preparing Operating Procedures for Shipping Packages

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Prepared for
U.S. Nuclear Regulatory Commission

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This report imposes no requirements.

PREFACE

This report provides guidance for writing manuals of operating procedures for shipping packages used for radioactive materials. The work was performed by the Lawrence Livermore National Laboratory (LLNL) and was funded by the Division of Engineering within the Office of Nuclear Regulatory Research of the Nuclear Regulatory Commission (NRC).

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INTRODUCTION

Background

To protect the health and safety of the public, shipping packages used to transport radioactive materials must be operated in accordance with subpart G of Title 10 of the Code of Federal Regulations (CFR) Part 71 and according to the quality assurance plan approved by the Nuclear Regulatory Commission (NRC). Specific criteria for using a shipping package must be documented in a Safety Analysis Report (SAR) that is reviewed and approved by the NRC prior to the first use of the shipping package. A Certificate of Compliance (CofC) is issued by the NRC, which authorizes the use of a package for transporting radioactive material. The shipper then develops detailed operating procedures based on criteria in the approved SAR and CofC. If there are conflicts between the CofC and the operating procedures, the CofC governs.

There is a wide variation in the operating procedures currently used for shipping radioactive material to and from various nuclear facilities. This NUREG/CR 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.

Purpose and Scope

Two separate documents related to package operations are 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. This document is referred to in this NUREG/CR as "operating procedures in the SAR." 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. This second document is referred to in this NUREG/CR as the "operating procedures manual."

This NUREG/CR addresses both the operating procedures in the SAR and the operating procedures manual for packages used to transport radioactive material. The purpose of this NUREG/CR is to give guidance in writing the operating procedures for the SAR and the operating procedures manual. General and specific requirements that should be included in each document are provided.

This NUREG/CR has two main sections. The first section covers information which should appear in the operating procedures section of the SAR. The second section covers information which should appear in the more detailed operating procedures manuals used by the operators and handlers of shipping packages.

The individual sections of this NUREG/CR recommend the format, contents, and levels of detail for both documents.

Procedures Format and Content

The same basic format is used for both the operating procedures portion of the SAR and the operating procedures manual. The major headings of the procedures for both documents are listed below:

1. Summary of Operating Requirements and Restrictions
2. General Information
3. Package Loading
4. Shipment Preparation

5. Package Receipt
6. Package Unloading
7. Inspection and Maintenance
8. Records and Reporting Requirements

1.0 OPERATING PROCEDURES IN SAFETY ANALYSIS REPORTS

This section addresses the contents of the operating procedures provided in the SAR. These SAR operating procedures, usually in section 7.0, contain all package-specific information about package operation drawn from all other sections of the SAR. These procedures in the SAR become the foundation for the more detailed of operating procedures manual.

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. Details should not be included here, but rather in sections 1.2 through 1.8. Each section of the SAR (i.e., thermal, structures, containment, criticality, shielding, etc.) should provide input to this section, as shown in Figure 1-1. All requirements and restrictions related to package operations should be briefly listed in this summary. This list will include drawing and revision numbers for all package components (as required for operations); a description of the form (solid, liquid, powder, etc.) and fissile load of the contents; any package handling restrictions (such as lifting height limits or dual load path requirements); any neutron poison, moderator, and gap requirements; expected gamma and neutron radiation levels, and locations of any streaming paths; and any closure (such as closure lid bolt torques necessary for containment) and component testing (such as pressure taps) requirements.

1.2 General Information

The operating procedures in the SAR should list any special equipment required for handling the particular package and include all pertinent details.

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. Instructions on the following items might be included:

1. Listing any special equipment that may be needed.
2. Ensuring that package sealing surfaces have been properly prepared and protected.
3. Checking 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 processing procedures and the package operating procedures.
4. Checking that all package components operate as designed and have been tested if necessary.
5. Contents insertion.
6. Closure placement and package assembly.
7. Decontamination of exterior surfaces of shipping package and transport vehicle.
8. Package transfer from the loading site to the transport vehicle.

1.4 Shipment Preparation

The operating procedures in the SAR must provide instructions on shipment preparation. These instructions should include at least the following items:

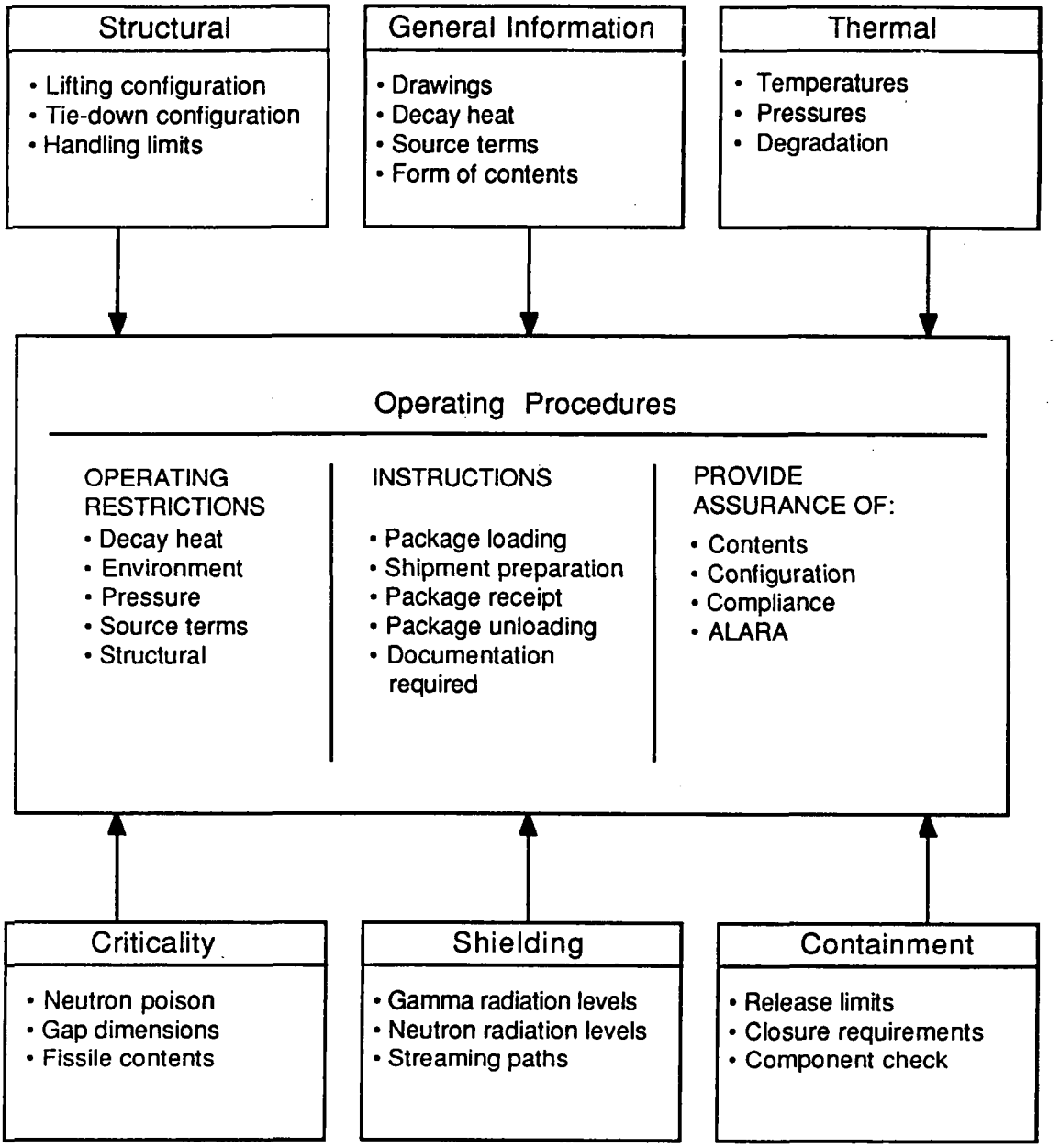

Figure 1-1 The operating procedures in the SAR include information from all other sections of the SAR.

1. Required package testing prior to release for transport.
2. Securing package to vehicle, including acceptable tie-down configurations.
3. Rendering unused lifting devices inoperable.
4. Temperature survey requirements.
5. Radiation survey requirement, including a determination of surface contamination.
6. Decontamination inspection and any other requirements for preparation of empty package for transport.

1.5 Package Receipt

The operating procedures in the SAR should give instructions to the package recipient on at least the following items:

1. Ensuring that radiological surveys and safety inspections of both the packaging and the transport vehicle are made.
2. Verifying that the contents are properly identified and in what form they are

1.6 Package Unloading

The operating procedures in the SAR provide instructions for package unloading. Instructions on the following items should be included:

1. Any special equipment that may be needed.
2. Closure removal.
3. Contents removal.
4. Inspection of interior of packaging after contents have been removed.
5. Possible preparation of packaging for short- or long-term empty storage.

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 for Each Shipment

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 Records of Package History

The licensee shall make all records available to the NRC for inspection, upon reasonable notice. The licensee shall maintain, during the life of the packaging to which they pertain, sufficient quality assurance records to furnish documentary evidence of the quality of packaging components that have safety significance and of services affecting quality. The records to be maintained include results of the determinations required by 10 CFR 71.85, and results of monitoring, inspection, and auditing of work performance during the design, fabrication, assembly, testing, modification, maintenance, and repair of the packaging. In addition, records required by 10 CFR 20.402(c)(2) must be maintained until the NRC authorizes their disposition.

The operating procedures in the SAR should specify how and where these records are to be maintained.

1.8.3 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. These regulations specify conditions and timing for reporting incidents including the following: any significant reduction in package effectiveness during use, any defects with safety significance found after the first use of a package, any loss or theft of licensed material, exposure to personnel or to the public above levels specified in 10 CFR 20.403(b), contamination or suspected contamination, and any fire, spillage or breakage. The operating procedures in the SAR should specify all package-specific reporting requirements required by these regulations.

2.0 DETAILED OPERATING PROCEDURES MANUALS

This section addresses the detailed operating procedures manual which is written for the package handlers and operators. 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 (as required for operations); a description of the form (solid, liquid, powder, etc.) 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 (such as closure lid bolt torques necessary for containment) and component testing (such as pressure taps) requirements. Details should not be included here, but rather in the appropriate section 2.2 to 2.8. The list of applicable drawings needs to appear only once in the procedures manual so that it is a simple revision to update the drawings if this is required during the lifetime of the package.

2.2 General Information

2.2.1 Planning

Operating procedures should stress the importance of planning each operation carefully, before any action is taken. Planning should include a review of the operating procedures and related drawings to assure that packaging, shipping, receiving, storage, and handling activities can be accomplished as specified. Planning should also include listing any anticipated problems and possible solutions.

2.2.2 Personnel Qualifications

Persons who perform any duties in shipping package operations should be trained in handling and inspecting the specific package, as well as in general techniques in safe handling of radioactive materials. The operating procedures should describe the required training for a particular shipping package system.

The training should include, but not be limited to:

a. Field training and trials
b. High-consequence operations training and briefing for possible exposure to chemical or radiological hazards
c. ALARA training
d. Written tests
e. Review of appropriate sections of the SAR, CofC, regulations, and other applicable documents, including the NRC approved QA program for transport packages.

The training should be of sufficient depth to thoroughly familiarize the personnel with the specific types of radioactive materials and with the specific packaging that they will be handling. After the initial in-depth training, persons involved in shipping package operations should undergo an annual refresher course. Those persons who perform inspection, examination, or testing of shipping packages should go through training such as that required by ANSI/ASME NQA-1.

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. This list should include all necessary specifications. If the same equipment is used for several different operations (e.g., package loading and package unloading), it should, nevertheless, be included in every section where the use of the equipment is discussed, with a reference for the specifications to the first section where the equipment is listed.

The operating procedures should list measures to assure that tools, gages, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specific times to maintain accuracy within necessary limits, per the requirements of 10 CFR 71.125.

2.2.4 Quality Assurance

As used in this guide, quality assurance (QA) comprises all those planned and systematic actions necessary to provide confidence that the shipping package operating procedures will provide the necessary guidance so that all package operations will be performed.

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.

In addition, the operating procedures should instruct the registered user of a package to obtain and maintain on file the certification from the supplier of the packaging that those elements of QA done by that supplier were in fact accomplished in accordance with the supplier's QA program.

2.3 Package Loading

2.3.1 Package Preparation

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

1. That all appropriate documents have been reviewed by operating personnel (the SAR, the CofC, the applicable portions of 10 CFR 71 and 49 CFR 173, and all other documents referenced by the procedures) and are available for review if necessary.

2. That the CofC permits the radioactive material to be shipped within the particular package used. This determination must be made in accordance with the guidelines provided in 10 CFR 71.83, when applicable.

3. That the package has been properly maintained, i.e., that all required periodic maintenance has been performed and documented within the scheduled requirements of the CofC, SAR, and maintenance program. This check may include verification on the QA received from the package supplier.

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

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

6. That all payload treatment processes performed subsequent to package loading (e.g., dewatering, solidification, volume reduction, and cooling) 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. The processing personnel should determine that the particular process employed is not inconsistent with the package handling requirements, as specified in the operating procedures.

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

8. That any check valves operate as designed.

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

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

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

12. 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. In this way, exposure to leak test personnel may be minimized.

It may be desirable to cover some or all of the exterior of the package prior to loading as a means of minimizing any possible decontamination efforts that may be required. Also, some seals may require special protective devices to be installed before contents are placed within the package. Operating procedures should describe such appropriate protective measures.

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. For example, when contents are inserted through a package secondary closure device and are subjected to a contents dewatering process, the operating procedures should indicate any temperature, handling, or material requirements the package design may impose on the dewatering process. Package operating procedures should require that processing personnel review these requirements and demonstrate by written documentation that the requirements are met.

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. For example, the chemical and physical (phase change) properties of uranium hexafluoride are very unstable in many situations. These properties should be discussed in conjunction with proper handling procedures of the material and packaging so that the operator will appreciate the considerations involved in the event of inadvertent deviations.

Operating procedures should describe inspections or cleaning procedures required after the contents are inserted. These procedures may include a visual check to ensure that debris has not accumulated on seal surfaces during the loading operation, that liquid fill lines that may be required

by the package design or use are flushed, or that all loading hardware has been removed from the package.

If the package is not to be closed and shipped immediately, the operating procedures should describe interim measures which should be taken immediately following loading to keep exposure to personnel ALARA and to protect essential packaging features such as valves and seals.

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. Procedures should be written to minimize exposure to operations personnel while the package is being so prepared.

To ensure proper closure, operating procedures should describe all inspections necessary immediately prior to closure placement. Seals should be given a final check to ensure that they are free from debris and have not been damaged during loading operations. Operating procedures should specify any shoring requirements that are effective.

Operating procedures should specify any special handling requirements for placement or operation of the closure device. These might include care to reduce the possibility of seal damage, to improve fastener fit-up, or to reduce operator exposure.

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. This may include the acceptability of employing various kinds of force to complete the installation of any of the various closure devices used in the package design.

Operating procedures should direct the order of installation of all closure devices and fasteners as well as any torque requirements placed on closure fasteners. If leak testing is required, operating procedures should specify when testing should be performed and the acceptance criteria. Operating procedures should, at a minimum, reference an acceptable leak test procedure but may include elements of the leak test within the operating procedure itself.

Operating procedures should direct the proper order of assembling of various package parts such as overpacks. If a special shipping structure such as a skid or pallet is to be used with the packaging, the interface and assembly of the package with this hardware should be described in detail.

2.3.4 Closing and Sealing

The closing and sealing of a package is important in determining the performance of the package in both normal and accident events. The extra care taken in a well written procedure, as well as during performance of the procedure, will result in reduced maintenance, less repeated work, and a reduction in personnel exposure.

These step-by-step procedures 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. In addition to the required precautions, the procedure should give some troubleshooting guidance if the closure cannot be properly secured initially.

The procedure should have sufficient detail to ensure that the final configuration is as shown on the SAR drawings. The closure procedures should not prescribe a final package configuration in conflict with the requirements of any of the applicable analyses in the SAR.

Some types of payloads, such as low level waste, have the potential for the generation of explosive gases. Operating procedures for packages that could transport these payloads should allow for venting and/or purging to eliminate this potential hazard. Many CofC for such packages require verification of gas generation conditions or require venting prior to release for shipment. For these cases, appropriate precautions must be implemented in the procedure to assure that these requirements are met.

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. These considerations include radiological, rigging, and compliance with the design considerations in the SAR. A check should be made to ensure that the transport vehicle is appropriate for the transportation of the load.

Specific consideration should be given to the radiological situation. Even if all handling is to be performed within a radiologically controlled boundary, caution should prevent any spread of contamination. For the package, the main concern is external contamination. Potential for external contamination is particularly high when partially assembled packages are handled, or during the testing of the package prior to shipping.

As with all procedures, those governing handling of the package should be a detailed step-by-step procedure. If the package can be handled in a partially assembled state, the procedure should relate clearly what is required for each step. Information such as how secure the lids have to be, or whether they have to be installed at all should be clearly stated to prevent mishandling or damage to the package. Many large-diameter packages require that their lids are completely installed prior to lifting to prevent damage. Design-specific precautions coupled with good rigging and radiological practices will provide a reasonable procedure for the handling of most packages.

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.

Both 10 CFR 71.87(i) and 49 CFR 173.443 require that limits for removable external radioactive contamination be met when measured on a wipe taken on a shipping package surface. The limits also apply to any transport vehicle used to transport radioactive material. Measuring techniques other than wiping may be used in accordance with the referenced regulations.

These guidelines should be considered in developing decontamination operation procedures:

1. Prior to being placed into the unloading area where contamination can occur, the shipping package should be placed onto a soft transportable surface such as wood or plastic. This action reduces the amount of contaminants that might become imbedded into the surface that supports the weight of the shipping package. A sheet of plastic or paper which is disposed of upon each use may further reduce contamination.

2. A protective surface coating or bag may be installed to reduce or eliminate contamination from specific areas of the shipping package. The protective surface coating or bag should be removable after operations have been completed.

3. If the shipping package is to be submerged into contaminated water and a protective coating or bag is not used, the outer surface should be wetted with water prior to immersion. This has the effect of sealing the pores in the metallic and painted surfaces.

4. After the shipping package has been placed into the loading/unloading area and the closure has been removed, a protective shield may be installed in the closure region to prevent contaminants from falling onto exterior surfaces of the package while the radioactive contents are being removed or inserted.

5. If the shipping package is immersed into contaminated pool water, the entire exterior surface should be rinsed immediately after the package is raised from the pool water. The exterior surfaces should be dried with composite padding or cloth rags, which should not contain any chemicals, oils, etc. If a sleeve is to be used prior to immersion in the pool, the operating procedure should give explicit instructions as to its use.

6. A decontamination agent should be applied, rinsed off, and then dried with clean padding or rags over sections of the package. The decontaminating agent should not contain oils, sulfur, or halogens or other chemicals that could damage the shipping package surface, mask smearable contaminants, or inadvertently add unwanted elements into the pool water.

7. Fibrous nonmetallic abrasive scrubbing pads which will not scratch the package surface may be used to scrub contaminated areas, especially the area on which the shipping package sat during operations.

8. After each segment of the shipping package has been decontaminated, a radiation monitor should survey the package surface. Decontaminating and surveying of the package should be repeated until the limits in 2.1 are not exceeded.

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. Examples of these requirements are:

1. The packaging is proper for the contents to be shipped;
2. The packaging is in unimpaired physical condition, except for superficial marks;
3. Each closure device of the packaging, including any required gasket, is properly installed, secured, and free of defects;
4. For fissile material, each moderator and neutron absorber, if required, is present and in proper condition.
5. Each special instruction for filling, closing, and preparation of the packaging for shipment has been followed;
6. Each closure, valve, or other opening of the containment system through which the radioactive content might escape is properly closed and sealed;
7. Each packaging containing liquid in excess of an A_2 quantity and intended for air shipment has been tested to show that it will not leak under an ambient atmospheric pressure of not more than 0.25 atmosphere, absolute, (0.25 kilograms per square centimeter or 3.6 psia). The test must be conducted on the entire containment system, or on any receptacle or vessel within the containment system, to determine compliance with this requirement;
8. The internal pressure of the containment system will not exceed the design pressure during transportation;

9. External radiation and contamination levels are within the allowable limits specified in this subchapter;
10. Any system for containing liquid is adequately sealed and has adequate space or other specific provision for expansion of the liquid;
11. Any pressure relief device is operable and set in accordance with written procedures;
12. The package has been loaded and closed in accordance with written procedures; and
13. Any structural part of the package which could be used to lift or tie down the package during transport is rendered inoperable for that purpose unless it satisfies the design requirements of 10 CFR 71.45.

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 must also determine that the packaging has been maintained in accordance with the maintenance schedule and maintenance program as presented in the SAR and CofC. The shipper should ensure that if applicable, the requirements of 10 CFR Part 73 have been taken into account. The operating procedures should explicitly list all requirements of this section.

2.4.2 Testing

Prior to release of a package for shipment, several tests may be required. Although these tests need to be performed before the final radiological surveys, some radiation and contamination surveys should be performed before the start of any testing, for the benefit of the testing personnel.

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. The basis for these requirements can be found in the SAR.

The shipper must ensure that the accessible package surface temperatures will not exceed the limits specified in 10 CFR 71.47 at any time during transportation.

The test procedures should be detailed, specifying all special tools, as well as possible corrective actions to be taken if the package does not pass any particular test. The procedure should emphasize safety and radiological control for the operator (ALARA). Supplemental information that may aid in resolving potential problems may be added to the procedure by appendices or references. Examples of helpful supplemental information might be a listing of potential problems and the appropriate corrective action, or detailed cleaning procedures.

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). The results of these surveys must, at a minimum, meet the levels set by the NRC and the Department of Transportation (DOT). Some sites and facilities have more restrictive limits that must be met prior to release of the package. The procedures should reference the government regulatory limits as well as levels that may be specific to the site.

The procedure requires detailed radiological surveys to ensure that the external surfaces of the package have no smearable contamination beyond the limits specified. The procedure should give guidance regarding strategic survey techniques considering the specific geometry of the package. A check list of survey areas, including known areas of potential contamination such as

penetrations, closure areas, and other contamination trap areas, should be provided to ensure proper surveying.

"Wrapping" the exterior of transport packages in order to achieve compliance with removable contamination limits is not an acceptable practice, unless the wrapping itself had been addressed in the package SAR.

A visual survey of the complete package should ensure that it is assembled correctly. This survey should cover the general condition of the package including verification that tamper-indicating devices are installed correctly; lifting eyes are covered, if required; fasteners are secured correctly; and personnel barriers, impact limiters, sunshields, and/or rain covers are correctly installed and secured. The operating procedure should include a check list for this survey.

2.4.4 Marking and Labeling

The marking and labeling of the package depends on the type of package and the payload. Some of the labeling is permanent and other labeling is shipment-specific.

The permanent labeling basically consists of that information required by 10 CFR 71.85. This includes model number, gross weight, and a package identification number assigned by the NRC. These items are usually included in the name plate information, and the model and identification number is conspicuously and durably marked on the side of the package. All permanent labeling is usually installed during fabrication of the package and does not need to be discussed in the operating procedure. The general condition of this permanent labeling should be checked prior to each shipment.

The detailed labeling of the packaging is shipment-specific. The basis for this labeling is the payload description which should be carefully reviewed prior to any labeling. The separate procedure should require the package and vehicle to be labeled per 49 CFR 173.444 and 49 CFR 173.471. Any old labels from previous shipments should be removed.

The procedure should also cover the proper placarding of the vehicle and labeling of the package. Per 49 CFR 173.446 and 49 CFR 173.427 the procedure should give a clear definition of what is considered to be an empty package and how it should be labeled. Determining and labeling a package as empty will influence a number of handling actions, such as the required testing. Placards should be secured to prevent loss or change during transport.

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. Loads used in the SAR to size the tiedown structure, which is a structural part of the packaging itself, are not necessarily the same as those used to design the parts of the tiedown system, which are not structurally part of the package. 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. Operating procedures describing acceptable tie-down configurations should use nomenclature consistent with that used in the SAR.

Due to the high mass density of many package designs, operating procedures should require that transport vehicle load ratings be reviewed for adequacy in light of the concentrated load.

Loads from the entire tie-down system should be combined with weight effects to ensure that the vehicle structure is adequate. Vehicle flexibility coupled with road-induced vibration can cause tiedown systems to work loose or fail. Therefore, the tie-down load path should be as direct as possible without compromising any required configuration constraints. Operating procedures for especially heavy packages, particularly those licensed for exclusive use shipments, should require that the main structure and tie-down system of the transport vehicle be inspected for integrity prior to release of the package for shipment. The operating procedure should contain a check list for this inspection. It should include, at a minimum, a visual inspection of main beam web-to-flange welds for cracks, beam webs for cracks, and tie-down structure for any signs of distortion or failure. The tie-down structure includes the entire load path from the package back into the main structural elements of the vehicle. Wooden decking materials, if present, should be inspected for integrity.

The operating procedures should also reference any other restrictions to the tie-down system described in the SAR or the package CofC. These restrictions may include interface materials, blocking restrictions, allowable bearing surfaces, feasibility of placing cargo above the package, stacking, temperature restrictions, center of gravity locations, package orientations, or power, pneumatic, or hydraulic requirements.

The operating procedures should require that all devices on the package which could be used for lifting, but are not capable of resisting three times the weight of the package without yielding, are provided with a suitable disabling device or cover prior to release of the package for shipment. Likewise, all features on the package which could be used as tie-down devices, but are not designed to be used as such, should be similarly disabled. The operating procedures should specifically note which devices require such treatment and which do not.

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 the package is to be reloaded prior to being released from the licensed facility, then this inspection should not be required. 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 per the requirements of Section 2.3.6 or is prepared for shipment as a Type A or B package, as applicable per the requirements of the package CofC and 49 CFR 173.

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 paperwork and classification of the shipment should be completed in accordance with the DOT and NRC requirements. These requirements include 10 CFR 71.91 for Records, 10 CFR 71.95 for Reports, 10 CFR 71.97 for Advanced Notification, and 49 CFR 173.471 for the use of U. S. NRC approved packages. This section in the operating procedure should not give a detailed description of the paperwork and classification process. However, it should reference standards such as ANSI N14.10 and NRC Regulatory Guides such as 7.1, 7.2, and 7.3 which give guidance in filling out the appropriate documentation.

The CofC and the SAR should be checked to ensure that the proposed shipment is allowed for the specific package. The description of the payload in the shipping documents should be in a form that can be readily correlated to that description in the package CofC.

In addition to the documentation and notification required by the federal regulations specified above, the separate radioactive material shipping procedure used at a specific site should cover any local or state notification or documentation requirements.

In addition to the documentation required for transport, other documentation may be required for the specific contents. This may include a Radioactive Shipping Report (RSR) or certification to the requirements of 10 CFR 61 for low level waste shipments.

2.5 Package Receipt

2.5.1 General

The section on package receipt in the operating manual should cover two general areas: 1) regulatory requirements and 2) technical inspections that must be made to establish the condition of the package and payload.

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. All procedures should reference this regulation controlling the receipt of radioactive material packages.

Title 10 CFR 20.205 controls both the radioactive contamination surveys and the radiation surveys that must be made on any package received. It also gives instructions on how soon after receipt of the package that these surveys and inspections must occur. If the results of either the contamination survey or the radiation survey exceed the limits specified, 10 CFR 20.205 requires that the licensee report these results to the appropriate NRC Regional Office and the final delivering carrier. The shipper should also be notified. If this is the case, the operating procedures should direct the carrier and the package recipient to impound the package until the proper authorities have been notified. All three, 10 CFR 20.205, 10 CFR 71.89, and 10 CFR 71.111, require that the licensee using the package must maintain procedures for safely opening packages in which licensed material is received.

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. Before instructions for performing the surveys and inspections are given, careful thought should be given to what needs to be accomplished and to any special features of the package in question. This would relate to checking areas that could be overlooked, or checking traps for rain water, etc. In the procedure, the person performing the first general inspection should be directed to note the general condition of the package and the transport vehicle and to look for things that are not specifically called out in the procedure. Many times this general inspection will detect important details that might otherwise be overlooked. It also gives an opportunity to look at the whole situation, allowing a number of small defects that are not significant in themselves to be evaluated for their possible overall impact.

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 surveys, in addition to covering radiological precautions, are a prime indicator of proper performance and assembly of the package. Since many packages are designed with several parts, these surveys should continue throughout the disassembly. 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. These surveys will help detect any possible leakage or shifting of payload that would impact the unloading operation.

Contamination surveys of both the package and the transport vehicle should be made to ensure that no radioactive material (payload or package contaminant) has leaked out of the package. The package and vehicle should also be examined for any moisture or water that may have been trapped on the package and then moved, during normal transportation, to a visible location. This is particularly true for packages that are designed to be used in and around fuel pools. Additionally, all water should be checked for contamination and noted. Even if all water turns out to be rain water, corrective action can be initiated to eliminate its collection or reduce its confusion with possibly contaminated water. Large quantities of rain water, snow, etc., should be removed from the package and transport vehicle so that they will not interfere with cleaning or opening operations of the package.

In addition to the required radiological surveys, a comprehensive visual survey of the package should be made to ensure that the package was properly assembled and has not sustained any significant damage. Careful attention should be given to possible damage to components that would affect the unloading of the package, such as lifting eyes, closure devices, or auxiliary equipment (e.g., personnel barriers or sunshields). Specific instruction should be given for any special features of the package that could be easily damaged or could sustain damage that might not be noted otherwise.

Labeling and placarding of a package and vehicle should be checked to ensure that they comply with regulations and that the payload and package expected is indeed what was received. Improper labeling and placarding should be reported to the shipper.

The inspection should determine that any tamper indicating devices are intact. If these devices are not intact, it should be reported to the licensee and shipper. Tiedowns for the package should also be inspected for proper attachment and wear. Significant damage such as excessive wear or broken, frayed or cracked connectors should be noted and reported to the shipper.

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 that does not damage the package or other equipment. Care should be taken to plan the process, select correctly sized equipment, avoid interface problems, etc. This care should be reflected in the written procedures.

All of the lifting and handling limitations addressed in the SAR must be met when removing the package from the transport vehicle. This is usually covered by using good rigging practices normally imposed at a given site. However, since 10 CFR 71 imposes special lifting requirements that are analyzed in the SAR, assumptions in the SAR should be addressed in the procedure. These include all aspects of the actual lift. Typically certain lift configurations are analyzed in the SAR, and these must be used when lifting the package. This also requires that specific lift points may or may not be used. Weights and locations of the centers of gravity of the package and contents may be calculated and must be considered in the lifting operation. Minimum lengths of connecting cables may be specified in the SAR to ensure that proper lift angles are met. Sometimes

spreader bars are required. The information required, whether length of sling, lift angle or mandated special equipment, should be referenced as a minimum in the operation procedures.

The correct size of lifting equipment must be available to ensure that the proper factors of safety are met. Using undersized lifting equipment should be avoided. The high density of the shielding for many packages can cause deception in the true weight of the package, particularly for smaller packages. The operating procedures should specify the correct configuration of the package during the lift. Many waste packages are not designed to be lifted with the lids removed. Others require overpacks, sunshields, etc., to be removed prior to lifting. Still other packages are required to be in a certain orientation, e.g., vertical, horizontal, or horizontal in a saddle or skid. The procedures should be specific as to whether tiedown points can be used for lifting or not. The procedure should have precautions against using either slings as basket hitches or other equipment in ways that may cause damage to fire shields, cooling fans, impact limiters, or other components of the package.

As in all aspects of using and maintaining equipment, the compatibility of materials used in and around the package must be considered. The improper use of carbon steel slings can cause carbon steel to be embedded into the stainless steel outer shells of some packages causing corrosion and decontamination problems.

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. Caution is especially important on bottom loading packages. 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.

The procedure should call attention to the placement of the package. The final location of the package should be planned prior to the removal. Again, the high density of many package shields may cause deception, and many floors and surfaces cannot support the weight safely. Depending on the type and use of the package being unloaded, the type of surface that it is placed on may need to be specified. Some packages require flat horizontal surfaces to allow for removal of the lids or closures.

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. The external cleanliness of many packages is especially important because of their use in controlled clean areas such as hot cells or fuel pools.

If the package is to be placed in a pool, the package must be cleaned and flushed completely to prevent cross contamination. If the package has any removable features such as impact limiters, raincovers, tiedown clamps, or secondary lids, they should be removed and surveyed prior to cleaning and flushing to ensure that nothing is trapped that can be carried into the pool. The removal of the auxiliary equipment prior to the cleaning procedure minimizes the amount of potentially contaminated materials.

Selection of the cleaning methodology, solution, and equipment calls for material compatibility with the package. Many packages use outer shells of austenitic stainless steel for ease of maintenance and decontamination, dictating the use of cleaning solutions low in chlorine. If mechanical methods are used, their effect on the surface finish, whether bare metal or painted,

should be considered. The flush and cleaning water or solution should be checked for possible 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. Checking the name plate for the model number and checking the shipping papers for the payload description will help to ensure that the correct procedures and equipment are used.

In the first part of the transfer procedure should be a list of any special equipment that may be needed. This list should include any special lifting equipment and any special tools (e.g., purge assemblies or handling fixtures) that might be required during unloading. Special lifting and handling equipment should have both the design load value and the load test value clearly listed in the procedure. This listing will minimize confusion when the package is used at many different facilities, each with its own unique safety requirements.

The procedure should contain precautions to protect areas of the package that may be sensitive to damage, such as penetrations, vents, and seal areas. It may be practical to use covers or protectors to minimize damage. Whether these are required or optional, they should be included in the special equipment list.

Wherever the package is placed to be opened, space limitations should be considered. There should be sufficient space to place each disassembled part, with adequate precautions taken in the event some of the parts are contaminated. There should also be enough overhead space for rigging and enough lifting room to lift the payload out of the package, or, in the case of a bottom loading package, to lift the package from over the payload. The operating procedures should specify any space requirements.

2.6.2 Closure Removal

Operating procedures for closure removal should be sufficiently detailed to prevent damage to equipment and to maximize the safety of operating personnel. Operating procedures should require that all equipment necessary to open and unload the package is available prior to beginning closure removal activities in order to reduce hazardous radiological or chemical exposure. The equipment may include cranes, wrenches, shielding fixtures, rigging for all steps of unloading, transfer bells, plumbing, or interface hardware.

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. If venting is not possible and a differential pressure could be present, specific instructions should be provided for equalization of the pressures of the package. These may require special blow-out prevention structures or perhaps careful heating or cooling of the package to eliminate the pressure differential. Operating procedures should include some indication of the effect of removing closure devices on the radiation levels near the package.

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. Operating instructions should provide instructions regarding safe storage of the closure. Other considerations regarding closure structure storage include exposure to the elements, facility ALARA concerns, and seal protection and preservation. The operating instructions should include special handling instructions for retention of closure fasteners to prevent loss or confusion of fasteners. These instructions are particularly important for packages with multiple closures employing various specialized fasteners. The operating procedures should clearly indicate the fastener specifications for each closure.

Some packages and payload combinations may require a detailed purging operation before opening. This procedure should be specific and give well defined acceptance criteria for determining when the procedure is complete.

2.6.3 Contents Removal

Procedures for the removal of package contents may vary considerably 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. Payload-specific instructions may be required for unusual payloads.

Packages used to transport fissile materials should have detailed instructions because of criticality concerns. Chemical reactivity of contents may also warrant carefully detailed handling instructions. For uranium hexafluoride, both chemical and nuclear reactivity must be avoided by procedural methods.

Specialized packaging, such as shielded sampling systems, may require contents removal procedures written specifically around design requirements completely outside of transport regulations or safety concerns.

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.

Operating procedures should specify proper procedures to ready the package for long-term storage and for all long-term storage requirements, such as optimum temperature for storage, protection from weather, seal preservation, or any other special treatment required to avoid deterioration of the packaging.

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. As part of this inspection program, they are leak tested periodically and prior to each shipment for some types of packages. Any failure of or damage to a gasket that would affect its functionality warrants its replacement. The replacement of the seals should be in

accordance with the manufacturer's procedures. The seals are only as good as the seal surfaces. Extreme care must be taken to ensure that the seal surfaces are undamaged. A good maintenance, care, and inspection program will not only allow the seals to perform as required, but will preclude expensive repair programs for the seal areas.

2.8 Records and Reporting Requirements

2.8.1 Records for Each Shipment

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 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 Records of Package History

The licensee should make all records available to the NRC for inspection, upon reasonable notice. The licensee maintains, during the life of the packaging to which they pertain, sufficient quality assurance records to furnish documentary evidence of the quality of packaging components that have safety significance, and of services affecting quality. The records to be maintained include results of the determinations required by 10 CFR 71.85, and results of monitoring, inspection, and auditing of work performance during the design, fabrication, assembly, testing, modification, maintenance, and repair of the packaging. In addition, records required by 10 CFR 20.402(c)(2) must be maintained until the NRC authorizes their disposal. The operating procedures should specify how and where these records are to be maintained. The registered user should obtain and maintain on file certification from the package supplier that these elements of QA done by the supplier were in fact accomplished in accordance with the NRC approved QA programs.

2.8.3 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. These regulations specify conditions and timing for reporting incidents including the following: any significant reduction in package effectiveness during use, any defects with safety significance found after the first use of a package, any loss or theft of licensed material, exposure to personnel or to the public above levels specified in 10 CFR 20.403(b), contamination or suspected contamination, and any fire, spillage or breakage.

DEFINITIONS

ALARA (as low as reasonably achievable). As low as is reasonably achievable taking into account the state of technology and the economics of improvements in relation to: (1) benefits to the public health and safety, (2) benefits to the radiation workers who are occupationally exposed, (3) other societal and socioeconomic considerations, and (4) the utilization of atomic energy in the public interest.

Carrier. Person(s) or organization accepting property for transport and engaged in carriage of property in a common, contract, or private capacity.

Cask. A type of packaging, usually large, which is heavily shielded against gamma radiation.

Certificate of Compliance (CofC). A document issued by the Nuclear Regulatory Commission (NRC) that certifies that a radioactive material shipping package meets the requirements of 10 CFR Part 71.

Consignee. Person or organization designated to receive a shipment following transport.

Consignor. See Shipper.

Containment System. The components of the packaging intended to contain the radioactive material during transport.

CFR. The Code of Federal Regulations.

Exclusive Use (also referred to in some regulations as "sole use" or "full load"). 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.

Licensee (also NRC Licensee). A person who is authorized to conduct activities under a license issued by the NRC.

Neutron Poisons. Materials other than fissile material which will absorb neutrons, such as boron, cadmium, or gadolinium.

Normal Form Radioactive Material. Radioactive material which has not been demonstrated to qualify as "special form radioactive material."

Owner. See Supplier. Could also be NRC licensee

Package means the packaging together with its radioactive contents as presented for transport.

(1) Fissile material package means a fissile material packaging together with its fissile contents.

(2) Type B package. A Type B package together with its radioactive contents. On approval, Type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kilopascal (100 lb/in^2) gauge or a pressure relief device which would allow the release of radioactive material to the environment under the tests specified in 10 CFR 71.73 (hypothetical accident conditions), in which case it will receive a designation B(M). B(U) refers to the need for unilateral approval of international shipments; B(M) refers to the need for

RELATED DOCUMENTS

In addition to this NUREG/CR, the following documents should be used in preparing operating procedures:

1. Office of the Federal Register, Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material," Office of the Federal Register, Washington, D.C.

2. Office of the Federal Register, Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation," Office of the Federal Register, Washington, D.C.

3. Office of the Federal Register, Title 49, Code of Federal Regulations, Part 173, "Shippers - General Requirements for Shipments and Packagings," Office of the Federal Register, Washington, D.C.

4. American National Standard, "Guide for Writing Operating Manuals for Radioactive Materials Packaging," ANSI N14.29, American National Standards Institute, 1430 Broadway, New York, New York 10018.

5. American National Standard, "Administrative Guide for Packaging and Transporting Radioactive Materials," ANSI N14.10.1, American National Standards Institute, 1430 Broadway, New York, New York 10018.

6. American National Standard, "Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants," ANSI/ASME NQA-2, Part 2.2, American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017.

7. American National Standard, "Supplementary Requirements for the Qualification of Inspection and Testing Personnel," ANSI/ASME NQA-1, Supplement 2S-1, American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017.

8. American National Standard, "Leakage Tests on Packages for Shipment of Radioactive Materials," ANSI N14.5, American National Standards Institute, 1430 Broadway, New York, New York 10018.

9. U.S. Nuclear Regulatory Commission, Regulatory Guide 7.4, "Leakage Tests on Packages for Shipment of Radioactive Materials," U.S. Nuclear Regulatory Commission, Washington, D.C.

multilateral approval. There is no distinction made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, see DOT regulations in 49 CFR 173. A Type B package approved prior to September 6, 1983, was designated only as Type B. Limitations on its use are specified in 10 CFR 71.13.

Package Recipient. See Receiver.

Packaging. The assembly of components necessary to ensure compliance with the packaging requirements of 10 CFR 71. Packaging may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging.

Radioactive Material. Any material, or combination of materials, that spontaneously emits ionizing radiation and has a specific activity in excess of 0.002 microcurie per gram of material.

Receiver. The receiver is the organization to which the radioactive material shipment is being made. The shipper and receiver could be the same organization.

Registered User. An NRC licensee who has registered with the NRC to use a specific packaging and in accordance with the provisions of 10 CFR 71.12.

SAR (Safety Analysis Report). A document or group of documents that provides a comprehensive technical evaluation and review of the design, testing, operational procedures, maintenance procedures, and quality assurance program for a packaging. The purpose of the SAR is to demonstrate compliance with the NRC regulatory requirements.

Shipment. A quantity of freight offered by one shipper at one time to one carrier for delivery to one consignee. A consignment is a shipment.

Shipper. The shipper is the party that has the responsibility under Federal regulations for the radioactive materials being transported. The shipper is the NRC licensee that has been granted authority to possess, utilize, and transfer the radioactive material. The shipper bears the additional responsibility for integrating the transport activities, although portions of this responsibility may be delegated to others. The shipper certifies to the carrier that the radioactive material being shipped is correctly identified; properly packaged, marked, labeled, and documented; and in proper condition for transportation in accordance with applicable regulations of the Department of Transportation. The shipper plays the principle role in the transfer of materials. The shipper may also be called the consignor.

Shipping Package. Identical to packaging.

Special Form Radioactive Material. Radioactive material that satisfies the following conditions:

(1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
(2) The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inch); and
(3) It satisfies the test requirements of 10 CFR 71.75.

A special form encapsulation designed in accordance with the requirements of 10 CFR 71.4(o) in effect on June 30, 1983, and constructed prior to July 1, 1985, may continue to be

used. A special form encapsulation either designed or constructed after June 30, 1985, must meet requirements of 10 CFR 71 applicable at the time of its design or construction.

Supplier. The supplier is an organization that provides equipment and services for the shipment of radioactive materials. Also, packaging supplier or cask supplier.

Transferee. The transferee is the organization responsible for transferring radioactive material from one party to another. The shipper is usually the transferee.

Type A Quantity. A quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material. A_1 and A_2 are given in or may be determined by procedures described in Appendix A of 10 CFR 71.

Type B Quantity. A quantity of radioactive material greater than a Type A quantity.

U.S. Department of Transportation (DOT). The DOT, acting through the Materials Transportation Bureau (MTB), promulgates rules and regulations pertaining to the packaging and transportation of radioactive materials. For Type B packages, the certification process is under NRC jurisdiction. The DOT focuses on carriage issues.

U.S. Nuclear Regulatory Commission (NRC). This federal agency has a broad statutory authority over transportation of radioactive material similar to that of the DOT. Under a memorandum of understanding between the two agencies, however, NRC limits its activities to performing safety evaluations of packages and issuing certificates of compliance for Type B packages and packages for fissile material. The NRC also prescribes rules for monitoring of packages on receipt, for limiting the exposure of individuals to ionizing radiation, and for in-transit security of certain materials. NRC imposes DOT shipping requirements by reference and inspects against them, and enforces those requirements.

User. A user is a NRC licensee who has registered with the NRC to use a specific packaging. See also Registered User.

NRC FORM 335 (2-84) NRCM 1102, 3201, 3202

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13. ABSTRACT (200 words or less)

This report provides guidance for writing manuals of operating procedures for shipping packages used for radioactive materials. Guidelines are provided which are based on the broad experience that exists in the shipping industry and are consistent with Subpart G of 10 CFR 71.

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