

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

This Safety Analysis Report (SAR) describes a reusable shipping package designed to protect greater than Type A quantities of radioactive material from both normal conditions of transport and hypothetical accident conditions as required by 10CFR71. The package is designated as the Model 3-60B package. The 3-60B will be used as a general purpose transport package, and has features that permit its contents to be loaded while the cask is submerged.

This SAR has been organized and formatted in accordance with Revision 2 of Regulatory Guide 7.9. The SAR has been prepared in accordance with Regulatory Guide 7.9 and includes information on the package required in Subpart D of 10CFR Part 71. In addition, the drawings of the packaging in Appendix 1.3 have been formatted in accordance with NUREG/CR-5502, "Engineering Drawings for 10 CFR 71 Package Approvals".

1.2 PACKAGE DESCRIPTION

1.2.1 Packaging

The packaging consists of a steel and lead cylindrical shipping cask with a pair of cylindrical, foam-filled impact limiters installed on each end. The packaging configuration is shown in Figure 1-1. Cask assembly drawings are included in Appendix 1.3. The approximate internal cavity dimensions are 35 inches in diameter and 109 inches high (with the lid installed). The cylindrical cask body is comprised of a 1¼ inch thick external steel shell and a ¾ inch internal steel shell. The annular space between the inner and outer shells is filled with a six (6) inch thickness of lead. All of the major components of the cask (except the impact limiter foam and lead shielding) are fabricated from stainless steel.

The base of the cask is a 3 inch thick circular external steel plate, 5 inches of lead, and a ¾ inch inner steel plate. The lid consists of several circular steel plates, a total of 10.5" thick. The lid is fastened to the cask body with sixteen, 1 1/2 - 6 UNC bolts. Also, a 12 ga. steel thermal shield is welded to the exterior barrel of the cask and provides protection during a fire accident.

Each end of the cask is protected during transport by a foam-filled, toroidal-shaped impact limiter. The impact limiters are 82 inches outside diameter (including shells) and 52" inside diameter, and extend approximately 15" beyond the outside wall of the cask. The portion of each impact limiter covering the end faces of the cask are about 18" thick and have a cylindrical opening in the center approximately 24" in diameter. The external shells of the impact limiters are fabricated from stainless steel and contain the impact limiting foam. The volume inside the shell is filled with a crushable, shock and thermal insulating, closed-cell polyurethane foam which is described in EnergySolutions Specification ES-M-172 (Appendix 8.3.1). The polyurethane is poured into the shell and allowed to expand until the void is completely filled. The foam bonds to the shell and creates a unitized construction for the impact limiters.

The general arrangement and details of the package are shown in EnergySolutions drawing C-002-165024-001, which is included in Appendix 1.3. This drawing shows the package's dimensions as well as all materials of construction.

Package Weight

Maximum gross weight for the 3-60 package is 80,000 lbs, including a maximum payload weight of 9,500 lbs, including contents, secondary containers, and cavity spacers.

Containment Features

The containment vessel is defined as the inner steel shell of the cask body together with closure features comprised of the lower surface of the cask lid, the primary lid bolts, plus the inner O-rings on the lid and the vent and drain port plugs. Figure 2-2 (Section 2) shows the containment boundary components.

Shielding

Gamma shielding in the cask walls consists of 6 inches of lead and 2 inches of steel. The cask bottom end provides shielding of 5 inches of lead and 3-3/4" inches of steel, and the lid provides 10½" of steel. There is no shielding specifically for neutrons.

Criticality Control Features

There are no materials used as neutron absorbers or moderators in the package.

Lifting and Tie-down Devices

The 3-60B has two sets of trunnions (upper and lower) that function as the lifting and tie-down devices. The upper two trunnions are primarily used for lifting and handling. The package is transported in the horizontal orientation by resting it in the shipping cradle, where it is supported and tied down by the four trunnions. Both sets of trunnions are structural parts of the package, and are analyzed accordingly in Chapter 2.

Packaging Closure Devices

There are three packaging closure devices:

- (1) The closure lid fits inside a protective rim located in the cask wall and has holes through which sixteen 1 ½" diameter hex head bolts are threaded into a forged ring attaching and sealing the lid.
- (2) The 1-1/8" diameter cask drain port is located at the bottom corner of the cask and is used primarily to drain water from the cavity. During transport a socket head, cylindrical-shaped rod is threaded into the drain port and seals it shut.
- (3) The 2" diameter cask vent port is located in the closure lid and primarily used when draining the cask cavity of water. During transport of the cask the vent port is sealed shut by bolting into it a plug assembly consisting of a cylindrical plug, seal plate, and O-ring seals. The seal plate bolts to holes in the cask closure lid using six ½" diameter hex head bolts.

Heat Transfer Features

A 12 gauge thermal shield is installed on the exterior of the cask wall. The thermal shield protects the cask during the hypothetical accident condition fire event. It is constructed of Type 304L stainless steel.

Packaging Markings

The cask nameplate is shown on the drawing in Appendix 1.3.

1.2.2 Contents

Cask Contents

The type and form of permitted contents of the cask will consist of:

- 1) By-product, source, or special nuclear material, in the form of:
 - dewatered powdered or dispersible solids, or
 - process solids, either solidified or dewatered, or
 - dewatered resins
- 2) Activated nuclear reactor or accelerator components or segments of components

Contents shall be packaged in secondary containers.

Maximum quantity of material per package.

- 1) Type B quantities of radioactive materials up to a maximum of 3000 A₂ or 1110 TBq (30,000 Ci), whichever is less.
- 2) Fissile material provided the mass limits of 10 CFR 71.15 are not exceeded
- 3) Decay heat of contents not to exceed 500 watts.

Loading Restrictions

Except for close fitting contents, shoring must be placed between the secondary containers or activated components and the cask cavity to prevent movement during accident conditions of transport.

As stated above in 1.2.2 above, the maximum activity of permitted contents for the 3-60 package is the smaller of 3000A₂ or 1110 TBq (30,000 Ci). Its fabrication category designation as given in RegGuide 7.11 is Category II. The fabrication criteria used for the 3-60 as a Category II package is given in Chapter 8.

The permitted contents for the 3-60 may include water and other organic materials that can radiolytically generate combustible gases such as hydrogen. The shipper must make a determination before each shipment containing materials that can generate hydrogen that the amount of hydrogen generated will be less than 5% of the cask cavity void volume over a period of time that is twice the expected shipping time. If the shipper does not make the determination on the amount of hydrogen that could be generated, or if the amount of hydrogen that could be generated is greater than 5%, the shipper may ship the package by inerting the cask cavity and secondary container (or the volume containing the potentially flammable gas contents). Inerting shall limit the oxygen to 5% by volume in the portions of the package that could have hydrogen greater than 5%.

1.2.3 Special Requirements For Plutonium

Any contents that contain more than 0.74 TBq (20 Ci) of plutonium must be in solid form.

1.2.4 Operational Features

There are no complex operational requirements associated with this package.

SECURITY RELATED INFORMATION
FIGURE WITHHELD UNDER
10 CFR 2.390

Figure 1-1
3-60B General Arrangement

1.3 Appendix

10-160B Shipping Cask Drawing
(withheld from public disclosure as security-related sensitive information)