TRANSPORTATION PACKAGE FOR REMOTE-HANDLED TRU WASTE

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ABSTRACT

Transport of remote-handled transuranic (RH-TRU) waste within the DOE complex and to the Waste Isolation Pilot Plant (WIPP) requires development, certification and fabrication of a new transport package design. The new package is called the NuPac 72-B cask and is being designed to transport a single canister of RH-TRU waste. The canister can accommodate up to three 200-L (55-gallon) drums of RH-TRU waste and has a pintle at the top end for remote handling at the loading and unloading sites. The NuPac 72-B cask is a legal weight truck cask which consists of a conventional stainless steel and lead outer cask body and a separate and removable stainless steel inner containment vessel which fits into the outer cask. Stainless steel skinned polyurethane foam-filled energy absorbers are attached at each end of the outer cask to protect the cask and contents against the consequences associated with normal and hypothetical accident conditions.

INTRODUCTION

Plans are being implemented to develop the capability for transportation of remote-handled transuranic (RH-TRU) wastes within the DOE system between TRU waste generators and to the Waste Isolation Pilot Plant (WIPP). The plans include installation of the equipment for handling the transportation cask and its contents at the loading and unloading sites as well as the development, certification and fabrication of a new design transportation cask. The new cask is called the NuPac 72-B cask and is being supplied to DOE by Nuclear Packaging, Inc.

RH-TRU WASTE

The RH-TRU wastes which will be transported in the NuPac 72- B cask are characterized by greater than 3.7 kBq (100 nCi) of TRU nuclides per gram of waste and a dose rate greater than 2 mSv (200 mRem) per hour on the surface of the drum containing the waste. The drum surface dose rate will typically be less than 1 Sv (100 Rem) per hour to meet the waste acceptance criteria for the WIPP. On an exception basis, the surface dose rate may be up to 10 Sv (1000 Rem) per hour with appropriate approval from the WIPP.

The RH-TRU wastes include both organic and inorganic materials in either a solid or solidified form since free liquid wastes are prohibited at the WIPP. The wastes have been and are being generated as a result of research and development programs or defense programs and consist of a wide variety of items usually from hot-cell operations. TRU contaminated paper-wipes,
clean-up rags, laboratory clothes, ion-exchange resins, absorbed liquids, solidified organic solutions, and plastics make-up some of the organic wastes. Metal and glass items, such as discarded tools, pumps, valves, racks and laboratory glassware are in the inorganic waste category.

The RH-TRU wastes will be placed into specially designed canisters. The canister was designed by Rockwell Hanford Operations for DOE several years ago. The canister and proposed contents have passed drop tests for Type A packaging. The canister is a right circular cylinder made of 0.64 cm (one- quarter inch) thick carbon steel. Approximately 307 cm (121 inches) long, the canister has a 66 cm (26 inch) outer diameter. Each canister can therefore contain up to three 200-L (55-gallon) drums of RH-TRU waste within the interior cavity of 897 L (31.7 cubic feet) of space. The canister design includes a pintle at the top end for remote-handling operations at the loading and unloading sites. The top end also has a filtered vent line passing up through the pintle to prevent pressurization due to gas generation within the waste. The top end has lead shielding to reduce the dose rate in the upward direction for ALARA purposes and, also, the lead protects the vent line and head itself from potential drop impact damage due to the movement of the contents of canister. Lead may also be included in the bottom head.

A second type of canister design was prepared for generator sites which would have constraints in handling a canister 307 cm (121 inches) long. The second type is half as long to permit use in existing facilities. Two short canisters would be welded together end to end to form a "stacked" canister for transport in the Nupac 72-B cask.

To send RH-TRU wastes to WIPP, each generator site will prepare a plan indicating how the waste will be packaged to ensure the disposal container and waste meets the waste acceptance criteria for disposal. To date there has not been a canister of RH-TRU waste filled since sites with such waste are still proceeding with obtaining approval for disposal at WIPP.

RH-TRU CASK

The NuPac 72-B cask is a legal-weight, truck-mounted cask designed to transport one canister of RH-TRU waste. The cask consists of a conventional stainless steel and lead outer cask body. An outer and inner stainless steel shell form the cylindrical body and sandwich approximately 5 cm (2 inches) of lead to reduce radiation dose rates from the canister to acceptable levels for transport. The lid of the outer cask is 15 cm (6 inch) thick stainless steel. The lid is fully recessed into an upper ring forging that is welded to the two cylindrical shells. The edge of the lid has two o-rings which form a bore seal that seal against an inside surface of the upper forging. The seals are designed to a "leak-tight" leakage rate of 1E-7 scc per sec in accordance with ANSI N14.5 This low leakage rate applies for both normal and hypothetical accident conditions of transport. The closed end of the cask is a five inches thick stainless steel plate that is welded to the bottom end of the two cylindrical shells.

In addition to the outer cask, there is a separate inner containment vessel (ICV). The ICV provides the secondary containment boundary needed for safe transport of greater than 740 GBq (20 curies) of Pu in accordance with 10 CFR 71.63. The ICV is a thin-walled stainless steel shell welded to a base plate and an upper ring forging. A 16.5 cm (6.5 inch) thick ICV lid bolts to the forging and has two o-rings which form a bore seal. This seal is also "leak-tight" per ANSI N14.5. The ICV has internal spacer rings which center the canister in the ICV cavity. There is a generous volume of space outside the canister and inside the ICV shell to accommodate gases generated in the waste.

There are vent and seal-leak test ports located in both the inner and outer lids that are designed with the capability for remote operations. The thick plates used for the lids and the lead and steel in the top of the canister will ensure low-dose rates during manual operations. Another remote operability feature is the use of bolts for the inner lid that are captive and have a twelve point, cone-shaped head to provide the capability for future use with robotic equipment.

Impact limiters with a stainless steel outer skin are attached to each end of the cask and give the package the familiar dumb-bell shape. Each impact limiter is filled with a poly urethane foam which would absorb the energy associated with the normal and hypothetical drop accident conditions of transport.

The cask and contents are passively cooled with a maximum decay heat of 300 watts per canister. The cask and contents are protected from the hypothetical fire accident condition by the use of a thermal shield around the exterior cylinder of the cask body. The thermal shield includes a wire spacer wrapped around the outer stainless steel shell of the cask. Outside of the wire wrap is a thin sheet of stainless steel that is welded to the outer shell. Together the wire and sheet metal form an air gap that is an insulator to reduce heat energy input to the cask body in a fire.

In the center of the cask body are two pivot trunnions for tie-down of the cask to the trailer. These trunnions allow the cask to be rotated on the trailer for loading and unloading operations. After removal of the impact limiters, the cask may be rotated from the horizontal transport position to vertical for subsequent operations. In the vertical orientation the cask can be locked into place or removed from the trailer by an overhead crane.

The cask, contents and trailer are required to weigh less than 28,636 kg (63,000 lbs.) with an 3,636 kg (8,000 lb.) canister. The gross weight of the cask is about 20,455 kg (45,000 lbs.) including the maximum loaded weight canister. The overall cask with impact limiters is 478 cm (188 inches) long by 193 cm (76 inches) outer diameter. With impact limiters removed, the cask body is 361 cm (142 inches) long by 107 cm (42 inches) outer diameter.

The NuPac 72-B cask will be analyzed for compliance with 10 CFR 71 and a Safety Analysis Report (SAR) submitted to NRC for review and approval. In addition to the safety calculations for this design, a comparison will be made to a predecessor cask, the NuPac 125-B cask. The 72-B cask is approximately a 64 percent scale version of the 125-B cask. Therefore, the results from a drop testing program at Sandia National Laboratories for a one- quarter scale model of the 125-B cask are directly applicable to the 72-B cask.

Delivery of the NuPac 72-B cask to the WIPP for transport of RH-TRU waste is currently scheduled for 1989. This schedule allows time to complete the preparations at the DOE sites, certification of the package by NRC, fabrication of the cask and trailers, and, training by the users.