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Hanford Site Radioactive Hazardous Materials
Packaging Directory

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Packaging Directory

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LIST OF TERMS

CoC	Certificate of Compliance
DAP	Documentation and Analysis for Packaging
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
HRCQ	Highway Route Controlled Quantity
LSA	Low Specific Activity
mrem/h	millirem per hour
NRC	U.S. Nuclear Regulatory Commission
ORM	Other Regulated Material
PO&D	Packaging Operations & Development
PORT	Packaging Operations Response Team
RAMPAC	U.S. Department of Energy Radioactive Material Packaging Database
RHMPD	Hanford Site Radioactive Hazardous Materials Packaging Directory
RL	U.S. Department of Energy, Richland Operations Office
SARP	Safety Analysis Report for Packaging
SEP	Safety Evaluation for Packaging
T&P	Transportation and Packaging
TRU	Transuranic
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

The Hanford Site Radioactive Hazardous Materials Packaging Directory (RHMPD) provides information concerning packagings owned or routinely leased by Westinghouse Hanford Company (WHC) for offsite shipments or onsite transfers of hazardous materials. Specific information is provided for selected packagings including the following: general description; approval documents/specifications (e.g., Certificates of Compliance [CoCs] and Safety Analysis Reports for Packaging [SARPs]); technical information (e.g., drawing numbers and dimensions); approved contents; areas of operation; and general information.

Packaging Operations & Development (PO&D) (509/376-0298) maintains the RHMPD and may be contacted for additional information or assistance in obtaining referenced documentation or assistance concerning packaging selection, availability, and usage.

This directory does not authorize use of any packaging. It is only a catalog providing summary information on packagings. All offsite shipments or onsite transfers must be made in accordance with the requirements of WHC-CM-2-14, *Hazardous Material Packaging and Shipping*, and the referenced approval documents (e.g., CoC and SARP).

Not every packaging used onsite is presently listed in the RHMPD. Assistance in selecting packagings not listed in this directory can be obtained from PO&D. Additional packagings will be added to the directory by PO&D when identified; users are encouraged to provide this information to PO&D.

1.1 PACKAGING TYPES

Packagings used for offsite shipments by WHC comply with the applicable U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) regulations. Packagings used for onsite transfers either comply with the regulations or are approved for onsite use only. The type of approval is noted for each packaging listed in the RHMPD.

The WHC frequently uses DOT and UN specification packagings for hazardous material shipments or transfers. Certain DOT specification packagings are listed in the RHMPD along with a reference to federal regulations that describe the construction of each packaging and authorized payload when specified. Other pertinent documentation or information is included as appropriate.

Certified NRC or U.S. Department of Energy (DOE) packagings identified in this directory may be used by WHC shippers for offsite shipments or onsite transfers in accordance with the applicable CoC provided that the DOE is formally registered as a user of the packaging. PO&D has on-line access to the DOE radioactive material packaging database (RAMPAC), and can verify that DOE is a registered user for specific packagings. If registration is required, PO&D can provide this service. Additional requirements apply to the shipment of certified packagings. Contact T&P for assistance.

PO&D maintains updated copies of the following reference documents:

- NUREG 0383, *Directory of Certificates of Compliance for Radioactive Materials Packages* (NRC)
- *Directory of DOE Certificates of Compliance for Radioactive Materials Packaging* for DOE-licensed packagings
- WHC-EP-0558, *Test and Evaluation Document for DOT Specification 7A Type A Packaging*, which describes packaging configurations authorized for the shipment of Type A quantities of radioactive materials. This directory describes the packaging, authorized contents, and certification that required testing has been performed.

PO&D also is available to assist shippers in performing the evaluation required to determine equivalency of the physical properties of the actual content of the packaging to those contents for which the package was tested.

Small quantity packaging may be used for onsite transfers or offsite shipments of certain hazardous materials. PO&D can assist in obtaining qualification and testing of this type of packaging.

1.2 DIRECTORY FORMAT

The directory is divided into eight sections. Section 1.0 contains information describing the contents of the RHMPD. Sections 2.0 through 8.0 are categories of packagings (e.g., drums and metal boxes). This directory is intended only as a guide to final choice of the appropriate packaging. It is strongly recommended that the shipper consult with the PORT team for any packaging selected before the purchase or use of the packaging for a new operation. The PORT team phone numbers can be found in the Hanford Phone Directory organizations and functions list under "Hazardous Material Packaging."

1.3 DEFINITION OF TERMS

A₁. The maximum activity of special form radioactive material permitted in a Type A package.

A₂. The maximum activity of radioactive material, other than special form or low specific activity radioactive material, permitted in a Type A package. These values are either listed in 49 *Code of Federal Regulations* (CFR) 173.435, "Transportation," or may be derived in accordance with the procedure prescribed in 49 CFR 173.433.

Containment system. The components of the packaging intended to retain the radioactive contents during transportation.

Depleted uranium. Uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.

Design. The description of a special form material, a package, or a packaging, that enables those items to be fully identified. The description may include specifications, engineering drawings, reports showing compliance with regulatory requirements, and other relevant documentation.

Documentation and Analysis for Packaging (DAP). A document prepared to demonstrate that a packaging meets the DOT requirement of a strong, tight packaging when used for shipments of LSA or LQ materials. A DAP is prepared when the onsite transfer of these materials cannot be made in Type A container or a manufacturer's certified strong, tight package. A DAP is also prepared in cases when, because of operational constraints, the LSA or LQ material cannot be packaged in accordance with the instructions provided in the packaging certificate or the DOT 7A Type A document. In such cases, an alternative method for packaging the material in accordance with DOT requirements is documented and approved in a DAP.

Enriched uranium. Uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

Fissile material. Any material consisting of or containing one or more fissile radionuclides. Fissile radionuclides are plutonium-238, plutonium-239, plutonium-241, uranium-233, and uranium-235. Neither natural nor depleted uranium are fissile material. Fissile materials are classified according to the controls needed to provide nuclear criticality safety during transportation, as provided in 49 CFR 173.455. Certain exclusions are provided in 49 CFR 173.453.

Highway route controlled quantity (HRCQ). A quantity within a single package that exceeds the following:

- (1) 3,000 times the A_1 value of the radionuclides as specified in 49 CFR 173.433 for special form radioactive material;
- (2) 3,000 times the A_2 value of the radionuclides as specified in 49 CFR 173.433 for normal form radioactive material; or
- (3) 30,000 Ci, whichever is least.

Limited quantity of radioactive material. A quantity of radioactive material that does not exceed the materials package limits specified in 49 CFR 173.423 and which conforms with requirements specified in 49 CFR 173.421.

Low specific activity material (LSA). Any of the following:

- (1) Uranium or thorium ores and physical or chemical concentrates of those ores
- (2) Unirradiated natural or depleted uranium or unirradiated natural thorium
- (3) Tritium oxide in aqueous solutions provided the concentration does not exceed 5.0 mCi/mL.

- (4) Material in which the radioactivity is essentially uniformly distributed and in which the estimated average concentration of contents does not exceed:
- (a) 0.0001 mCi/g of radionuclides for which the A_2 quantity is not more than 0.05 Ci;
 - (b) 0.005 mCi/g of radionuclides for which the A_2 quantity is more than 0.05 Ci, but not more than 1 Ci; or
 - (c) 0.3 mCi/g of radionuclides for which the A_2 quantity is more than 1 Ci.
- (5) Objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination, when averaged over an area of 1 m², does not exceed 0.0001 millicurie (220,000 disintegrations per minute) per cm² of radionuclides for which the A_2 quantity is not more than 0.05 Ci, or 0.001 mCi (2,200,000 disintegrations per minute) per cm² for other radionuclides.

Natural thorium. Thorium with the naturally occurring distribution of thorium isotopes (essentially 100 weight percent thorium-232).

Natural uranium. Uranium with the naturally occurring distribution of uranium isotopes (approximately 0.711 weight percent uranium-235 and the remainder essentially uranium-238).

Normal form radioactive material. Radioactive material that has not been demonstrated to qualify as "special form radioactive material."

Offsite Shipment. A shipment intended for transport outside the Hanford Site controlled access boundaries on public access roadways.

Onsite Shipment. A shipment that is transported within the Hanford Site controlled access boundaries between DOE contractors.

Packaging. For radioactive materials, the packaging together with its radioactive contents as presented for transport. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging.

Radiation level. The radiation dose-equivalent rate expressed in mrem/h.

Radioactive contents. The radioactive material, together with any contaminated liquids or gases, within the package.

Radioactive material. Any material having a specific activity greater than 0.002 μ Ci/g (see definition of "specific activity").

Safety Analysis Report for Packaging (SARP). A document that provides a comprehensive technical evaluation and review of the design, testing, operational procedures, maintenance procedures, and quality assurance program to demonstrate compliance with the NRC regulatory safety standards, or equivalent standards established by the DOE for approving packagings and/or issuing certificates of compliance.

Safety Analysis Report for Packaging (SARP) (Onsite). A document prepared and approved to authorize onsite transfers of Type B materials. A SARP contains documentation of extensive safety analyses (e.g., thermal, shielding, structural) performed to ensure the packaging can safely transport its intended contents. An onsite SARP is generally required for packaging containing radioactive quantities in excess of one A_2 as shown in the table in 49 CFR 173.435 or calculated by the methods described in 49 CFR 173.433.

Safety Evaluation for Packaging (SEP). A document prepared and approved to authorize onsite transfers including special one-time shipments or campaigns, emergency shipments, minor deviations to offsite-approved packagings for onsite use, and lower hazard packagings (Type A, Low-Specific Activity, and nonradioactive) which do not meet offsite requirements, and are used exclusively onsite. A SEP for a Type B packaging is limited to a maximum approval duration of one year.

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 mm (0.197 inch).
- (3) It satisfies the test requirements of 49 CFR 173.469. Special form encapsulations designed in accordance with the requirements of 49 CFR 173.389(g) in effect on June 30, 1983, and constructed before July 1, 1985 may continue to be used. Special form encapsulations either designed or constructed after June 30, 1985 must meet the requirements of this paragraph.

Specific activity (of a radionuclide). Activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

Type A package. A Type A packaging together with its limited radioactive contents. A Type A package does not require competent authority approval, since its contents are limited to A_1 or A_2 .

Type B package. A Type B packaging together with its radioactive contents.

Type A packaging. A packaging designed to retain the integrity of containment and shielding required by this part under normal conditions of transport as demonstrated by the tests set forth in 49 CFR 173.465 or 49 CFR 173.466, as appropriate.

Type B packaging. A packaging designed to retain the integrity of containment, shielding, and subcriticality required by this part when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR 71.

1.4 REFERENCES

- 49 CFR 173, "Shippers-General Requirements for Shipments and Packaging," Title 49, *Code of Federal Regulations*, Part 173, as amended, U.S. Department of Transportation, Washington, D.C.
- 49 CFR 173.24 "Standard Requirements for All Packages," Title 49, *Code of Federal Regulations*, Part 173.24, U.S. Department of Transportation, Washington, D.C.
- 49 CFR 173.433 (b)) "Mixture of radionuclides, including radioactive decay chains," Title 49, *Code of Federal Regulations*, Part 173, as amended, Subpart I, U.S. Department of Transportation, Washington, D.C.
- 49 CFR 393.100-106 "Protection Against Shifting or Falling Cargo," Title 49, *Code of Federal Regulations*, Part 393, as amended, U.S. Department of Transportation, Washington, D.C.
- DOE 1991, *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, WIPP/DOE-069, Revision 4, U.S. Department of Energy, Carlsbad, New Mexico.
- DOE-RL 1993, *Hanford Site Hoisting and Rigging Manual*, DOE-RL-92-36, U.S. Department of Energy, Richland, Washington.
- NUREG 0383, *Directory of Certificates of Compliance for Radioactive Materials Packages*, as revised, Nuclear Regulatory Commission, Washington, D. C.
- SD-RE-SAP-002, *Safety Analysis Report for Packaging Transportation and Storage of TRU Contaminated Organics*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-013, *Safety Analysis Report for Packaging Railroad Liquid Waste Tank Cars*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-014, *Safety Analysis Report for Packaging Irradiated Fuel Container*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-024, *Safety Analysis Report for Packaging of Non-Transuranic, Non-Fissile Radioactive Waste Transportation in 55-Gallon Drum*, Westinghouse Hanford Company, Richland, Washington.

- SD-RE-SAP-025, *Safety Analysis Report for Packaging Decontaminated Equipment Self-Container for Transport*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-033, *Safety Analysis Report for Packaging of Transuranic Radioactive Material in the 55-Gallon Drum*, HCS-042-002, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-043, *Safety Analysis Report for Packaging Internally Shielded 55-Gallon Drum*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-044, *Safety Analysis Report for Packaging 225-B Waste Cask*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-054, *Safety Analysis Report for Packaging 21-PF-1 Overpack, EBR-II Spent Fuel Storage Cask System for Transport*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-083, *Safety Analysis Report for Packaging AL-M6, CoC*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-084, *Safety Analysis Report for Packaging 21-PF-1 Overpack/Zircalloy Hull Cask*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-085, *Safety Analysis Report for Packaging Requalification of DOT-17C, DOT-17E/17H, DOT-17H, 55-Gallon Drums HCS-042-003*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-091, *Safety Analysis Report for Packaging TRU Metal Box Container*, Westinghouse Hanford Company, Richland, Washington.
- SD-RE-SAP-092, *Safety Analysis Report for Packaging Low-Level Metal Box Container*, Westinghouse Hanford Company, Richland, Washington.
- SNL 1991, *Beneficial Uses Shipping System Cask (BUSS) Safety Analysis Report for Packaging (SARP)*, SAND 83-0698 (TTC-0430), Albuquerque, New Mexico.
- UNI 1985, *Safety Analysis Report for Packaging Single Pass Fuel Cask*, UNI-3419. UNC Nuclear Industries, Richland, Washington.
- WHC-EP-0558, *Test and Evaluation Document for DOT Specification 7A Type A Packaging*, Westinghouse Hanford Company, Richland, Washington.
- WHC-HS-BP-0040, *Procurement Specification, Metal Box for Shipping and Storage of Solid Transuranic Radioactive Material*, Westinghouse Hanford Company, Richland, Washington.
- WHC-HS-BP-0041, *Procurement Specification, Metal Box Container for Shipping and Disposal of Solid Low-Level Radioactive Material*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-FF-SARP-001, *Safety Analysis Report for Packaging Radial Reflector Shipping Container*, Westinghouse Hanford Company, Richland, Washington.

- WHC-SD-FF-SARP-008, *T-3 Cask Safety Analysis Report for Packaging*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-MP-SARP-001, *Safety Analysis Report for Packaging Doorstop Sample Carrier System*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-NR-SARP-001, *Safety Analysis Report for Packaging Finished Fuel Assembly Shipping Package*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-NR-SARP-002, *Safety Analysis Report for Packaging OH-142 Mark I (Big Bertha)*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-NR-SARP-004, *Safety Analysis Report for Packaging Ion Exchange Modules (IXM)*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-DAP-001, *Documentation and Analysis for the LSA Plywood Box*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-DAP-002, *Documentation and Analysis for the B-25 Box*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-DAP-006, *Documentation and Analysis for Packaging, Limited Quantity Ice Chests*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-OMM-002, *Operating and Maintenance Instructions for the Hedgehog Package*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-OMM-003, *Operating and Maintenance Instructions for the 1-Liter Liquid Shipper Package*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-OMM-006, *Operating and Maintenance Instructions for the Warthog Package*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SARP-001, *Sample Pig Transport System Safety Analysis Report for Packaging*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SARP-002, *Safety Analysis Report for Packaging Onsite Transfer Cask*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SARP-003, *Safety Analysis Report for Packaging Disposable Solid Waste Cask (DSWC) Packaging System*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SARP-004, *Safety Analysis Report for Packaging Standard Waste Box*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SARP-005, *Safety Analysis Report for Packaging (Onsite) for the Modified Fuel Spacer Burial Box*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SARP-006, *Safety Analysis Report for Packaging (Onsite) 85-Gallon Retrieval Drum*, Westinghouse Hanford Company, Richland, Washington.

- WHC-SD-TP-SARP-007, *Safety Analysis Report for Packaging Flexible Material Packaging*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-001, *Safety Evaluation for Packaging for the Liquid Sample Packaging*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-011, *Safety Evaluation for Packaging (SEP), 222-S Laboratory Cargo Tank*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-020, *Safety Evaluation for Packaging, Plywood Box*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-022, *Safety Evaluation for Packaging, Neutron Source Holder Assembly*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-023, *Safety Evaluation for Packaging, NaK Bonded Fuel Pins*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-024, *Safety Evaluation for Packaging, Transportation of Equipment for 241-C-106 Waste Sluicing System*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-026, *Safety Evaluation for Packaging, 101-SY Hydrogen Mitigation Mixer Pump Package*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-027, *Safety Evaluation for Packaging, 222-S Laboratory Cargo Tank for Onetime Type B Material Shipment*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-028, *Safety Evaluation for Packaging for the N Reactor/Single Pass Reactor Fuel Characterization Shipments*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-029, *Safety Evaluation for Packaging, Transfer of 101-AZ Thermocouples*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-030, *Safety Evaluation for Packaging, Transfer of 101-AZ Pumps*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-032, *Safety Evaluation for Packaging, 102-AP Mixer Pump Package*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-TP-SEP-033, *Safety Evaluation for Packaging for the Shipment of K West Basin Canister Samples in the PAS-1 Cask*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-WM-SARP-001, *Safety Analysis Report for Packaging Lead-Lined Drum/21PF-1 Packaging System*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-WM-SARP-005, *Safety Analysis Report for Packaging Neutralized Current Acid Waste (NCAW) Packaging System*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-2-14, *Hazardous Materials Packaging and Shipping*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-5-20, *Manufacturing Process Specification for N Reactor Fuel*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-6-1, *Standard Engineering Practices*, Westinghouse Hanford Company, Richland, Washington.

WIPP 165-F-001-W, Rev. F, TRUPACT II Standard Waste Box Assembly, Westinghouse Hanford Company, Richland, Washington.

2.0 DRUMS

COMMON NAME: 208 L (55 Gallon) Drum

OFFICIAL NAME: 208 L (55 Gallon) Drum

DESCRIPTION:

The 208 L (55 gallon) drum is a carbon steel right circular cylinder. A variety of finishes are authorized, for example painted or galvanized. The superseded DOT 17C drum is constructed of 1.52 mm (16 gauge) carbon steel with three rolled swaged hoops. The superseded DOT 17H drum is similarly constructed utilizing 1.22 mm (18 gauge) carbon steel. The drums have an 84.5 cm (33.25 in.) usable inside height and 57.2 cm (22.5 in.) internal diameter. The drum exterior dimensions are 88.9 cm (35 in.) in height and 61.0 cm (24 in.) in diameter. The drums are equipped with a removable gasket head cover. A removable 2.67 mm (12 gauge) locking bolt ring joins the head cover to the drum.

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-002 (for TRU liquid organics);

CONFIGURATION: The drum for the transfer of TRU liquid organics is the superseded DOT 17C galvanized drum and has a rigid 2.29 mm (90 mil) polyethylene liner installed. Drums used for transfer of TRU liquid organics have either a vent clip or Nuc-Fil filter installed for venting purposes. Inner containment of the liquid organics is provided by a 4 L (1 gallon) polyethylene or polypropylene wide mouth bottle with a screw cap. The bottle has a maximum 15.2 cm (6.0 in.) outside diameter with a minimum 8.9 cm (3.5 in.) diameter wide mouth. The bottle is placed inside a vented polyethylene bag. The liner and bottle are provided with vent holes. The packaging arrangement of the 4 L (1 gallon) bottles is depicted in Figures 2-1 and 2-2. The empty weight of the galvanized drum is 31.75-kg (70 lb).

APPROVED CONTENTS: The approved contents for drums authorized by WHC-SD-RE-SAP-002 are solids, organics, liquids, and TRU. The maximum allowable weight is 227 kg (500 lb).

SARP: WHC-SD-RE-SAP-024 (for non-fissile);

CONFIGURATION: The superseded DOT 17 C or 17H drums used for transfer of TRU and non-fissile solids are painted and have a 0.10 mm (4 mil) or greater polyethylene liner installed. The empty weight of the painted drum is 26 kg (57.3 lb).

APPROVED CONTENTS: The approved contents for drums authorized by WHC-SD-RE-SAP-024 are up to and including 20 Ci of non-TRU, non-fissile solid radioactive material. The maximum allowable weight is between 45.4 and 381 kg (100-840 lb).

SARP: WHC-SD-RE-SAP-033 (for TRU)

CONFIGURATION: The superseded DOT 17 C or 17H drums covered by WHC-SD-RE-SAP-033; require a polyethylene liner of 0.10 mm (4 mil) or more.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-SD-RE-SAP-033 are solids, TRU, and fissile (up to 400 g). The maximum allowable weight is between 318 and 658 kg (700-1450 lb) up to HRCQ allowed.

APPROVED FOR OFFSITE: No.

APPROVED FOR ONSITE: Yes; Type A, Type B

REUSABLE: Drums covered by WHC-SD-RE-SAP-002 and WHC-SD-RE-SAP-033 are reusable, but drums covered by WHC-SD-RE-SAP-024 are not reusable.

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

COMMON NAME: Type A Drum
OFFICIAL NAME: 208 L (55 Gallon) Drum
DESCRIPTION:

The 208 L (55 gallon) drum is a carbon steel right circular cylinder. A variety of finishes are authorized, for example painted or galvanized. The superseded DOT 17C drum is constructed of 1.52 mm (16 gauge) carbon steel with three rolled swaged hoops. The superseded DOT 17H drum is similarly constructed utilizing 1.22 mm (18 gauge) carbon steel. The drums have an 84.5 cm (33.25 in.) usable inside height and 57.2 cm (22.5 in.) internal diameter. The drum exterior dimensions are 88.9 cm (35 in.) in height and 61.0 cm (24 in.) in diameter. Painted drums have a 0.10 mm (4 mil) or greater polyethylene liner installed. The empty weight of the galvanized drum is 31.75 kg (70 lb). The empty weight of the painted drum is 26 kg (57.3 lb). Galvanized steel drums purchased to the WHC specification HS-V-P-0010, Revision A through C, can be used under this authorization. Drums purchased under revision C will not be marked as DOT 17C. Those drums will carry a UN 1A2 marking. No other drums marked UN 1A2 can be shipped as Type A package under this authorization unless the vendor has certified they are equivalent to drums built to the old DOT 17C Specification. See Figure 2-1.

The drums are equipped with a removable gasket head cover. A removable 2.67 mm (12 gauge) locking bolt ring joins the head cover to the drum.

NOTE: WHC-EP-0558 does not authorize the use of equivalent size performance-oriented drums marked as UN 1A2. A drum built using the same design, and materials and methods of construction as the superseded DOT specification drum it is replacing can be used. Because of changes in the industry, it is unlikely that a standard product with equivalent materials and methods of construction will be found. The shipper must maintain documentation that the replacement drum is equivalent to the drum identified in WHC-EP-0058. Drums used as Type A packagings are not required to be marked as meeting any other DOT specification.

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see note above.)

CONFIGURATION: DOT 17H drums covered by WHC-EP-0558 require that when the load contains powder like material RTV sealant or equivalent be applied to the surface of the lid gasket in contact with the drum body. Venting is not approved. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. See information below on physical form and weight.

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see note above.)

CONFIGURATION: DOT 17C and equivalent drums covered by WHC-EP-0558; require the use of a drum liner. Both heavy walled and flexible liners are authorized. Several types of vents are authorized. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. While the physical form and weight identified below are authorized, the shipper must determine that the actual contents are closely simulated by the test contents. If they are not, testing or analysis must be conducted and documented to demonstrate DOT-7A compliance with the actual contents. See WHC-EP-0558 for a description of test contents.

PHYSICAL FORM:

- Solids only. Three forms are authorized. Each shipper must determine the most appropriate form for their particular contents and comply with any special requirements.
 - Material Form 1: Solids--Any particle size.
 - Material Form 2: Solids--Large particle size only (e.g., sand, concrete, debris, or soil).
 - Material Form 3: Solids--Objects with no significant dispersible or removable contamination. (For definition, see 49 CFR 173.433, contamination control).
- Maximum Gross Weights:
 - Form 1: 409 kg (900 lb).
 - Form 2: 454 kg (1000 lb).
 - Form 3: 454 kg (1000 lb).

CHEMICAL FORM:

The shipper must evaluate and ensure chemical compatibility of the material to be shipped with the materials of the packaging in contact with the payload.

RADIOLOGICAL:

The 1.2 m (4 ft) drop test caused deformation of the packaging resulting in a decrease in the distance from the exterior to the center of the package at the bottom edge. For the DOT 17C drum the dented was 7.0 cm (2.75 in. approximate). For the DOT 17H drum the dented was 9.5 cm (3.75 in. approximate). The shipper must ensure that the radiation level at any surface would not increase by more than 20% (relative to the radiation level of the undamaged configuration) if such a deformation would occur.

APPROVED FOR OFFSITE: Yes; Type A, LSA

APPROVED FOR ONSITE: Yes; Type A, LSA

LINER: See configuration information above.

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 2-1. 208 L (55 Gallon) Drum.

H9505010.1

Figure 2-2. Cutaway of Packaging Arrangement for 208 L (55 Gallon) Drum.

H9505010.2

COMMON NAME: 208 L (55 Gallon) Shielded Drum

OFFICIAL NAME: Waste Drum Assembly, 45.7 cm (18 in.), 38.1 cm (15 in.), and 30.5 cm (12 in.)

DESCRIPTION:

The 208 L (55 gallon) drum is a carbon steel right circular cylinder, which serves as a primary containment barrier for the contents. The DOT 17H drum is constructed of 1.22 mm (18 gauge) carbon steel with three rolled swaged hoops. The primary container is modified by the addition of a fiber-reinforced annulus of concrete and two lead shields.

The annulus consists of concrete poured around a fiber form. The form and concrete extend a nominal 81 cm (32 in.) from the bottom of the drum. Lead sheets, which provide shielding equivalent to the concrete annulus, are positioned at the top and bottom of the annulus. The bottom lead shield is positioned by a plywood sheet and held in place by the concrete. The top lead shield assembly is held in position by a plywood sheet and wood blocks. The top shield assembly is sized to prevent the lead from moving out of position during shipment. This arrangement forms a cylindrical cavity with the nominal dimensions shown in Table 2-1.

Secondary containment is provided through the use of a plastic bag liner inside the cavity (see Figure 2-3). The bag liner, which is sized to fit the cavity diameter, has a wall thickness of a nominal 0.10 mm (4 mil) and a length of about 1.83 m (6 ft). The plastic liner is sealed by twisting, (i.e., horsetailing) and taping.

The drums are equipped with a removable gasket head cover. A removable 2.67 mm (12 gauge) locking bolt ring joins the head cover to the drum.

Table 2-1. Internally Shielded 55-Gallon Drum Specifications.

Internal Dimensions		Concrete shield thickness	Weight of shielded drum	Weight of shield	Weight of contents
Diameter	Height				
29.2 cm (11 1/2 in.)	79.7 cm (31 3/8 in.)	13.3 cm (5 1/4 in.)	449 kg (990 lb)	40.9 kg (90 lb.)	209 kg (460 lb)
38.3 cm (15 3/32 in.)	82.2 cm (32 3/8 in.)	8.7 cm (3 13/32 in.)	327 kg (720 lb)	22.7 kg (50 lb)	331 kg (730 lb)
46 cm (18 3/32 in.)	81.3 cm (32 in.)	4.8 cm (1 29/32 in.)	209 kg (460 lb)	25.0 kg (55 lb)	449 kg (990 lb)

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-043 (for internally shielded drum)
 DRAWINGS: H-2-94447, H-2-94446, and H-2-94445

APPROVED CONTENTS:

The internally shielded 208 L (55 gallon) drum is acceptable for shipping 20 Ci or less of solid non-fissile radioactive material. The shipment of absorbed inorganic liquid is permitted when a quantity of absorbent material capable of absorbing twice the volume of liquid present. Contents may include all isotopes; however, in the case of fissile isotopes, only fissile-exempted quantities are permitted.

The radioactive materials normally shipped are found as contamination on items such as glass, paper, plastic, rags, wood, rock, soil, metal, pipe, and tools. Materials being shipped to burial shall contain no more than 100 nCi (3.7 k Bq) of transuranic radionuclides per gram of waste matrix.

The internal dimensions and the approximate net weights for the three package designs are shown in Table 2-1. For a specific drum, the weight and volume are governed by the maximum gross drum weight of 658 kg (1,450 lb) and by the actual drum modification. Contents shall not be capable of reacting significantly with the packaging or other contents.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; 20 Ci or less of solid non-fissile radioactive material.

LINER: Drum covered by WHC-SD-RE-SAP-043: 0.10 mm (4 mil) or greater polyethylene.

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 2-3. 208 L (55 Gallon) Shielded Drum.

H9505010.3

COMMON NAME: 132 L (35 Gallon) Drum

OFFICIAL NAME: 132 L (35 Gallon) Drum

DESCRIPTION:

The 132 L (35 gallon) drum is a carbon steel right circular cylinder. A variety of finishes are authorized, for example painted or galvanized. The superseded DOT 17C drum is constructed of 1.52 mm (16 gauge) carbon steel with three rolled swaged hoops. The drums have an 85.1 cm (33.5 in.) usable inside height and 45.7 mm (18 in.) internal diameter. The drum exterior dimensions are 88.3 cm (34.8 in.) in height and 52.1 cm (20.5 in.) in diameter. The empty weight of the drum is 17.7 kg (39.0 lb). See Figure 2-4. The drums are equipped with a removable gasket head cover. A removable 2.67 mm (12 gauge) locking bolt ring joins the head cover to the drum.

NOTE: WHC-EP-0558 does not authorize the use of equivalent size performance-oriented drums marked as UN 1A2. A drum built using the same design, and materials and methods of construction as the superseded DOT specification drum it is replacing can be used. Because of changes in the industry, it is unlikely that a standard product with equivalent materials and methods of construction will be found. The shipper must maintain documentation that the replacement drum is equivalent to the drum identified in WHC-EP-0058. Drums used as Type A packagings are not required to be marked as meeting any other DOT specification.

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see above note)

CONFIGURATION: DOT 17C covered by WHC-EP-0558 require that when the load contains powder like material RTV sealant or equivalent be applied to the surface of the lid gasket in contact with the drum body. Venting is not approved. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. While the physical form and weight identified below are authorized, the shipper must determine that the actual contents are closely simulated by the test contents. If they are not, testing or analysis must be conducted and documented to demonstrate DOT-7A compliance with the actual contents. See WHC-EP-0558 for a description of test contents.

PHYSICAL FORM:

- Solids only. Three forms are authorized. Each shipper must determine the most appropriate form for their particular contents and comply with any special requirements.
 - Material Form 1: Solids--Any particle size.

- Material Form 2: Solids--Large particle size only (e.g., sand, concrete, debris, or soil).
- Material Form 3: Solids--Objects with no significant dispersible or removable contamination. (For definition, see 49 CFR 173.433, contamination control).

- Maximum Gross Weights:

- Form 1: 181 kg (400 lb).
- Form 2: 181 kg (400 lb).
- Form 3: 181 kg (400 lb).

CHEMICAL FORM:

The shipper must evaluate and ensure chemical compatibility of the material to be shipped with the materials of the packaging in contact with the payload.

RADIOLOGICAL:

The 1.2 m (4 ft) drop test caused deformation of the packaging resulting in a decrease in the distance from the exterior to the center of the package at the bottom edge. The dent was 2.9 cm (1.125 in. approximate). The shipper must ensure that the radiation level at any surface would not increase by more than 20% (relative to the radiation level of the undamaged configuration) if such a deformation would occur.

APPROVED FOR OFFSITE: Yes; LSA, Type A

APPROVED FOR ONSITE: Yes; LSA, Type A

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 2-4. 132 L (35 Gallon) Drum.

**DOT 7A Type A
49 CFR 178.350**

H9505010.5

COMMON NAME: 114 L (30 Gallon) Drum

OFFICIAL NAME: 114 L (30 Gallon) Drum

DESCRIPTION:

The 114 L (30 gallon) drum is a carbon steel right circular cylinder. A variety of finishes are authorized, for example painted or galvanized. The superseded DOT 17C drum is constructed of 1.52 mm (16 gauge) carbon steel with three rolled swaged hoops. The superseded DOT 17H drum is similarly constructed utilizing 1.22 mm (18 gauge) carbon steel. The drums have a 71.1 cm (28.0 in.) usable inside height and 45.7 cm (18 in.) internal diameter. The drum exterior dimensions are 74.9 cm (29.5 in.) in height and 50.8 cm (20.0 in.) in diameter. The empty weight of the drum is 15.2 kg (33.5 lb). See Figure 2-5. The drums are equipped with a removable gasket head cover. A removable 2.67 mm (12 gauge) locking bolt ring joins the head cover to the drum.

NOTE: WHC-EP-0558 does not authorize the use of equivalent size performance-oriented drums marked as UN 1A2. A drum built using the same design, and materials and methods of construction as the superseded DOT specification drum it is replacing can be used. Because of changes in the industry, it is unlikely that a standard product with equivalent materials and methods of construction will be found. The shipper must maintain documentation that the replacement drum is equivalent to the drum identified in WHC-EP-0058. Drums used as Type A packagings are not required to be marked as meeting any other DOT specification.

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see above note)

CONFIGURATION: DOT 17C drums covered by WHC-EP-0558 require that when the load contains powder like material RTV sealant or equivalent be applied to the surface of the lid gasket in contact with the drum body. No liner is required. Vents are not authorized. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. See information below on physical form and weight. See WHC-EP-0558 for a description of test contents.

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see above note)

CONFIGURATION: DOT 17H drums covered by WHC-EP-0558 require the use of drum liners. Both heavy walled and flexible liners are authorized. Venting is approved. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. While the physical form and weight identified below are authorized, the shipper must determine that the actual contents are closely simulated by the test contents. If they are not, testing or analysis must be conducted and documented to demonstrate DOT-7A compliance with the actual contents. See WHC-EP-0558 for a description of test contents.

PHYSICAL FORM:

- Solids only. Three forms are authorized. Each shipper must determine the most appropriate form for their particular contents and comply with any special requirements.
 - Material Form 1: Solids--Any particle size.
 - Material Form 2: Solids--Large particle size only (e.g., sand, concrete, debris, or soil).
 - Material Form 3: Solids--Objects with no significant dispersible or removable contamination. (For definition, see 49 CFR 173.433, contamination control).
- Maximum Gross Weights:

DOT 17C

- Form 1: 181 kg (400 lb).
- Form 2: 227 kg (500 lb).
- Form 3: 227 kg (500 lb).

DOT 17H

- Form 1: 181 kg (400 lb).
- Form 2: 181 kg (400 lb).
- Form 3: 181 kg (400 lb).

CHEMICAL FORM:

The shipper must evaluate and ensure chemical compatibility of the material to be shipped with the materials of the packaging in contact with the payload.

RADIOLOGICAL:

The 1.2 m (4 ft) drop test caused deformation of the packaging resulting in a decrease in the distance from the exterior to the center of the package at the bottom edge. For both the DOT 17C and 17H drum the dent was 7.0 cm (2.75 in. approximate). The shipper must ensure that the radiation level at any surface would not increase by more than 20% (relative to the radiation level of the undamaged configuration) if such a deformation would occur.

APPROVED FOR OFFSITE: Yes; LSA, Type A

APPROVED FOR ONSITE: Yes; LSA, Type A

LINER: See configuration information above.

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 2-5. 114 L (30 Gallon) Drum.

DOT 7A Type A
49 CFR 178.350

H9505010.4

COMMON NAME: 18.9 L (5 Gallon) and 37.8 L (10 Gallon) Drum

OFFICIAL NAME: Drums, 18.9 L (5 Gallon) and 37.8 L (10 Gallon), Steel

DESCRIPTION:

The 18.9 L (5 gallon) drum is a carbon steel right circular cylinder. Various finishes are authorized, for example painted or galvanized. The superseded DOT 6C drum is constructed of 0.76 mm (22 gauge) carbon steel with two rolled swaged hoops. The drum has a 31.8 cm (12.5 in.) usable inside height and 28.6 cm (11.3 in.) internal diameter. The drum exterior dimensions are 34.3 cm (13.5 in.) in height and 31.1 cm (12.3 in.) in diameter. The drum is equipped with a removable gasket head cover. A removable 0.91 mm (20 gauge) locking bolt ring joins the head cover to the 18.9 L drum. The empty weight of the drum is 3 kg (6.6 lb). See Figure 2-6.

The 37.8 L (10 gallon) drum is a carbon steel right circular cylinder. Various finishes are authorized, for example painted or galvanized. The superseded DOT 6C drum is constructed of 0.91 mm (20 gauge) carbon steel with two rolled swaged hoops. The drum has a 40.0 cm (15.8 in.) usable inside height and 35.6 cm (14.0 in.) internal diameter. The drum exterior dimensions are 43.8 cm (17.3 in.) in height and 38.1 cm (15.0 in.) in diameter. The drum is equipped with a removable gasket head cover. A removable 1.52 mm (16 gauge) locking bolt ring joins the head cover to the 37.8 L drum. The empty weight of the drum is 5.1 kg (11.2 lb). See Figure 2-6.

NOTE: WHC-EP-0558 does not authorize the use of equivalent size performance-oriented drums marked as UN 1A2. A drum built using the same design, and materials and methods of construction as the superseded DOT specification drum it is replacing can be used. Because of changes in the industry, it is unlikely that a standard product with equivalent materials and methods of construction will be found. The shipper must maintain documentation that the replacement drum is equivalent to the drum identified in WHC-EP-0058. Drums used as Type A packagings are not required to be marked as meeting any other DOT specification.

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see above note)

CONFIGURATION: 5 and 10 gallon DOT 6C drums covered by WHC-EP-0558 require that when the load contains powder like material RTV sealant or equivalent be applied to the surface of the lid gasket in contact with the drum body. No liner is required. Vents are not authorized. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. While the physical form and weight identified below are authorized, the shipper must determine that the actual contents are closely simulated by the test contents. If they are not, testing or analysis must be conducted and documented to demonstrate DOT-7A compliance with the actual contents. See WHC-EP-0558 for a description of test contents.

PHYSICAL FORM:

- Solids Only. Three forms are authorized. Each shipper must determine the most appropriate form for his particular contents and comply with any special requirements (e.g., RTV, etc.).
 - Material Form 1: Solids--Any particle size.
 - Material Form 2: Solids--Large particle size only (e.g., sand, concrete, debris, soil, etc.).
 - Material Form 3: Solids--Objects with no significant dispersible or removable contamination. (For definition, see 49 CFR 173.443, *Contamination Control*).
- Maximum Gross Weight Forms 1, 2, and 3:
 - 18.9 L (5 gallon): 36.3 kg (80 lb).
 - 37.8 L (10 gallon): 72.6 kg (160 lb).

CHEMICAL FORM:

The shipper must evaluate and ensure chemical compatibility of the material to be shipped with the materials of the packaging in contact with the payload.

RADIOLOGICAL:

Dents approximately 27.9 mm (1.1 in.) and 38.1 mm (1.5 in.) appeared in the 18.9 L (5 gallon) and 37.8 L (10 gallon) drums, respectively, following the 1.2 m (4 ft) drop test on the bottom edge. The shipper must ensure that the radiation level at any surface would not increase by more than 20% (relative to the radiation level of the undamaged configuration) if such a deformation would occur.

APPROVED FOR OFFSITE: Yes; Type A, LSA

APPROVED FOR ONSITE: Yes; Type A, LSA

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 2-6. 18.9 L and 37.8 L (5 and 10 Gallon) Drums.

DOT 7A Type A 49 CFR 178.350

H9505010.6

COMMON NAME: 18.9 L (5 Gallon) Drum
OFFICIAL NAME: Drum, 18.9 L (5 Gallon) Drum
DESCRIPTION:

The 18.9 L (5 gallon) drum is a carbon steel right circular cylinder. Various finishes are authorized, for example painted or galvanized. The superseded DOT 17C drum is constructed of 0.76 mm (22 gauge) carbon steel with two rolled swaged hoops. The drum has a 31.8 cm (12.5 in.) usable inside height and 28.6 cm (11.3 in.) internal diameter. The drum exterior dimensions are 33.0 cm (13.0 in.) in height and 30.5 cm (12.0 in.) in diameter. The empty weight of the drum is 3 kg (6.6 lb). The drum is equipped with a removable gasket head cover. A removable 0.91 mm (20 gauge) locking bolt ring joins the head cover to the drum. See Figure 2-7.

NOTE: WHC-EP-0558 does not authorize the use of equivalent size performance-oriented drums marked as UN 1A2. A drum built using the same design, and materials and methods of construction as the superseded DOT specification drum it is replacing can be used. Because of changes in the industry, it is unlikely that a standard product with equivalent materials and methods of construction will be found. The shipper must maintain documentation that the replacement drum is equivalent to the drum identified in WHC-EP-0058. Drums used as Type A packagings are not required to be marked as meeting any other DOT specification.

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (For use as DOT Spec 7A packaging, see above note)

CONFIGURATION: 5 gallon DOT 17C drums covered by WHC-EP-0558 require that when the load contains powder like material RTV sealant or equivalent be applied to the surface of the lid gasket in contact with the drum body. No liner is required. Vents are not authorized. See WHC-EP-0558 for configuration details.

APPROVED CONTENTS: The approved contents for drums authorized by WHC-EP-0558 are solids. While the physical form and weight identified below are authorized, the shipper must determine that the actual contents are closely simulated by the test contents. If they are not, testing or analysis must be conducted and documented to demonstrate DOT-7A compliance with the actual contents. See WHC-EP-0558 for a description of test contents.

PHYSICAL FORM:

- Solids Only. Three forms are authorized. Each shipper must determine the most appropriate form for his particular contents and comply with any special requirements (e.g., RTV).
 - Material Form 1: Solids--Any particle size.

- Material Form 2: Solids--Large particle size only (e.g., sand, concrete, debris, soil, etc.).
- Material Form 3: Solids--Objects with no significant dispersible or removable contamination. (For definition, see 49 CFR 173.443, *Contamination Control*).
- Maximum Gross Weight forms 1, 2, and 3: 45.4 kg (100 lb).

CHEMICAL FORM:

The shipper must evaluate and ensure chemical compatibility of the material to be shipped with the materials of the packaging in contact with the payload.

RADIOLOGICAL:

Denting approximately 13 mm (0.5 in.) appeared in the 18.9 L (5 gallon) drum following the 1.2 m (4 ft) drop test on the bottom edge. The shipper must ensure that the radiation level at any surface would not increase by more than 20% (relative to the radiation level of the undamaged configuration) if such a deformation would occur.

APPROVED FOR OFFSITE: Yes; Type A, LSA

APPROVED FOR ONSITE: Yes; Type A, LSA

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 2-7. 18.9 L (5 Gallon) Drum.

H9505010.7

COMMON NAME: 322 L (85 Gallon) Retrieval Drum

OFFICIAL NAME: UN 1A2, Solid Material, Packaging Group I, 400 kg capacity, 322 L (85 Gallon) Drum

DESCRIPTION:

The 322 L (85 gallon) drum that is authorized to be used as a retrieval drum is the UN1A2, solid material, Packaging Group I, 322 L drum. It is a commercially-available metal container in the shape of a right cylinder with usable inside dimensions of 96.2 cm (37.9 in.) height and 66.6 cm (26.0 in.) diameter. The drum exterior dimensions are 99.1 cm (39.0 in.) in height and 70.1 cm (27.6 in.) in diameter. It is constructed of galvanized steel with three rolled or swaged hoops. The empty weight of the drum is 35 kg (77 lb). See Figure 2-8.

The drum is equipped with a removable gasketed headcover. A removable 2.67 mm (12 gauge) locking bolt ring joins the headcover to the drum. The vent/filter is configured to a bung fitting 19 mm (3/4 in.), which has a Nucfil¹ vent/filter installed in it. The filter will provide for the continuous equalization of the internal and environmental pressure while maintaining containment.

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-006 (for 322 L [85 gallon] drum)

OTHER: HS-VP-0010, Rev. C, Drums, DOT UN1A2; Solid and Liquid Material, 322 Liter

Note: The SARP currently only authorizes the use of Grief Brother's drums purchased to HS-VP-0010, Revision C. The SARP also contains a milage restriction. Users considering shipment of drums under this SARP should contact the technical contacts listed below before making the shipment.

CONFIGURATION: The 322 L retrieval drum consist of radioactive materials in drums (208 L [55 gallon] and smaller) which may be of questionable integrity, be breached, contain non-compliant waste forms, and/or have other defects. Dunnage shall be added between the payload and retrieval drums to limit payload drum motion during handling.

APPROVED CONTENTS: The contents of the 322 L retrieval drum consist of mixed and non-mixed radioactive waste in drums (208 L (55 gallon) and smaller) which may be of questionable integrity, be breached, contain non-compliant waste forms, and/or have other defects.

A retrieval drum that contains 200 g of fissile material or less may be handled without restriction. Drums with fissile content greater than 200 g, but less than 335 g of fissile material may be shipped with special handling requirements per the SARP. Payload

¹Nucfil is a trademark of Nuclear Filter Technology, Incorporated.

drums with greater than 335 g of fissile material may not be transported in the 322 L retrieval drum unless specifically authorized by the SARP. The SARP authorizes the 322 L retrieval drum for the shipment of up to 515 g of fissile material in payload drums that utilize the LID-1 inner container.

The physical form of the payload drum's contents will be solid, with up to 1 g of free liquids, waste materials will usually include items such as radioactively contaminated paper, glass, plastics, rags, wood, shielding, metal pipe, pump parts, absorbed liquids, animal waste, rocks and soil.

Dunnage shall be added between the payload and retrieval drums to limit payload drum motion during handling. In cases where nondestructive examination has determined that the payload drum contains free liquids up to 1 g, vermiculite or equivalent absorbent material shall be used as dunnage to absorb the free liquids that are present in the retrieval drum.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, and HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 2-8 85-Gallon Retrieval Drum.

H9505010.65

COMMON NAME: 322 L (85 Gallon) Drum

OFFICIAL NAME: UN 1A2, Solid Material, Packaging Group I, 400 kg capacity, 322 L (85 Gallon) Drum

DESCRIPTION:

The 322 L (85 gallon) UN 1A2 galvanized drum, Packaging Group I, for solid material, is a commercially-available metal container in the shape of a right cylinder with usable inside dimensions of 96.2 cm (37.9 in.) height and 66.6 cm (26.0 in.) diameter. The drum exterior dimensions are 99.1 cm (39.0 in.) in height and 70.1 cm (27.6 in.) in diameter. It is constructed of steel with three rolled or swaged hoops. The empty weight of the drum is 35 kg (77 lb).

The drum is equipped with a removable gasketed headcover. A removable 2.67 mm (12 gauge) locking bolt ring joins the headcover to the drum. The drum lid may be configured with a 19 mm (3/4 in.) bung fitting. See Figure 2-8.

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: Vendor supplied information in accordance with requirements in HS-VP-0010, Rev. E, Drums, DOT UN1A2; Solid and Liquid Material, 322 Liter

CONFIGURATION: The 322 L (85 gallon) UN 1A2 drums covers Type A quantities of radioactive waste. Filtered vents are authorized. The packaging may require the use of a poly bag liner see vendor supplied Type A packaging documentation.

APPROVED CONTENTS:

The contents of the 322 L retrieval drum consist of radioactive material.. Including material in drums (208 L (55 gallon) and smaller) which may be of questionable integrity, be breached, and/or have other defects.

APPROVED FOR OFFSITE: Yes; LSA, Type A

APPROVED FOR ONSITE: Yes; LSA, Type A

LINER: Yes

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

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3.0 METAL BOXES

COMMON NAME: TMB

OFFICIAL NAME: TRU Metal Box

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-091

SPECIFICATION: WHC-HS-BP-040

DESCRIPTION:

The Transuranic Metal Box (TMB) is a rectangular carbon steel box available in five different sizes with various external dimensions and approved gross weights (see Table 3-1 for TMB external dimensions). The maximum gross weight for each box size is limited to the manufacturer's certified weight. The TMB is manufactured to Specification WHC-HS-BP-040, meets DOT Type A requirements, and also has been certified to pass a 9.1 m (30 ft) drop test without catastrophic failure. All the containers have the capability for handling by forklift or sling. The container is equipped with a standard Nucfil filter for venting purposes. See Figure 3-1.

Table 3-1. TMB Exterior Dimensions.

Model	Length		Width		Height	
TMB-I	173 cm	5 ft, 8 in.	137 cm	4 ft, 6 in.	97.8 cm	3 ft, 2½ in.
TMB-II	18 cm	6 ft, 2½ in.	128 cm	4 ft, 2½ in.	97.8 cm	3 ft, 2½ in.
TMB-III	213 cm	7 ft, 0 in.	122 cm	4 ft, 0 in.	122 cm	4 ft, 0 in.
TMB-VI	224 cm	7 ft, 4 in.	137 cm	4 ft, 6 in.	137 cm	4 ft, 6 in.
TMB-V	284 cm	9 ft, 4 in.	173 cm	5 ft, 8 in.	196 cm	6 ft, 5 in.

APPROVED CONTENTS:

The contents of the TMB container are limited to less than 1000 g of fissile material mixed with less than 7500 A₁/A₂s of non-fissile radionuclides. Shipments made over roadways with free and not approved for offsite unlimited public access are restricted to 350 g of fissile material or less.

The TMB is intended to be a multipurpose container and the contents will vary widely. The approved contents of the TMB include small particulate solids (granules or powders), solids of large particulate size (sand, concrete, soil, etc.), or solid equipment and/or scrap materials (pumps, piping, gloveboxes, clothing, dirt, etc.). All contents are dry, with absorbent used to take up any residual liquid. All equipment is individually wrapped in plastic except when size or As Low As Reasonably Achievable (ALARA) considerations prohibit. If the items are not wrapped individually, the box is lined with plastic (nominal 0.15 mm [6 mil] or greater) before loading and the plastic is folded over the contents before the lid is installed.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, and HRCQ

LINER: 0.15 mm (6 mil) or greater polyethylene

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 3-1. TRU Metal Box.

Type	Length	Width	Height	Minimum Required Total Gross Weight
TMB-I	173 cm (5 ft 8 in.)	137 cm (4 ft 6 in.)	97.8 cm (3 ft 2-1/2 in.)	1,671 Kg (3,680 lbs)
TMB-II	189 cm (6 ft 2-1/2 in.)	128 cm (4 ft 2-1/2 in.)	97.8 cm (3 ft 2-1/2 in.)	1,712 Kg (3,770 lbs)
TMB-III	213 cm (7 ft)	122 cm (4 ft)	122 cm (4 ft)	2,288 Kg (5,040 lbs)
TMB-IV	224 cm (7 ft 4 in.)	137 cm (4 ft 6 in.)	137 cm (4 ft 6 in.)	3,033 Kg (6,780 lbs)
TMB-V	285 cm (9 ft 4 in.)	173 cm (5 ft 8 in.)	196 cm (6 ft 5 in.)	6,933 Kg (15,270 lbs)

.H9505010.12

COMMON NAME: LMB

OFFICIAL NAME: Low-Level Metal Box

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-092

SPECIFICATION: WHC-HS-BP-041

DESCRIPTION:

The Low-Level Metal Box (LMB) is a rectangular carbon steel box with various external dimensions and approved gross weights. The maximum gross weight is ultimately limited to the actual "Maximum Gross Weight" identification marking indicated by the container manufacturer based on the box category, size, and design payload density (see Table 3-2 for LMB minimum design payload density based on category). The LMB is manufactured to Specification WHC-HS-BP-041, meets DOT Type A requirements, and also has been certified to pass a 9.1 m (30 ft) drop test without catastrophic failure. All the containers have the capability for handling by forklift or sling. See Figure 3-2.

Table 3-2. Low-Level Metal Box Categories.

Low-level metal box category	Minimum design payload density
LMB-L (light)	801 kg/m ³ (50 lb/ft ³)
LMB-M (medium)	1,602 kg/m ³ (100 lb/ft ³)
LMB-H (heavy)	2,403 kg/m ³ (150 lb/ft ³)

APPROVED CONTENTS:

The contents of the LMB container are limited to less than 3000 A₁/A₂s of non-fissile radionuclides. The LMB is intended to be a multipurpose container and the contents will vary widely. The approved contents of the LMB include small particulate solids (granules or powders), solids of large particulate size (sand, concrete, soil, etc.), or solid equipment and/or scrap materials (pumps, piping, gloveboxes, clothing, dirt, etc.). All contents are dry, with absorbent used to take up any residual liquid. All equipment is individually wrapped in plastic except when size or As Low As Reasonably Achievable (ALARA) considerations prohibit. If the items are not wrapped individually, the box is lined with plastic (nominal 0.15 mm [6 mil] or greater) before loading and the plastic is folded over the contents before the lid is installed.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, and HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 3-2. Low-Level Metal Box.

WHC Low-Level Metal Box Category	Minimum Design Payload Density
LMB-L (light)	802 kg/m ³ (50 lb/ft ³)
LMB-M (medium)	1,604 kg/m ³ (100 lb/ft ³)
LMB-H (heavy)	2,406 kg/m ³ (150 lb/ft ³)

H9505010.13

COMMON NAME: SWB

OFFICIAL NAME: Standard Waste Box

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-004

DRAWING: WIPP 165-F-001-W, Rev. F
H-2-815139, Rev. 0

OTHER: WHC-EP-0558 (for DOT Spec 7A packaging)

DESCRIPTION:

The SWB is a carbon steel container designed and fabricated at the Waste Isolation Pilot Plant (WIPP). The inner cavity of the SWB measures 93.2 cm (36.7 in.) high x 132 cm (51.9 in.) wide x 174 cm (68.7 in.) in length for an internal volume of approximately 1.84 m³ (65 ft³). The external dimensions of the SWB measure 94.0 cm (37 in.) high x 138 cm (54.5 in.) wide x 180 cm (71.0 in.) in length. The SWB lid is secured by the installation of forty two 1.3 cm (1/2 in.) Flat Head Socket Cap Screws. The empty weight of the SWB is approximately 295 kg (650 lb) and the maximum gross weight allowed is 1814 kg (4000 lb). Six clips (three on each side) are located on the top sides of the SWB for lifting and tiedown purposes.

The SWB is designed such that two SWB containers can be inserted in the TRUPACT II shipping cask for transport in commerce to the WIPP. The SWB meets the requirements of Type A radioactive materials packaging. The SWB is shown in Figure 3-3. Only Style 1 (i.e., bolted closure) is authorized for use on the Hanford Site.

APPROVED CONTENTS:

The SWB is authorized for transfer of up through Type B fissile, HRCQ (DOT 1991a) quantities of TRU waste. The payload will vary widely, with all materials shipped in solid form. Contents will be small particulate solids (granules and powders), large particulate solids (e.g., sand, concrete, and soil), or solid equipment and/or scrap materials, typically pumps, piping, gloveboxes, tank sections, and clothing. The payload is defined in accordance with the Waste Acceptance Criteria for the Waste Isolation Pilot Plant, WIPP/DOE-069, Revision 4 (DOE 1991). The SWB shall not contain more than 15 g of fissile material, if waste in the form of plastic (excluding wrapping and liners) is part of the payload.

APPROVED FOR OFFSITE: Yes; Type A, per WHC-EP-0558, LSA; Type B, and HRCQ in TRUPACT II

APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, and HRCQ, per WHC-SD-TP-SARP-004

LINER: 0.10 mm (4 mil) or greater polyethylene

REUSABLE: No

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 3-3. Standard Waste Box.

H9505010.14

COMMON NAME: Strong Tight Box

OFFICIAL NAME: B-12 LSA Waste Container

APPROVAL DOCUMENTS/SPECIFICATIONS:

DESCRIPTION:

The B-12 LSA Waste Container is a rectangular "strong-tight" container fabricated from ASTM A-569 low-carbon hot-rolled steel. The manufacturer is Container Products Corporation. The inner dimensions of the B-12 measure 58.4 cm (23 in.) high x 117 cm (46 in.) wide x 183 cm (72 in.) in length for an internal volume of approximately 1.25 m³ (44 ft³). The external dimensions of the B-12 measure 71.1 cm (28 in.) high x 119 cm (47 in.) wide x 185 cm (73 in.) in length. See Figure 3-4.

APPROVED CONTENTS:

Not Applicable

APPROVED FOR OFFSITE: Yes; LSA

APPROVED FOR ONSITE: Yes; LSA

LINER: None

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 3-4. B-12 LSA Waste Container.

Dimensions	Interior		Exterior	
	(cm)	(in.)	(cm)	(in.)
Height	58.4	(23)	71.1	(28)
Width	117	(46)	119	(47)
Length	183	(72)	185	(73)

H9505010.17

COMMON NAME: Strong Tight Box

OFFICIAL NAME: B-25 LSA Waste Container

APPROVAL DOCUMENTS/SPECIFICATIONS:

DAP: WHC-SD-TP-DAP-002

Other: Container Products Corporation (CPC, 1995)

DESCRIPTION:

The B-25 LSA Waste Container is a rectangular "strong-tight" container fabricated from ASTM A-569 low-carbon hot-rolled steel. The manufacturer is Container Products Corporation. The inner dimensions of the B-25 measure 119 cm (47 in.) high x 117 cm (46 in.) wide x 183 cm (72 in.) in length for an internal volume of approximately 2.55 m³ (90 ft³). The external dimensions of the B-25 measure 132 cm (52 in.) high x 119 cm (47 in.) wide x 185 cm (73 in.) in length. See Figure 3-5.

APPROVED CONTENTS:

Not Applicable

APPROVED FOR OFFSITE: Yes; LSA

APPROVED FOR ONSITE: Yes; LSA

LINER: None

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 3-5. B-25 LSA Waste Container.

H9505010.16

COMMON NAME: Strong Tight Box

OFFICIAL NAME: Strong Tight Compactable Waste Container

APPROVAL DOCUMENTS/SPECIFICATIONS:

DESCRIPTION:

The Strong-Tight Compactable Waste Container is a rectangular container fabricated from carbon steel. Container Products Corporation manufactures this container. The external dimensions of the container measure 183 cm (72 in.) high x 122 cm (48 in.) wide x 305 cm (120 in.) in length for an internal volume of approximately 6.1 m³ (216 ft³). The maximum payload weight authorized is 1,361 kg (3,000 lb). See Figure 3-6.

APPROVED CONTENTS:

Not Applicable

APPROVED FOR OFFSITE: Yes; LSA

APPROVED FOR ONSITE: Yes; LSA

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 3-6. Strong Tight Box.

H9505010.15

4.0 WOODEN BOXES

COMMON NAME: Red Box

OFFICIAL NAME: Finished Fuel Assembly Shipping Packaging

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-NR-SARP-001

DRAWINGS: H-3-31889 or H-3-18005

DESCRIPTION:

The fuel assembly packaging consists of a reusable open-top box used to transport unirradiated N Reactor fuel assemblies. The fuel assemblies are held in a lattice arrangement (four rows of nine assemblies each) with wooden spacers. A retaining plate is used to hold the spacer and fuel assemblies in position. Each layer of fuel assemblies is in a plastic envelope containing packets of moisture absorbing material (desiccant). The package is shipped with the top open. One side is removable to facilitate the loading of assemblies and positioning of spacers and plastic. Plywood is used as blocking between the packaging sides and shorter assemblies. A tie rod is used to secure the removable side. Skids are attached to the bottom of the packaging to allow movement with a forklift truck. There are no lifting or tiedown devices attached to the packaging other than the skids. Packaging dimensions are listed in Table 4-1. The maximum weight of the packaging and its contents is approximately 999 kg (2200 lb). The weight of the package will vary depending on the size and number of fuel assemblies being shipped. See Figure 4-1.

Table 4-1. Red Box Dimensions.

Drawing number	Height		Length		Width	
H-3-31889	66.7 cm	26.3 in.	123 cm	48.3 in.	76.8 cm	30.3 in.
H-3-18005	66.7 cm	26.3 in.	123 cm	48.3 in.	77.6 cm	30.6 in.
H-3-18005	66.7 cm	26.3 in.	123 cm	48.3 in.	69.4 cm	27.3 in.

APPROVED CONTENTS:

The finished fuel assemblies are fabricated and assembled in accordance with WHC-CM-5-20, *Manufacturing Process Specification for N Reactor Fuel*, and are limited to 36 assemblies per package. The assemblies consist of tube-in-tube metallic uranium elements in a zirconium alloy jacket. The Mark IV Assembly is 0.95% enriched with ^{235}U (inner and outer tubes). The Mark IA Assembly has an outer tube with a 1.25% enrichment of ^{235}U and an inner tube of 0.95% enrichment. Lengths vary between 38.1 to 53.3 cm (15 to 21 in.) for the Mark IA and 43.2 to 66 cm (17 to 26 in.) for Mark IV fuel. WHC-CM-5-20 gives specific fuel assembly information. Type A quantities of natural uranium enriched to less than 20% are unlimited, therefore, this is a Type A shipment.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A

LINER: 0.10 mm (4 mil) or more polyethylene

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 4-1. Finished Fuel Assembly Shipping Package – Red Box.

Drawing	H-3-31889	H-3-18005	
Height cm (in.)	66.7 (26.3)	66.7 (26.3)	66.7 (26.3)
Length cm (in.)	123.0 (48.3)	123.0 (48.3)	123.0 (48.3)
Width cm (in.)	76.8 (30.3)	77.6 (30.6)	69.4 (27.3)

H9505010.11

COMMON NAME: Plywood Box

OFFICIAL NAME: Plywood Box

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-020

DRAWING: H-1-42701

DESCRIPTION:

The rectangular plywood box (Figure 4-2) is constructed of 1.9 cm (3/4 in.) A-C fire retardant exterior plywood. The plywood is joined by 5.1 x 10.2 cm (2 x 4 in.) lumber serving as stiffeners, framing, and supports. Four 10.2 x 10.2 (4 x 4 in.) sections of lumber are fastened to the bottom of the box as skids. All joints on the ends, sides, and bottom and plywood joined to structural members are glued and stapled.

Four 3.2 cm (1 1/4 in.) wide steel bands are tightened horizontally around the box after fabrication. When the box is filled, the lid is glued and nailed into place. Six 3.2 cm (1 1/4 in.) wide steel bands are tightened around the closed box. The outside dimensions of the plywood box are 122 cm high by 136 cm high by 244 long (4 ft wide by 4 ft 5 1/2 in. high by 8 ft long). The internal volume of the box is approximately 3.96 m³ (140 ft³). The empty weight of the box is approximately 306 kg (675 lb). The allowed gross weight of the box is 2,270 kg (5000 lb).

APPROVED CONTENTS:

- Authorized contents of the plywood box will consist of miscellaneous contaminated tools, equipment, or solid waste.
- Total activity (curies) shall not exceed a Type A quantity. For a mixture of radionuclides, the activity levels shall be calculated to the requirements of (49 CFR 173.433 [b]) and the resulting summed quantities must not exceed unity.
- No more than 15 g of fissile material shall be allowed per box.
- Free or absorbed liquids are not allowed in the box.
- Compressed or uncompressed gases are not allowed in the box.
- The gross weight of the loaded box shall not exceed 2,270 kg (5,000 lb).

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A

LINER: Yes; 0.15 mm (6 mil) or more polyethylene

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 4-2. Plywood Box.

H9505010.10

COMMON NAME: LSA Plywood Box

OFFICIAL NAME: LSA Plywood Box

APPROVED DOCUMENTS/SPECIFICATIONS:

DAP: WHC-SD-TP-DAP-001 (LSA plywood box)
DRAWING: H-2-83306

DESCRIPTION:

The rectangular plywood boxes are constructed of 1.9 cm (3/4 in.) A-C fire retardant exterior plywood. The plywood is joined by 5.1 x 10.2 cm (2 x 4 in.) lumber serving as stiffeners, framing, and supports. Four 10.2 x 10.2 (4 x 4 in.) sections of lumber are fastened to the bottom of the box as skids. All joints on the ends, sides, and bottom and plywood joined to structural members are glued and stapled. The top of the box is attached by three 15 cm (6 in.) heavy strap hinges, and two 10.2 cm (4 in.) latching hasps which provide a secure lid closure.

There are two configurations of the box (See Figures 4-3 and 4-4). The first is 122 cm (4 ft) high, 122 cm (4 ft) wide and 244 cm (8 ft) long, and the second one is 61 cm (2 ft) high, 122 cm (4 ft) wide and 244 cm (8 ft) long. The internal volume of the first box is approximately 3.96 m³ (140 ft³), and the internal volume of the second box is approximately 1.98 m³ (70 ft³). The empty weight of the first box is approximately 306 kg (675 lb) and the empty weight of the second box is approximately 153 kg (337 lb). The allowed gross weight for each box is 2,268 kg (5,000 lb).

APPROVED CONTENTS:

These plywood boxes are designed to transport non-TRU LSA quantities of material. Contents shall consist of miscellaneous scrap and solid waste; for example, contaminated tools, equipment, paper and plastic waste. The gross weight of the box shall not exceed 2,268 kg (5,000 lb).

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA

LINER: Yes; 0.15 mm (6 mil) or more polyethylene

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 4-3. LSA Plywood Box, 122 cm x 122 cm x 244 cm (4 ft by 4 ft by 8 ft).

H9505010.8

Figure 4-4. LSA Plywood Box, 61.0 cm x 122 cm x 244 cm (2 ft by 4 ft by 8 ft).

H9505010.9

5.0 OTHER CONTAINERS

COMMON NAME: RRSC

OFFICIAL NAME: Radial Reflector Shipping Container

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-FF-SARP-001 (for radial reflector)

DRAWINGS: See Table 5-1

Table 5-1. Radial Reflector Shipping Container Drawings.

Drawing number	Abbreviated title
CONRES-278R001	Shipping and Storage Container
CONRES-278R002	Base Assembly
CONRES-278R003	Cover Assembly
CONRES-278R004	Reflector Support Assembly
CONRES-278R005	Clamp Assembly
CONRES-278R006	Pallet Assembly
CONRES-278R007	Skid
CONRES-278R008	Details
CONRES-278R009	Dummy Load
H-3-44048	Base Modification
H-3-44049	Pallet Modification
H-3-44050	Accelerometer Mounting Bracket
H-3-46165	Base Modification Type "B"
H-3-46166	Swing Bolt Assembly
H-3-46167	Strongback Bracket Modification
H-3-46168	Modification and Assembly
H-3-48336	Radial Reflector Shipping Container

DESCRIPTION:

The Radial Reflector Shipping Container (RRSC) presently is used to transport FFTF fuel and nonfuel reactor assemblies. The fully loaded package consists of two hemi-cylinders that bolt together to form a full cylinder that can contain up to four assemblies attached to a strongback. The strongback is composed of welded perpendicular steel plates and is attached to one end of the package by two upending pins which allow the strongback to be raised into the vertical position when the cover is removed.

The two RRSC hemi-cylinders are constructed of 1.88 mm (14 gauge) 1010-1020 carbon steel, and when bolted together, form a cylinder with interior dimensions of 419 cm (165 in.) long by 47.6 cm (18.75 in.) inside diameter and exterior dimensions of 424 cm (167 in.) long by 68.6 cm (27 in.) outside diameter. Four lifting eyes welded to the top cylinder allow lid lifting. The internal strongback assembly consists of a 0.64 cm (0.25 in.) thick vertical plate and 0.48 cm (0.19 in.) thick horizontal plates constructed of 1010-1020 carbon steel to which polypropylene hex supports are attached. The two cylinder halves are bolted together with an O-ring seal. The bottom cylinder has an attached base plate with eight separate shock mounts for shock and vibration reduction, giving the RRSC an overall height of 88.4 cm (34 in.).

The empty weight of the RRSC is 975 kg (2,150 lb). The maximum authorized weight of the packaging and its contents is 1824 kg (4,000 lb). The weight of the package varies depending on the size and number of assemblies being shipped. See Figures 5-1, 5-2 and 5-3.

APPROVED CONTENTS:

Shipment of fuel and non-fuel assemblies is compared to the reactivity of Driver Fuel Assemblies (DFA). The DFA is described with its contents in Table A-2 of the SARP. The typical fuel and non-fuel assembly and pin design parameters with their fuel compositions are listed in Tables A-3 and A-4 of the SARP. The Series I & II DFA consists of 217 fuel pins arranged in a lattice structure. The fuel composition of each fuel pin is a mixture of plutonium-uranium oxide ($\text{PuO}_2\text{-UO}_2$) with the plutonium weight percent of 19.8 to 31.0, with the remaining weight percent composed of depleted natural uranium and oxygen. The fuel pin is depicted in Figure 7 of the SARP. The assembly and pin design parameters are listed in Table A-2 of the SARP. Each fuel pin is 5.8 mm (0.230 in.) OD with a 0.38 mm (0.015 in.) cladding thickness, and is 237 or 238 cm (93.4 or 93.6 in.) long, depending on the fuel group. A 1.4 mm (0.056 in.) diameter wire is wrapped around the cladding with a pitch of 30.2 cm (11.9 in.) to provide the hexagonal lattice spacing arrangement. Pin components include the following:

- A tungsten-inert-gas (TIG) bonded lower endcap
- An inconel reflector
- Insulator pellets
- A 91.4 cm (36 in.) long $\text{PuO}_2\text{-UO}_2$ pellet stack
- More insulator pellets
- Another reflector
- A spring
- A plenum spacer tube
- A tag gas capsule
- A TIG-bonded uppercap

All components are made of steel except for the reflectors, pellets, and tag gas. The pins are designed to operate at high temperatures in the reactor.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 5-1. Radial Reflector Shipping Container.

H9505010.18

Figure 5-2. Radial Reflector Shipping Container – Open View.

H9505010.19

Figure 5-3. Radial Reflector Shipping Container—Open View.

H9505010.20

COMMON NAME: Cargo Tank

OFFICIAL NAME: Cargo Trailer, DOT MC-312

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-011 (for 222-S Lab cargo tank)

DESCRIPTION:

The container is 18,925 L (5000 gallon) DOT MC-312 specification cargo tank truck with a clearbore straight shape vessel. The container is approximately 1128 cm (444 in.) long and 147 cm (57 3/4 in.) in diameter and is constructed of 4.17 mm (8 gauge) stainless steel, two piece barrel with one circumferential weld. The container has an ASME tested 5.1 cm (2 in.) rupture disc with polyethylene drain tube located at the top center of the vessel. The 241 kpa (35 psig) air inlet pressure package (consisting of a pressure gauge, a ball valve, a coupler, and an ASME approved relief valve) is mounted in the dam area. The container also has a 7.6 cm (3 in.) stainless steel dip tube in the rear dam area, and another 7.6 cm (3 in.) stainless steel dip tube in the forward dam area. The dam is a part of the cargo tank flashing system, and it is built as a stainless steel construction spillbox with polyethylene drain hoses on each side, located just ahead of the suspension. See Figure 5-4.

APPROVED CONTENTS:

The trailer is used to transport bulk liquid LSA radioactive material.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-4. Cargo Trailer

H9505010.25

COMMON NAME: Ion Exchange Modules (IXM)
OFFICIAL NAME: Self-Contained Ion Exchange Modules
APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-NR-SARP-004
DRAWING: H-1-46279

DESCRIPTION:

The Ion Exchange Modules (IXM) consist of six carbon steel ion exchange tanks centered in a 218 cm (86 in.) by 178 cm (70 in.) by 202 cm (79.5 in.) block of concrete that provides approximately 50.8 cm (20 in.) of shielding on all sides for reducing radiation levels (see Figure 5-5). The six ion tanks are connected to a common header by a 7.6 cm (3 in.) diameter galvanized pipe. Each individual tank is vented by 1.3 cm ($\frac{1}{2}$ in.) diameter galvanized pipe. All pipe openings extend to the surface of the concrete block. Following removal from service, the header outlet is capped with a 7.6 cm - 1361 kg (3 in. - 300 pound) pipe cap. The 7.6 cm (3 in.) inlet is reduced to 5.1 cm (2 in.) using a 3 x 2 reducer, and a 5.1 cm (2 in.) NPT Carbon Composite (Nucfil) filter is installed. Five of the existing 1.3 cm ($\frac{1}{2}$ in.) vents are equipped with 1.9 cm ($\frac{3}{4}$ in.) NPT Nucfil filters. The sixth vent is equipped with a three position, three way valve, with one port attached to a 1.9 cm ($\frac{3}{4}$ in.) NPT Nucfil filter, and the other used for sampling hydrogen concentrations and purging of the IXM. Gross weight of the IXM is approximately 19,051 kg (42,000 pounds).

APPROVED CONTENTS:

When removed from service, all liquids will be drained from the IXM. The IXM will contain approximately 0.59 m³ (21 ft³) of resin. It will, at 100 KW, contain mixed-bed ion exchange resin similar to that used in a standard demineralized water treatment facility. This resin collects all the salts in the KW basin. The IXM, at 100-KE, will contain "Purolite NRW-37". The resin collects cesium efficiently, strontium (which exists in the KE basin in five times the quantity of cesium) with reduced efficiency, and other materials to a lesser extent. Tables 1 and 2 in the SARP list the radionuclide concentrations expected in the 100-KW and KE IXMs when they are shipped for burial.

APPROVED FOR OFFSITE: No
APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, HRCQ
REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-5. Ion Exchange Module.

H9505010.66

COMMON NAME: Limited Quantity Ice Chests

OFFICIAL NAME: Limited Quantity Ice Chests

APPROVAL DOCUMENTS/SPECIFICATIONS:

DAP: WHC-SD-TP-DAP-006

DESCRIPTION:

The ice chests are commercial, off-the-shelf items. The ice chests have gross weight capacities of 25 kg (55 lb) and 29 kg (65 lb). The primary openings are covered by hinged lids and secured by latches. See Figure 5-6.

Once the sample bottles are loaded and the lids are closed, the entire perimeter of the lid-to-container interface is taped securely with duct tape to provide additional sealing of the ice chests.

APPROVED CONTENTS:

The contents of the ice chests must meet the definition of limited quantity as provided by the regulations. Contents inside the ice chests are liquid samples contained in glass bottles. The sample bottle sizes range in size from 40 mL (1.35 oz) to 2,360 mL (79.80 oz).

Before shipping, each sample bottle shall be double wrapped in air bubble plastic wrap, the individually wrapped bottles placed in a plastic bag, and the plastic bag arranged in the ice chest. The ice chests will be kept cool with ice or an ice substitute.

APPROVED FOR OFFSITE: Yes; Limited Quantity

APPROVED FOR ONSITE: Yes; Limited Quantity

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-6. Limited Quantity Ice Chest.

H9505010.68

COMMON NAME: Liquid Waste Tank Car
OFFICIAL NAME: LWTC, Liquid Waste Tank Car
APPROVED DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-013

DESCRIPTION:

The tank cars are built to Hanford Specification HWS-7589, which is a 49 CFR 179.200 111A100-W-6 specification tank car. Each tank car is constructed of 11 mm (7/16 in.) 304L stainless steel and has a 75,700 L (20,000 gallon) capacity. The tanks measure 13.4 m (44 ft) in length by 2.7 m (9 ft) in diameter. Seven ports for loading, venting, and unloading are located on a flanged closure plate mounted on the top center of each car. A lidded sealed dome cupola provides a containment barrier for fittings, valves, and flanges during transport and storage. The cupola also protects the dome equipment during an accident situation. See Figure 5-7.

A self-contained hydraulic sluicer removes solids from the tank on a routine basis. The sluicing system prevents build-up of radioactive sludges and significantly reduces exposure to personnel. The vent nozzle provides an air pocket of 30.5 cm (12 in.) in the top of the tank. The fill and discharge line extends the full depth of the tank and ends in an insulated sump 20.3 cm (8 in.) in diameter extended 20.3 cm (8 in.) below the tank bottom.

APPROVED CONTENTS:

Materials to be transported in tank cars include dilute, liquid, fissile excepted waste from the following:

- 100-N reactor decontamination
- Phosphate
- Dilute 300/400 Area waste

The maximum load limit for the 75,700 L (20,000 gallon) tanks is 92,616 kg (204,000 lb). Administrative controls limit the volume of the tank car shipments to a maximum of 71,915 L (19,000 gallon). However, the specific gravity of the waste may require a more limiting volume.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-7. Liquid Waste Tank Car.

H9505010.94

COMMON NAME: Plastic Wrap

OFFICIAL NAME: Flexible Material Package

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-007

DESCRIPTION:

The Flexible Material Package (FMP) consists of two or more layers of flexible material (0.10 mm [4 mil] minimum thickness for each layer) wrapped around the specific radioactively contaminated item. The minimum dimensions of the wrapped item are 10.2 cm (4 in.). Dimensions and configurations of the FMP will vary based on the item(s) to be wrapped. Padding of any sharp edges and corners of the item is done to prevent puncture or stress to the flexible material. Closure of the layers of the flexible material is accomplished by either taping/horsetailing with reinforced cotton cloth tape or equivalent or heat sealing.

The flexible materials authorized for FMP usage are PERMALON X100 FR, GRIFFLYN T-55 TR, LORETEX 2000/2000 FR-6, and LORETEX 3000/3000 FR-7. PERMALON X100 FR is a multilayer high-density polyethylene copolymer film composed of twelve diametrically-oriented layers mechanically bonded together. GRIFFLYN T-55 FR is a 3-ply low-density copolymer and nylon yarn laminated material reinforced with a non-woven grid of high-strength cord in a diamond pattern. The LORETEX Series are woven with ribbons of high-density polyethylene and are coated on both sides with 0.15 mm (1½ mil) thick polyethylene to form a strong, flexible waterproof fabric. Specifications for the materials are listed in the SARP.

APPROVED CONTENTS:

The authorized waste contents contained in the FMP envelope consist of radioactively contaminated pumps, jumpers, thermocouple probes, agitators, pressure test equipment, impact wrenches, de-entrainers, valves, tools, concrete cover blocks, glove boxes, filter boxes, fans and fan housings, electric motors, tanks, piping, metal or wood plates or panels, equipment too large to fit into burial boxes, and other similar items. The equipment may be flushed externally and internally to reduce hazardous constituents and radioactive contamination levels. A fixant may be applied to the outer surfaces. The radioactive contents are limited to low levels based on a dose consequence evaluation. Refer to the SARP (Section 1.2) for the activity limits for the FMP for specific isotopes. There are no specific maximum contents weight for the FMP. The contents weight of the FMP will vary with the various types of equipment to be packaged. Tiedown requirements relating to items weighing less than 4,540 kg (10,000 lb) and items weighing greater than 4,540 kg (10,000 lb) are provided in the SARP.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: No

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

COMMON NAME: Self-Container

OFFICIAL NAME: Self-Container

APPROVAL DOCUMENTS/SPECIFICATIONS:

'SARP: WHC-SD-RE-SAP-025

DESCRIPTION:

Occasionally, pieces of contaminated equipment require movement between facilities. Suitable packages are not always available for these moves. As some of this equipment is capable of withstanding transport without a package, the SARP was developed. The decontaminated equipment moved using the SARP is referred to as a self-container. For routine transport, all openings in the equipment are sealed in a manner which precludes venting and loss of radioactive material.

APPROVED CONTENTS:

- The waste material in the interior of the self-container that is readily removable is removed.
- Radioactive material remaining within the self-container is fixed to the extent feasible and all external openings are sealed.
- The exterior of the self-container meets surface contamination limits for smearable contamination of less than 2,200 dpm/100 cm² for beta-gamma emitting radionuclides and less than 220 dpm/100 cm² for alpha-emitting radionuclides.
- The self-container, when being shipped to disposal, shall contain 100 nCi or less of TRU radionuclides per gram of contaminated matrix, i.e., be classified as nontransuranic material.
- The maximum dose equivalent rate at any point on the self-container surface at contact does not exceed 500 mrem/h.
- The amount of radioactive material shipped may be up to 100 A₂ (Type B). Fissile exempted materials are permitted.
- No free liquids are permitted.

Contents other than those explicitly authorized in the SARP may not be shipped without specific ECN approval.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

'REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

COMMON NAME: 1-L Liquid Shipper Package

OFFICIAL NAME: 1-L Liquid Shipper Package

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (for DOT 7A packaging)
WHC-SD-TP-OMM-003

DESCRIPTION:

The 1-L Liquid Shipping packaging consists of a SafeSend™ container manufactured by the 3M Company as a hazardous materials shipper and a 1-L, Narrow mouth, Teflon², fluorinated ethylene propylene (FEP) bottle with a Tefzel³ ethylene-tetrafluoroethylene (ETFE) screw closure. The SafeSend™ container is manufactured by the 3M Company as the SP-RIL Kit, and is available through various vendors. The 1 L bottles are manufactured by vendors identified in the OMM are available through various packaging vendors. The SafeSend canisters and 1 L inner containers are described in detail in the OMM. The packaging system has been tested and certified by the U.S. Department of Energy (DOE) to have passed the U.S. Department of Transportation (DOT) 7A Type A packaging requirements for radioactive materials. See Figure 5-8.

APPROVED CONTENTS:

The contents of the 1 L Liquid Shipper package are limited to Type A activity or less, fissile-excepted quantities only, liquid or solid materials (49 CFR 171.8, 49 CFR 173.403 and 453). Some materials may have additional hazards and these hazards must be considered per 49 CFR requirements. The combination of payload, liquid or solid, and packaging can not exceed the tested maximum gross weight of 4.1 kg (9 lb).

Additional restrictions are discussed in the OMM.

APPROVED FOR OFFSITE: Yes; Type A, LSA

APPROVED FOR ONSITE: Yes; Type A, LSA

LINER: None

REUSABLE: Yes; eight times maximum.

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

²Teflon is a trademark of E.I. duPont de Nemours and Company.

³Tefzel is a trademark of E.I. duPont de Nemours and Company.

Figure 5-8. 1 Liter Liquid Shipper.

DOT 7A Type A
49 CFR 178.350

COMMON NAME: Hedgehog

OFFICIAL NAME: Hedgehog Packaging System

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (for DOT 7A packaging)

WHC-SD-TP-OMM-002

DRAWING: H-2-824999

DESCRIPTION:

The Hedgehog is a multi-configuration, shielded, Type A packaging for radioactive solids and liquids. Maximum weight for the complete package is approximately 29 kg (63 lb), and the overall dimensions are 48.3 cm (19 in.) square by 63.5 cm (25 in.) tall. There are four configurations of the Hedgehog, which allow the user to trade shielding thickness for sample volume. The basic configuration consists of a foam filled polyethylene overpack case, a polyethylene Safesend container, and a wooden spacer. The basic configuration carries a 1 L sample bottle with no shielding. Optional stainless steel inner containers can be added to provide three additional configurations. It can carry either a 250 ml sample bottle (providing approximately 1.3 cm [$\frac{1}{2}$ in.] of shielding), a 125 ml container and sample bottle (providing a total of approximately 2.5 cm [1 in.] of shielding), or a 30 ml container and sample bottle (providing a total of approximately 3.8 cm [1.5 in.] of shielding). Components can be procured selectively if the user does not need all four configurations. See Figures 5-9 - 5-12.

APPROVED CONTENTS:

Contents are solid or liquid radioactive materials not to exceed a Type A quantity. The payload weight is limited to the gross weight of the as-tested liquids and bottles (WHC-EP-0558, Section 7.17.2.1.1).

APPROVED FOR OFFSITE: Yes; Type A

APPROVED FOR ONSITE: Yes; Type A

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-9. WHC Hedgehog Container Outer Case.

DOT 7A Type A
49 CFR 178.350

H9505010.81

**Figure 5-10. WHC Hedgehog Container—30-mL Version.
(without outer case)**

**DOT 7A Type A
49 CFR 178.350**

H9505010.78

Figure 5-11. WHC Hedgehog Container-250-mL Version.
(without outer case)

DOT 7A Type A
49 CFR 178.350

Figure 5-12. WHC Hedgehog Container–250-mL Version.
(without outer case)

DOT 7A Type A
49 CFR 178.350

COMMON NAME: Warthog

OFFICIAL NAME: WHC Grout Sample Packaging

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-EP-0558 (for DOT 7A packaging)

WHC-SD-WM-OMM-006

DRAWINGS: H-2-131500, H-2-131501, H-2-13502, and H-2-13503

DESCRIPTION:

The Warthog is a lead and stainless steel shielded Type A packaging for radioactive solids and liquids. Maximum weight for the complete package is approximately 179 kg (394 lb), and the overall dimensions are approximately 76.2 cm (30 in.) in diameter by 104 cm (41 in.) tall.

The outermost component is the Overpack Assembly (H-1-131500), which is made from a 416 L (110 gallon) drum. The approximate weight of the Overpack Assembly is 97 kg (214 lb). The interior of the drum is filled with foam, and a stainless steel lined cavity is provided for the Secondary Container.

The Secondary Container (H-1-131502) is a 21.6 cm (8.5 in.) diameter, 33.7 cm (13.25 in.) long cylindrical stainless steel container with 3.3 cm (1.3 in.) thick walls. The approximate weight of the Secondary Container is 54 kg (118 lb). The cover assembly incorporates eight tabs which interlock with corresponding notches in the container wall.

The Primary Container (H-1-131501) is a 14.2 cm (5.6 in.) diameter, 22.9 cm (9 in.) long cylindrical stainless steel canister with integral lead shielding 1.8 cm (0.7 in.) and 1.84 cm (0.725 in.) thick walls. The approximate weight of the Primary Container is 28 kg (62 lb). The canister cover and flange are designed to interface with a Central Research Laboratories' 105 millimeter Double-Door Transfer System (DDTS). The DDTS allows transfer of the payload from the Primary Container into a hot cell without breaking containment of either the Primary Container or the hot cell. The Primary Container can also be opened manually using the Handling Tool (H-2-131503). See Figure 5-13.

APPROVED CONTENTS:

Contents are solid or liquid radioactive materials not to exceed a Type A quantity. The maximum payload weight is 237 g (0.52 lb) (including weight of sample bottle).

APPROVED FOR OFFSITE: Yes; Type A

APPROVED FOR ONSITE: Yes; Type A

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-13. WHC Grout Sample Packaging (Warthog).

DOT 7A Type A 49 CFR 178.350

H9505010.83

COMMON NAME: Modified Fuel Spacer Burial Box (MFSB)

OFFICIAL NAME: Modified Fuel Spacer Burial Box (MFSB)

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-005

DRAWINGS: H-2-817864, H-2-821822, and H-2-72106

DESCRIPTION:

The MFSB is a non-reusable transportation and burial box comprised of steel reinforced concrete walls, lid, and a steel bottom. It is designed to accommodate large pieces of contaminated equipment. It is equipped with a lifting cradle that will allow it to be lifted from its transport vehicle (railcar) into a trench for burial.

The packaging is a full open box, 325 cm (10 ft 8 in.) wide by 239 cm (7 ft 10 in.) high by 836 cm (27 ft 5 in.) long (including deflector). The internal size of the box is 305 cm (10 ft) wide, 183 cm (6 ft) high, and 732 cm (24 ft) long resulting in a payload volume of 40.8 m³ (1,440 ft³). Container weight is 13,620 kg (15 tons); cover weight is 4,267 kg (4.7 tons) each; positive closure device weight is 1,090 kg (1.2 tons); the cradle weight is 2,225 kg (2.45 tons); contents weight is 10,900 kg (12 tons); and gross weight is approximately 35,866 kg (39.5 tons).

The box is constructed of steel-reinforced concrete (Portland Cement, Type II, ASTM C150), held in place by a frame consisting of welded steel channels, angle iron, beams and plays as stiffeners for corners and bottom support. The sides are constructed of 10.2 cm (4 in.) thick steel-reinforced high-density concrete. The bottom is constructed of 0.64 cm (1/4 in.) steel plate. The entire box is mounted on a structural steel frame. A gasketed two-piece box lid is constructed of steel-reinforced concrete with a steel channel frame work with lifting bails. Guides are welded to the upper portion of the steel frame of the box to assist in the positioning of the lids. A positive closure system is provided by four beam weldments that are placed over the lid panels and attached by threaded connections to the walls of the MFSB. Lifting/tiedown lugs are provided for lifting the unloaded box and for tiedown. Figure 5-14 is an illustration of the packaging.

APPROVED CONTENTS:

The contents of the packaging consist of radioactively contaminated/irradiated fuel spacers, drums, tanks, jumpers, process equipment, building rubble, piping, valves, reactor and storage basin components, carbon steel and stainless steel equipment, structural components, filtration components, borated concrete blocks, activation and mixed fission products. Combustible waste (e.g., paper, plastic, wood, rubber, cloth) may be included with noncombustible waste. Oxidizing or pyrophoric material, or free liquids, shall not be allowed. Total payload weight shall not exceed 10,900 kg (12 tons), and items shall not exceed the size limitations.

Because of the variety of items which may be placed into the box, no standard dunnage configuration is used. Items shall be positioned to minimize

movement, evenly distributed to maintain a centrally located center of gravity, and dunnage added as required to prevent movement of material in the packaging.

The MFSB will transport Type B quantities of mixed fission products. The total maximum activity shall not exceed 2,000 A₂s. Fissile material shall be less than 15 g per package (fissile-excepted for transfer). Transuranic (TRU) contamination will not exceed 100 nCi/g of waste (non-TRU for burial). The major radionuclides include ⁶⁰Co, ^{137m}Ba, ⁹⁰Y, ⁹⁰Sr, and ¹³⁷Cs. The expected worst case payloads for a single MFSB are listed in the SARP.

The contents shall be either Category 1 or Category 3 waste for burial purposes. Contact-handled shipments shall be limited to 150 Ci of ¹³⁷Cs/^{137m}Ba, 150 Ci of ⁶⁰Co, and 100 Ci of ⁵⁴Mn. These limits may be exceeded if shielding is used.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-14. Modified Fuel Spacer Burial Box.

COMMON NAME: 101-SY Hydrogen Mitigation Mixer Pump (HMMP) Package

OFFICIAL NAME: 101-SY Hydrogen Mitigation Mixer Pump (HMMP) Package

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-026

DRAWING: H-2-83734

DESCRIPTION:

The 101-SY Hydrogen Mitigation Mixer Pump (HMMP) will be removed from TK-101-SY and enclosed inside a portable flexible bag assembly. The pump will be inserted into a separate packaging with a nominal length of 1,585 cm (52 ft) and a nominal diameter of 163 cm (64 in.). The cavity size is 1,585 cm (52 ft) long by 160 cm (63 in.) in diameter for an internal volume of 31.9-m^3 (1126-ft^3). See Figure 5-15.

The packaging enclosure consists of a long section of cylindrical carbon steel standard wall pipe with flanges attached on each end. The piping section has a 163 cm (64 in.) outside diameter by 1.3 cm ($\frac{1}{2}$ in.) wall thickness. The closure on one end of the packaging is a 5.1 cm (2 in.) thick plate welded inside the end of the 163 cm (64 in.) diameter pipe. Flanged closure connections are attached using 2.5 cm (1 in.) diameter bolts in a standard hole configuration. Stiffening rings are installed at intervals along the length of the HMMP package to support/protect the package during lifting and normal transfer and/or potential accident conditions. An outer layer of plate is installed between the stiffening rings to form a 5.1 cm (2 in.) circle annulus for installation of shielding material along the full length of the package. The outer plate is 0.79 cm ($\frac{5}{16}$ in.) thick along the container length, except from column line 8 through 15 which uses a 1.3 cm ($\frac{1}{2}$ in.) thick plate.

The calculated maximum gross weight of the HMMP package with external shielding (lead shot) and contents (HMMP) is approximately 62,652 kg (138,000 lb). The weight of the HMMP package without shielding and with contents is approximately 33,110 kg (72,930 lb). The maximum weight of the package is based on installing shielding material in the full length of the shielding annulus.

APPROVED CONTENTS:

The total estimated activity attached to the HMMP is 561 Ci and is 280 times the effective A_2 value of the mixture of radionuclides. The quantity of fissile material attached to the pump is 1.8 g. The package is considered fissile excepted since the fissile content is less than 15 g. Refer to the SEP for breakdown of specific radionuclides.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 5-15. 101 SY Hydrogen Mitigation Mixer Pump (HMMP) Package.

H9505010.75

COMMON NAME: 101-AZ Thermocouple Package

OFFICIAL NAME: WRSP-2

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-029

DRAWING: H-2-818193

DESCRIPTION:

Thermocouples will be removed from waste tank 241-AZ-101. A special flexible receiver will be used to contain the thermocouples during removal from the tank. The packaging enclosure consists of a long section of cylindrical carbon steel standard wall pipe with flanges attached on each end. The pipe has a 51 cm (20 in.) outside diameter by 0.95 cm (0.375 in.) wall thickness. Flanged closure connections are attached using 2.9 cm (1 1/8 in.) diameter bolts, nuts, and lock washers in a standard hole configuration. Stiffening rings are installed at intervals along the length of the packaging to support the packages during lifting and normal transfer or potential accident conditions. A layer of 0.47 cm (3/16 in.) thick plate is installed between the stiffening rings to form a 3.8 cm (1 1/2 in.) wide annulus around the packaging for installation of shielding material. The packaging with flanges is 1,987 cm (65 ft 2 1/4 in.) long and the cavity size is 48.9 cm (19 1/4 in.) in diameter and 1,981 cm (65 ft) long for an internal volume of 3.73 m³ (132 ft³). See Figure 5-16.

The associated weights of the packaging with its contents are as follows:

Empty packaging	4,358 kg (9,600 lb)
Thermocouple	182 kg (400 lb) maximum
Carriage assembly	409 kg (900 lb)
Package without shielding including carriage assembly and thermocouple	4,949 kg (10,900 lb)
Package with maximum lead shielding including carriage assembly and thermocouple	10,124 kg (22,300 lb)

APPROVED CONTENTS:

The total estimated activity attached to a thermocouple is 35 Ci. The quantity of fissile material attached to the thermocouple is less than 1 g. The package is considered to be fissile excepted. Refer to the SEP for breakdown of specific radionuclides.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-16. 101-AZ Thermocouple Package.

H9505010.71

COMMON NAME: 101-AZ Transfer Pump Package

OFFICIAL NAME: WSRP-1

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-030 (for pump)

DRAWING: H-2-818192

DESCRIPTION:

A transfer pump will be removed from waste tank 241-AZ-101. A special flexible receiver will be used to contain the pump during removal from the tank. The packaging enclosure consists of a cylindrical carbon steel standard wall pipe with flanges attached on each end. The pipe has a 91.4 cm (36 in.) OD by 0.95 cm (0.375 in.) wall thickness. Flanged-end closure connections are attached using 2.85 cm (1 1/8 in.) diameter bolts, nuts, and lock washers in a standard hole configuration. Stiffening rings are installed at intervals along the length of the packaging to support the packages during lifting and normal transfer or potential accident conditions. A layer of 0.47 cm (3/16 in.) thick plate is inserted between the stiffening rings to form a 3.8 cm (1 1/2 in.) wide annulus around the packaging for installing shielding material. The overall length of the package with end closures installed is 1,987 cm (65 ft 2 1/4 in.) and the cavity size is 89.5 cm (35 1/4 in.) in diameter and 1,981 cm (65 ft) long for an internal volume of 12.2 m³ (437 ft³). See Figure 5-17.

The associated weights of the packaging with its contents are as follows:

Empty packaging	6,483 kg (14,280 lb)
Transfer pump	2,306 kg (5,080 lb)
Carriage assembly	1,607 kg (3,540 lb)
Flexible receiver bag	227 kg (500 lb)
Package without shielding including carriage assembly, new pump, and bag	10,624 kg (23,400 lb)
Package with maximum lead shielding including carriage assembly, new pump, and bag	19,404 kg (42,740 lb)

APPROVED CONTENTS:

The total estimated activity attached to a transfer pump is 130 Ci. The quantity of fissile material attached to a transfer pump is less than 1 g. The package is considered to be fissile excepted. Refer to the SEP for breakdown of specific radionuclides.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 5-17. 101 AZ Transfer Pump Package.

H9505010.73

COMMON NAME: 106-C Waste Sluicing System Package

OFFICIAL NAME: WSSP-1/WSSP-2

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-024

DRAWINGS: H-2-83722, H-2-83723, H-2-83724,
H-2-83726, and H-2-83727

DESCRIPTION:

A heel pump and transfer pump will be removed from TK-106-C and an agitator pump will be removed from 241-AY-102. Special flexible receivers will be used to contain the pumps during removal from the tanks. Two sizes of packages will be provided.

The packagings consist of two lengths that are of identical design and construction. The overall length of the WSSP-1 packaging is nominally 1,493 cm (49 ft) and the overall length of the WSSP-2 container is nominally 1,890 cm (62 ft). Both packagings are 131 cm (51 $\frac{1}{4}$ in.) in diameter. The internal volume of the WSSP-1 packaging is 20.1 m³ (711 ft³) and the internal volume of the WSSP-2 packaging is 25.5 m³ (900 ft³).

The main packaging assembly consists of a cylindrical carbon steel long section of standard wall pipe with closures on each end. The pipe has a 132 cm (52 in.) OD by 0.95 cm (0.375 in.) wall thickness. Flanged closure connections are attached using 2.5 cm (1 in.) diameter bolts in a standard hole configuration. Stiffening rings are installed at intervals along the length of the packaging to support/protect the package during lifting and normal and/or potential accident conditions. A layer of 0.47 cm (3/16 in.) thick plate is installed between the stiffening rings to form a 3.8 cm (1 $\frac{1}{2}$ in.) wide annulus for installation of shielding material along the full length of the packaging.

The maximum gross weight of the WSSP-1 packaging with external shielding (lead shot) and contents (heel pump) is approximately 29,919 kg (65,900 lb). The weight of the WSSP-1 package without shielding and with contents (heel pump) is 12,848 kg (28,300 lb). The maximum gross weight of the WSSP-2 package with external shielding (steel shot) and with contents (agitator pump) is approximately 28,557 kg (62,290 lb). The weight of the WSSP-2 package without shielding and with contents is 14,701 kg (32,380 lb). The maximum weight of the packages is based on installing shielding material in the full length of the shielding analysis. See Figure 5-18.

APPROVED CONTENTS:

The total estimated activity attached to the heel pump is 673 Ci and is 1,080 times the effective A_2 value of the mixture of radionuclides. The total curies for the transfer pump is 97 Ci and is 254 times the effective A_2 value. The total activity for the agitator pump is 927 Ci and is 2,450 times the effective A_2 value. Fissile material attached to the heel pump is 11.6 g, the transfer pump is 1.7 g, and the agitator pump is 1.8 g. Each package is considered "fissile excepted" since the total fissile content in each package is less than 15 g. Refer to the SEP for breakdown of specific radionuclides.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 5-18. 106 C Waste Sluicing System Package.

COMMON NAME: 102-AP Mixer Pump (APMP) Package

OFFICIAL NAME: 102-AP Mixer Pump (APMP) Package

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-032 (for APMP)

DRAWING: H-14-100147

DESCRIPTION:

The 102-AP Mixer Pump (APMP) will be removed from tank 102-AP and enclosed inside a portable flexible bag assembly. The pump will be inserted into a separate packaging with a nominal length of 1585 cm (52 ft) and a nominal diameter of 163 cm (64 in.). The cavity size is 1585 cm (52 ft) long by 160 cm (63 in.) for an internal volume of 31.9 m³ (1126 ft³). See Figure 5-19.

The main packaging enclosure consists of a long section of cylindrical carbon steel standard wall pipe flanges attached on each end. The pipe has a 163 cm (64 in.) outside diameter by 1.3 cm (0.5 in.) wall thickness. The closure on one end of the package is a 5.1 cm (2 in.) thick plate welded to the end of the 163 cm (64 in.) diameter pipe. Flanged closure connections are attached using 2.5 cm (1 in.) diameter bolts in a standard hole configuration. Stiffening rings are installed at intervals along the length of the APMP package to support and protect the package during lifting and normal transfer and/or potential accident conditions. An outer layer of plate is installed between the stiffening rings to form a 5.1 cm (2 in.) wide annulus for installation of shielding material along the full length of the package. The outer plate is 0.79 cm (5/16 in.) thick along the container length, except from column line 8 through 15, which uses 1.3 cm (0.5 in.) thick plate.

APPROVED CONTENTS:

Radionuclide activity in terms of curie contents indicates that the APMP Package must be transported as a Type B quantity of waste. The total curies of waste material attached to the APMP is estimated to be 228 Ci, which is more than eight times the effective A₂ value of the mixture of radionuclides. The package is considered fissile excepted since the fissile content is less than 15 g. Refer to the SEP for breakdown of specific radionuclides.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-19. 102 AP Mixer Pump Package.

H9505010.72

COMMON NAME: FFTF Reactor Cover Gas Packaging System

OFFICIAL NAME: FFTF Reactor Cover Gas Packaging System

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: WHC-SD-FF-OMM-004

DRAWINGS: H-4-54050, H-3-60704, H-4-54053, H-4-54054,
H-3-60703

DESCRIPTION:

The DOT Specification 7A FFTF Reactor Cover Gas System consists of a Grab Sampler (a shielded stainless steel cylinder containing reactor cover gas sample), and an overpack with foam packing (Figures 5-20 and 5-21).

There are two packaging configurations, one for the wall mounted unit, and one for the trap mounted unit. Drawings for the wall units are H-4-54050 (for the Grab Sampler), and H-3-60704 (for its overpack). Drawings for the trap mounted unit H-4-54053 and H-4-54054 (for the Grab Sampler), and H-3-60703 (for its overpack). The shielding on the Grab Sampler consists of top and bottom (one half each) cylindrical pieces, made of carbon steel, secured together by four 1/4-20 UNC socket head screws or by bolted handles. The A&J Manufacturing Company's (A&J) B4 container with foam packaging provides the overpack. The overpack is 112 cm (44 in.) long by 71.1 cm (28 in.) wide by 53.3 cm (21 in.) high. The overpack (including the foam packing) is water and fire resistant. The overpack is secured by three latches on the front, one latch on each end, and two permanently installed 4.8 cm (1.9 in.) wide nylon straps (approximately 25.4 cm [10 in.] from each end) with cam buckles. For handling there are four handles (two on each end). The overpack has two wood blocks (one on each end), situated under the overpack, to facilitate handling of the package by forklift.

Additional inner containers other than reactor cover gas cylinders may be considered for transport of Type A radioactive materials (solid, liquid, or gas) inside the overpack. These inner containers shall be approved by an ECN to the operations and maintenance manual (WHC-SD-TP-OMM-004) for the FFTF Reactor Cover Gas Sampling System.

The maximum gross weight of the package is 90.7 kg (200 lb).

APPROVED CONTENTS:

The contents may not exceed fissile excepted, Type A quantities of radioactive (and compressed) reactor cover gas samples from FFTF.

Additional contents may be approved by appropriate safety documentation.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 5-20. FFTF Reactor Cover Gas Packaging System.

Figure 5-21. FFTF Reactor Cover Gas Packaging System.

H9505010.87

COMMON NAME: PAS-1 Cask

OFFICIAL NAME: NuPac PAS-1 Packaging

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-038
 OTHER: CoC USA/9184/B(U)
 DRAWINGS: H-1-80792, H-1-80793

DESCRIPTION:

The cask consists of a stainless steel primary containment vessel enclosed inside a secondary containment vessel/environmental shield, forming two containment barriers. The primary containment vessel can be configured to house various types of payloads. Figure 5-22 depicts the configuration that is used to transport K Basin sludge samples. This configuration consists of up to two sample carriers arranged in a sample carrier rack.

The bulk of the shielding for the cask is provided by the secondary containment vessel which consists of lead clad in carbon steel.

Impact protection for the PAS-1 Cask is provided by two foam-filled steel-clad overpacks.

The sample carriers (Figure 5-23) are used to provide shielding for the sample bottles when the PAS-1 Cask is open. They are constructed of lead shielding encased in a stainless steel shell. The lids are constructed entirely of stainless steel. The carriers are equipped with two bolts to ensure positive closure and a lifting attachment. The sample carriers are fabricated per drawing H-1-80792.

The dimensions of the PAS-1 cask are as follows:

Primary containment - inner cavity	45.7 cm (18 in.) ID x 55.6 cm (21.0 in.) high
Primary containment - exterior	52.1 cm (20.5 in.) OD x 59.4 cm (23.4 in.) high
Secondary containment - inner cavity	52.5 cm (20.7 in.) ID x 60.0 cm (23.6 in.) high
Secondary containment - exterior	82.6 cm (32.5 in.) OD x 99.1 cm (39.0 in.) high
Package with overpack	122 cm (48.0 in.) OD x 168 cm (66 in.) high

ID = Inside diameter
 OD = Outside diameter

Source term shielding is provided by the sample carriers, primary containment vessel, and secondary containment vessel. The sample carrier provides some shielding during transport; however, its primary purpose is to provide shielding when the cask is open.

The shielding provided by the secondary containment vessel includes 12.9 cm (5.1 in.) of lead and 5.08 cm (2.0 in.) of steel on the bottom, 12.9 cm (5.1 in.) of lead and 1.92 cm (0.75 in.) of steel on the sides, and 12.2 cm (4.8 in.) of lead and 7.62 cm (3.5 in.) of steel on top.

Additional shielding is provided by the primary containment vessel, which has 1.27 cm (0.5 in.) of steel on the bottom, 1.91 cm (0.75 in.) of steel on the sides, and 2.54 cm (1.0 in.) of steel on top.

The sample carrier provides 2.71 cm (1.07 in.) of lead and 1.27 cm (0.5 in.) of steel on the bottom, 1.91 cm (0.75 in.) of lead and 0.58 cm (0.23 in.) of steel on the sides, and 5.08 cm (2.0 in.) of steel on top for shielding.

The tiedown assembly for the PAS-1 cask consists of a floor pallet, three turnbuckles, an overhead fixture, three tiedown points, and three anchor points.

The maximum loaded PAS-1 cask weight is 12,800 lb.

APPROVED CONTENTS:

Offsite

The contents are presently limited to radioactive materials in the form of liquid or gases that may be contained in sample casks, cartridges, and vials identified in the certificate. An amendment to the certificate is pending that will allow transport of 4 L of sludge samples.

Onsite

The contents of the samples bottles are limited to sludge samples from the K basins.

APPROVED FOR OFFSITE: Yes

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER; None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-22. PAS-1 Cask with Sample Carriers.

H9505010.88

Figure 5-23. Sample Carrier.

H9505010.89

COMMON NAME: FL 10-1

OFFICIAL NAME: FL 10-1

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: CoC USA/9009/B()F

DRAWING: General Electric 112D3018, Rev. 2

DESCRIPTION:

Two 1.52 (16 gauge) 208 L (55 gallon) drums which are 173 cm (68 in.) long and 57.2 cm (22.5 in.) in diameter are welded end to end. The support mechanism for the containment vessel consists of wood supports, steel inner sleeve, and nut ring. Fire resistant phenolic foam is formed in place between the containment vessel and drum body. The outer drum closure is accomplished with a 2.29 mm (12 gauge) bolt locking ring.

The containment vessel is a 304L stainless steel 12.7 cm (5 in.) Schedule 40 pipe, approximately 136 cm (53.5 in.) long (internal volume of 0.017 m³ [0.61 ft³]) with a 304L stainless steel 1.3 cm (0.5 in.) thick welded bottom plate and a 304L stainless steel slip-on flange and blind flange which are fastened by eight, 1.9 cm (0.75 in.) steel bolts. The flange closure is gasketed by two fluoroelastomer O-rings. See Figure 5-24.

The packaging has a maximum gross weight of 234 kg (515 lb.)

APPROVED CONTENTS:

Uranyl nitrate solutions enriched in the U-235 isotope, provided the U-233 content is not more than 1% of the U-235 content; or Uranyl nitrate solutions having a combined concentration of U-233 and U-235 not exceeding 250 grams per liter and an H to fissile material atomic ratio not less than 80 provided the U-233 content is not greater than 20% of the combined U-233 and U-235 content; or Uranyl sulfate solution (UO₂SO₄) containing U-235; or dry compounds and mixtures of U-235; or Uranium oxide interspersed with graphite or silicon carbide plus plastic packing material.

APPROVED FOR OFFSITE: Yes, Type A, Type B

APPROVED FOR ONSITE: Yes, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-24. FL10-1 Shipping Container.

H9505010.93

COMMON NAME: DOT-6M

OFFICIAL NAME: DOT Specification 6M; Metal Packaging

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: 49 CFR 178.354 Specification 6M; metal packaging

49 CFR 178.360 Specification 2R; inside containment vessel

DOE/RL-94-68 User's Guide for Shipping Type B Quantities of Radioactive and Fissile Material, including plutonium, in DOT-6M Specification Packaging Configurations

DESCRIPTION:

The DOT-6M packaging system consists of a cylindrical inner containment vessel (Specification 2R) centered in an outer steel drum (removable head). The drum size may be between 38 L and 416 L (10 and 110 gallons). Further containment and impact absorbing components are arranged inside the inner containment vessel. Only specific configurations are approved by DOE for shipping Type B quantities of radioactive materials (See DOE/RL-94-68).

The DOT-6M configuration used at the Hanford Site to transport solid plutonium metal is 113 L (30 gallon) drums with an inner vessel with a cavity 13 cm (5 in.) diameter and 41 cm (16 in.) long. The external dimensions of the packaging are approximately 88 cm (34.6 in.) high and 61 cm (24.0 in.) in diameter. The gross weight is 79 kg (175 lb). See Figures 5-25 and 5-26.

This packaging does not provide significant shielding for gamma emitting isotopes.

APPROVED CONTENTS:

Type B payloads are limited to the authorized contents as described in the User's Guide. These contents include plutonium and other fissile materials.

APPROVED FOR OFFSITE: Yes

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 5-25. DOT 6M.

H9505010.90

Figure 5-26. DOT 6M (internal view).

H9505010.91

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6.0 CASKS

COMMON NAME: EBR-II with 21PF-1

OFFICIAL NAME: 21PF-1 Overpack/EBR-II Spent Fuel Storage Cask System

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-054

DRAWING: H-2-68598

DESCRIPTION:

The 21-PF-1/EBR-II Cask System has two different configurations, one for spent fuel and one for Neutralized Current Acid Waste (NCAW) shipments. The spent fuel configuration consists of three components: an inner containment with weld closures, the EBR-II cask, and the 21PF-1 overpack. The NCAW configuration consists of four components: a core sampler/quadrilatch mechanism, an inner liner, the EBR-II cask, and the 21-PF-1 overpack.

For the spent fuel configuration, the inner containment consists of either single- or double-encapsulated steel containers. If a double-encapsulated container is used, the inner container is a 10.2 cm (4 in.) Schedule 40 stainless steel pipe, and the outer container is a 12.7 cm (5 in.) Schedule 40 stainless steel pipe. If a single-encapsulated container is used, the container is a 12.7 cm (5 in.) Schedule 40 pipe that is qualified as "Special Form" as defined in 49 CFR 173.469. The overall dimensions of the inner containment are 14.2 cm (5.6 in.) diameter by 104 cm (41 in.) long including a handling grapple.

For the NCAW configuration, the inner containment consists of the core sampler/quadrilatch mechanism inside a 5.2 cm (2 in.) stainless steel liner, 104 cm (41 in.) long.

The inner containments (spent fuel and NCAW) are stored in the EBR-II Cask which has overall dimensions of 44.5 cm (17.5 in.) diameter by 151 cm (59.5 in.) long. A 15.2 cm (6 in.) diameter by 107 cm (42 in.) long cavity (internal volume of 0.019 m³ [0.69 ft³]) is provided for the inner containment. The cask is constructed of carbon steel and uses 12.7 cm (5 in.) of poured lead for shielding. The EBR-II Cask is closed with a lid and sealing gasket.

The DOT 21-PF-1 Overpack (49 CFR 178.21-CAPE 1662-4) is used for transporting the EBR-II Casks. The overpack, with overall dimensions of 109 cm (43 in.) diameter by 231 cm (91 in.) long and a 78.7 cm (31 in.) diameter by 211 cm (83 in.) long cavity, is constructed of steel wood, and phenolic foam. See Figure 6-1.

APPROVED CONTENTS:

Spent Fuel

The contents of the inner containment are mechanically mixed and/or sintered irradiated plutonium-uranium (Pu-U) compounds. The Pu-U compounds may be either oxides, nitrides and/or carbides. The plutonium in the Pu-U compounds will be limited to no more than 50%. The plutonium isotopic distribution is restricted as follows:

- ^{238}Pu = 0.1% max
- ^{240}Pu = 40% max
- ^{241}Pu = 5% max
- ^{242}Pu = 4% max
- ^{239}Pu = remainder

The uranium isotopic distribution is restricted as follows:

- ^{233}U = 0.1% max
- ^{234}U = 0.1% max
- ^{235}U = 94% max
- ^{236}U = 0.1% max
- ^{238}Pu = remainder

Although the arrangement of the fuel in the inner containment is not restricted, the total dry fissile content is limited to 4,000 g and the decay heat is limited to no more than 300 watts per package. Given the dose rate is no more than 200 mrem/h, a dry fissile content of 4,000 g will not produce a heat load of more than 300 watts.

NCAW

The NCAW samples are mixtures of radioactive liquids and solid waste ranging from packaged sediment or suspended sediment solutions to free liquids. The samples, each with a volume of about 250-ml, contain a wide range of radionuclides. The worst case activity for each radionuclide is listed in the SARP. The NCAW sample contents may not exceed 17 A_2s .

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-1. EBR-II with 21PF-1 Overpack.

	Diameter	Length
Cask	44.5 cm (17.5 in.)	151 cm (59.5 in.)
Cask Cavity	15.2 cm (6 in.)	107 cm (42 in.)
Overpack	109 cm (43 in.)	231 cm (91 in.)
Overpack Cavity	78.7 cm (31 in.)	211 cm (83 in.)

H9505010.26

COMMON NAME: 21PF-1 Overpack with Zircaloy Hull Cask

OFFICIAL NAME: 21PF-1 Overpack with Zircaloy Hull Cask

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-084
DRAWING: H-2-68598

DESCRIPTION:

The DOT 21PF-1 Overpack (49 CFR 178.21-CAPE 1662-4) is used for transporting the EBR-II casks. The overpack, with overall dimensions of 109 cm (43 in.) diameter by 231 cm (91 in.) long and a 78.7 cm (31 in.) diameter by 211 cm (83 in.) long cavity, is constructed of steel, wood, and phenolic foam. See Figure 6-2.

APPROVED CONTENTS:

Leached Zircaloy hulls and fines produced from PNL fuel tube shearing operations.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, HRCQ

LINER: None

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-2. 21PF-1 Overpack with Zircaloy Hull Cask – Open View.

H9505010.28

COMMON NAME: T-3

OFFICIAL NAME: USA/9132/B(M)F, Model T-3

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-FF-SARP-008
DRAWINGS: H-4-66230, H-3-47474, H-4-66535, and
Los Alamos Drawing 54Y-110854
CoC: 9132

DESCRIPTION:

A stainless steel and lead-shielded irradiated fuel shipping package. The cask is a right circular cylinder with steel-encased rigid polyurethane foam (320 kg/m^3) [20 lb/ft^3] impact limiters. The outer cask shell comprises of a 2.5 cm (1 in.) thick stainless steel shell overlaid with a 3.4 mm (10 gauge) stainless steel cover with a 2.03 cm (0.08 in.) air gap for thermal protection. The containment vessel measures 373 cm (147 in.) in length by 20.4 cm (7.98 in.) in diameter for an internal volume of 0.120 m^3 (4.25 ft^3). The containment vessel is sealed at the bottom end with a 30 cm (11.8 in.) thick stainless steel plug with two Vitron O-ring seals. The top end is sealed with a 29.5 cm (11.63 in.) thick stainless steel plug with two Vitron O-ring seals. The bottom plug is secured by a closure plate and the top plug is secured by 16 hex flange screws. The annular space between the inner and outer shells is filled with lead having a thickness of approximately 20.3 cm (8 in.) (Figure 6-3). The overall length of the cask is 450 cm (177 in.) and the external diameter is 67.2 cm (12.4 in.).

APPROVED CONTENTS:

Irradiated:

- Mixed oxide fuel pins and assemblies
- Spent fuel containers composed of U-235 and/or Pu-239 oxides, carbides, nitrides, or metallic alloys
- Sodium-bonded metal fuel pins
- Carbide fuel pins
- Structural components not to exceed 1,400 thermal watts

See CoC for specific approved fuel specifications.

APPROVED FOR OFFSITE: Yes

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 6-3. T-3 Shipping Cask.

H9505010.85

COMMON NAME: Neutron Source Cask

OFFICIAL NAME: Neutron Source Cask and Neutron Source Holder Assembly

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-RE-SEP-022 (for neutron source cask)

DRAWING: H-2-95277

DESCRIPTION:

Neutron Source Cask--The source is contained in a stainless steel capsule with the following ends: (1) a male hex head provided for attachment of a special extraction and replacement tool, and (2) a female threaded fitting for attachment to the neutron probe. The neutron source storage cask is a horizontal cylinder, steel-encased neutron shielding (borated polyethylene) pig with a hinged door at one end. A door retaining pin and padlock hasp is provided to ensure containment of the source within source cavity. The cask outside dimensions are 35.6 cm (14 in.) long by 35.6 cm (14 in.) diameter. The source is used to obtain neutron probe scans of Tank Farm internal dry wells and external soil dry wells to monitor moisture content. The source storage cask is approved as DOT Specification 7A container.

Neutron Source Holder Assemblies (Figures 6-4 and 6-5)--The Neutron Source Holder Assemblies are shielded holster devices for transporting the source and probe assembly between monitoring locations. The source end of the monitoring probe is held within the shielded sleeve of each assembly. The probe is attached to a cable on a boom that is mounted on the outside of the dry well monitoring van.

The Neutron Source Holder Assembly No. 1 consists of a carbon steel pipe mounted vertically on the front bumper of the dry well monitoring van. Contained within the pipe is a 15.2 by 7.0 cm (6 by 2.75 in.) ID sleeve of boronated polyethylene as a neutron shield. A carbon steel holster assembly hinges on the pipe, and is utilized to hold the probe assembly in place. A securing pin located at the top of the assembly restrains the probe to the holster. The source holder assembly with the holster in an upright position is approximately 61 cm (24 in.) in height, and weighs approximately 20.4 kg (45 lb) without the probe assembly installed. Further details are shown on drawing H-2-95277.

The Neutron Source Holder Assembly No. 2 consists of a 30.5 cm (12 in.) square aluminum box mounted on an aluminum frame. The aluminum frame and box are connected to the dry well monitoring van's frame at the rear of the vehicle. The neutron shield used inside the aluminum box is a 30.5 cm (12 in.) cube of boronated polyethylene with a 7.0 cm (2.75 in.) hole down the center for the neutron source. A holder assembly located at the bottom-center of the aluminum box secures the source from movement. Further details are provided by drawings produced by Greenspan, Inc.

APPROVED CONTENTS:

The contents shall be 1.5 Ci americium-beryllium sources, as special form (one per container).

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 6-4. Neutron Source Holder Assembly, No. 1.

H9505010.32

Figure 6-5. Neutron Source Holder Assembly, No. 2.

H9505010.92

COMMON NAME: Big Bertha

OFFICIAL NAME: Cask OH-142 Mark I, Big Bertha

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-NR-SARP-002

DRAWINGS:

Cask drawings: H-1-51849, H-1-51850

Ion Exchange Column drawing: H-1-34789

DESCRIPTION:

The packaging system consists of the Big Bertha Cask and the Ion Exchange Columns. Big Bertha consists of a pair of cylindrical impact limiters placed on the top and bottom of a cylindrical lead-shielded cask. Each impact limiter has an external shell fabricated from ductile low-carbon steel that allows it to undergo large deformation and still maintain the structural integrity of the package. The volume between the inner and outer shell of the impact limiters is filled with a shock-absorbing and thermal-insulating rigid polyurethane foam. The lower impact limiter is welded to the cask outer shell and bottom.

The cask is provided with a pipe plug and drain system used for removal of entrapped liquids. The cask consists of two concentric carbon steel cylindrical shells surrounding a 8.9 cm (3½ in.) thick lead shield. The inner cavity is lined with 2.67 mm (12 gauge) ASTM 240 stainless steel. The Big Bertha packaging consists of a primary lid and six secondary lids, two impact limiters, and a containment liner (Figures 6-6 and 6-7). The external dimensions of the cask are 193 cm (76 in.) in diameter and 213 cm (84 in.) in height. The internal dimensions of the cask are 168 cm (66 in.) in diameter and 183 cm (72 in.) in height for an internal volume of 3.40 m³ (142 ft³). The Ion Exchange Columns are welded carbon steel pressure vessels. They are 45.7 cm (18 in.) in diameter and 177 cm (69.5 in.) long. They weigh approximately 363 kg (800 lb) per column before draining. After they are drained they weigh approximately 250 kg (550 lb). Gross weight for the package is approximately 29,030 kg (64,000 lb), including an estimated payload weight of 4,536 kg (10,000 lb).

APPROVED CONTENTS:

The contents of the package consists of spent resins contained in six (maximum) Ion Exchange Columns. Internal decay heat is limited to 400 watts. Additionally, contents are limited to quantities of radionuclides that result in maximum radiation dose rates on the exterior surface of the package of 200 mrem/h and 10 mrem/h at 2 m (6.6 ft) from the cask surface. Transuranic contamination is limited to less than 100 nCi/g. Total fissile material is limited to 15 g maximum for fissile excepted shipment.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 6-6. Model OH-142 Components.

Figure 6-7. Tiedown System for Model OH-142.

H9505010.35

COMMON NAME: NCAW Cask/21PF-1A Overpack

OFFICIAL NAME: Neutralized Current Acid Waste (NCAW) Cask

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-WM-SARP-005

DRAWINGS: See Table 6-1

Table 6-1. NCAW Cask/21PF-1A Overpack Drawings.

Drawing number	Abbreviated title
H-2-91498, Sheets 1-3 H-2-99316, Sheets 1-4 H-2-91685, Sheets 1-2 H-2-85097, Sheets 1-7	Core Sampler Assembly
H-2-91684, Sheet 1, Rev 3	Modified Quadralatch Assembly
H-2-99725, Sheet 1, Rev 2 H-2-99725, Sheet 2, Rev 2 H-2-99725, Sheet 3, Rev 3 H-2-99725, Sheet 4, Rev 0 H-2-99725, Sheet 5, Rev 0	Transfer Cask NCAW Core Sampling
H-2-99731, Sheet 1, Rev 1 H-2-99731, Sheet 2, Rev 0	NCAW Transfer Cask Lifting Bail
H-2-81756, Sheet 1, Rev 0	Phenolic Foam Impact Limiter Insert Assembly

DESCRIPTION:

The NCAW Cask is constructed of concentric 304 stainless steel shells encasing 12.7 cm (5 in.) lead shielding (Figure 6-8). Inside the payload cavity, the cask retains a scoop assembly that accommodates a sealed liner containing the payload. The system allows the liner to be extended into a hot cell facility. Figure 6-9 shows the liner extended. The cask is sealed with a gasketed, bolted closure and is lifted and handled by means of a lifting bail attached around the midsection of the cask. The NCAW cask is transported within a two-piece cylindrical phenolic foam insert shell with a density of 481 kg/m³ (6 lb/ft³) that is placed within a DOT Specification 21PF-1A or -1B Overpack. The position of the cask inside the overpack is shown in Figure 6-10.

The external dimensions of the cask are 55.9 cm (22 in.) in diameter by 127 cm (50 in.) long. The internal cavity is 9.55 cm (3.76 in.) in diameter by 122 cm (48 in.) long. The weight of the cask, including payload, is 2,044 kg (4,507 lb). The total weight of the cask, foam insert, and overpack is 2952 kg (6507 lb).

APPROVED CONTENTS:

The allowable contents of the NCAW Packaging System include solids, liquids, slurries, or powders, with total activity limited to, but not exceeding, 30 A₂ of fissile exempt quantities of radioactive material. The contents are typically 250-mL waste tank samples contained within a quadralatch core sampler. Table A1-2, in the SARP, lists the worst-case nuclide inventory and the activity of each nuclide for 250 mL of NCAW. Note that the contents shall not exceed 850 mL of sample material based on maximum quantity of 30 A_{2s}. The contents shall not contain organic material. The shipper shall not package any material that would be liable to react between or among the packaging components.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes; Liner has a maximum usage limit of 50 trips.

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-8. Neutralized Current Acid Waste Cask.

H9505010.36

Figure 6-9. Neutralized Current Acid Waste Cask – Exploded View.

H9505010.37

Figure 6-10. Neutralized Current Acid Waste Cask in Overpack.

H9505010.38

COMMON NAME: DSWC

OFFICIAL NAME: Disposable Solid Waste Cask

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-003 (for DSWC)

DRAWINGS: See Table 6-2

Table 6-2. Disposable Solid Waste Cask Drawings.

Drawing number	Description
H-4-56150, sheet 1, Rev 1, sheet 2, Rev 0	System Assembly DSWC
H-4-56151, sheet 1, Rev 1	DSWC Assembly
H-4-56152, sheet 1, Rev 0	DSWC Transporter Assembly
H-4-56153, sheet 1-2, Rev 1	Lifting and Handling Fixtures Fabrication
H-4-56154, sheet, 1-2, Rev 0	Elevator Impact Limiter Weldment Detail
H-4-56155, sheet 1, Rev 3, sheet 2, Rev 2	Steel Liner Weldment Details
H-4-56156, sheet 1, Rev 1	Steel liner Closure Weldment and Details
H-4-56157, sheets, 1-2, Rev 3	DSWC Concrete Assembly
H-4-56158, sheets 1-2, Rev 0	Impact Limiters Weldments
H-4-56159, sheets 1-2, Rev 0	DSWC Transporter Interface
H-4-56160, sheet 1, Rev 1, sheet 2, Rev 0	Tiedown Weldment Details
H-4-33356	Open Waste Container
H-4-33357	Closed Waste Container

DESCRIPTION:

The DSWC packaging system consists of the following:

- Steel-lined and concrete shielded DSWC disposable cask
- Transporter trailer and associated tie-down hardware
- Two impact limiters
- Lifting and handling hardware

The inner steel liner with a 55.9 cm (22 in.) ID is approximately 2.5 cm (1 in.) thick, 366 cm (144 in.) long, functions as the containment boundary, and provides approximately 0.91 m³ (32 ft³) of usable volume. Shielding is provided by the liner, 76.2 cm (30 in.) thick concrete around the liner, and two 30.5 cm (12-in.) thick steel shield plugs. One shield plug is welded to the bottom of the liner. The other is a removable plug and its located at the top (installed after loading) of the liner, providing shielding against the payload radiation.

The DSWC is also equipped with a 122 cm (48 in.) long and 8.1 cm (3.2 in.) thick auxiliary radiation shield. The auxiliary shield is constructed of 1.52 or 3.40 mm (16 or 10 gauge) steel sheeting wrapped around the outside of the steel liner. The upper and lower impact limiters are installed at each end of the DSWC to protect the cask from damage during cask handling and transfers.

The insert or the basket, as shown in Figure 6-11, is either an Open Waste Container (OWC, H-4-33356) or a Closed Waste Container (CWC, H-4-33357). The OWC is 370 cm (145.5 in.) long, and approximately 272 kg (600 lb). The CWC is similar to the OWC except it has a 50.3 cm (19.8 in.) OD, is 363 cm (142.7 in.) long, and weighs 204 kg (450 lb).

Maximum gross weight of the waste container (loaded) is 2,270 kg (5,000 lb). The maximum weight of a fully loaded DSWC package is approximately 108,300 lb. The DSWC is loaded from the top and transported upright as shown in Figure 6-12. A cross-sectional view of the DSWC is shown in Figure 6-13.

APPROVED CONTENTS:

The DSWC may contain up to and including 30,000 Ci of solid, non-fissile radioactive material. The packaging system is designed for onsite transfer of Type B quantities of FFTF non-fuel irradiated core components or other fissile exempt, non-dispersible solid radioactive wastes. The payload consists of an insert or basket containing core components such as reflectors, control rods and absorbers, and other miscellaneous solid wastes such as scrap metals. The calculated effective A_2 for reflector assemble contents is 10.3 Ci. The source term is a result of neutron activation of the core assembly material or solid radioactive wastes. The source term is further described in Section 4.0 of Part B of the SARP.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type B

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-11. Six Compartment Open Waste Container.

H9505010:39

Figure 6-12. DSWC Transporter Rigged for Trip to Disposal Site.

Figure 6-13. Disposable Solid Waste Cask (cross-section).

H9505010.41

COMMON NAME: Onsite Transfer Cask

OFFICIAL NAME: Onsite Transfer Cask

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-002 (for OTC)

DRAWINGS: See Table 6-3

Table 6-3. Onsite Transfer Cask Drawings.

Drawing Number	Abbreviated Title
H-2-38079, Sheet 1, Rev. 13 ECNs 192270, 604384	Transfer Cask Assembly
H-2-38079, Sheet 2, Rev. 10 ECNs 169232, 171467, 195740, 604384	
H-2-38079, Sheet 3, Rev. 5 ECNs 192270, 171438, 171480	
H-2-38079, Sheet 4, Rev. 3 ECNs 604384, 601380	
H-2-38079, Sheet 5, Rev. 4 ECNs 171480, 171467, 192296, 192270, 604384, 602543	
H-2-87141, Sheet 1, Rev. 0 ECNs 602543, 614912	Transfer Cask II Assembly (Units SN-01G through SN-29G only)
H-2-87141, Sheet 2, Rev. 0	
H-2-87141, Sheet 3, Rev. 0	
H-2-87141, Sheet 4, Rev. 0	
H-2-87141, Sheet 5, Rev. 0	
H-2-825312, Sheet 1	Transfer Cask Modifications and Lifting Ring and Rod (Transfer Cask III)
H-2-91684	Samplers Modified Quadralatch Assembly Universal Sampler Assembly Sludge Sampler, 7/8 in. Diameter Valve Rotary Valve Sludge Sampler (reusable) Surface Sampler Auger Assembly Surface Sampler Auger Surface Sampler Auger (20 in. configuration) Retained Gas Sampler Assembly Prototype Inner Tube Assembly
H-2-85097*	
H-2-99316*	
H-2-91685*	
H-2-79960*	
H-2-79961*	
H-2-79960, H-2-79961	
H-2-821608, Sheets 1-8*	
9505, Sheets 1-3 (See Part A, Section 5.7; Vendor Drawing Information Only Copy)	
H-2-38078	
H-2-83320	Cask Transfer Container
H-2-83324	Unit 1 Cask Truck
H-2-83324	Unit 2 Cask Truck
H-2-83323	Miscellaneous Accessories Unit 2 Cask Truck

* Due to hydrogen generation limits, these samplers are currently the only ones authorized for transfer in the OTC.

DESCRIPTION:

The Onsite Transfer Cask (OTC) consists of two concentric cylindrical containers: the cask and the liner. The cask is constructed of concentric stainless steel shells encasing 2.5 cm (1 in.) of lead shielding. The cask lid is a modified blind flange. The stainless steel *liner assembly*, sealed with an expansion type stopper, holds the payload. The maximum weight of the OTC, including the design payload, is 181 kg (400 lb). There are three approved liner configurations: the standard liner, the auger sampler liner 25.4 cm (10 in.), and the 50.8 cm (20 in.) auger sampler. The cask is approximately 114.3

cm (45 in.) in length and 12.7 cm (5 in.) in diameter. Either liner is capable of fitting within the Transfer Cask or the Transfer Cask II. The Transfer Cask II liner, noted on drawing H-2-87141, is not authorized for use. The Transfer Cask II is interchangeable with the Transfer Cask. The Transfer Cask III bodies are interchangeable, but the lids without handles must be used for flammable gas shipments. The Transfer Cask cavity is 6.1 cm (2.4 in.) in diameter and 108.7 cm (42.8 in.) long. The cavity of the Transfer Cask II is 6.9 cm (2.7 in.) in diameter and 108.7 cm (42.8 in.) in length. The standard liner assembly is 5.7 cm (2.3 in.) in diameter and 107.2 cm (42.2 in.) long (external dimensions). The auger sampler liner dimensions are 5.7 cm (2.3 in.) in diameter with an overall length of 107.2 cm (42.20 in.). The Transfer Cask III can have either the Transfer Cask I or II cavity dimensions.

The internal diameter of the standard liner is 5.1 cm (2.0 in.) The auger sampler liner has an internal diameter of 5.3 cm (2.12 in.) with a useable cavity length of 77.5 cm (30.5 in.) (for the 27.9 cm [11 in.] auger sampler) and 105.4 cm (41.5 in.) (for the 50.8 cm [20 in.] auger sampler). Figure 6-14 shows an exploded view of the cask components, and a view of the Transfer Cask Container. The OTC can only be transported on approved transfer cask trucks. See Figure 6-15 for the tiedown of the OTC.

APPROVED CONTENTS:

The allowable contents of the OTC are fissile-exempt solids, liquids, and slurries contained within an authorized core sampler. The contents typically are 250 cc waste tank samples, but may be as large as 500 cc. Table A1-2, in the SARP, lists the worst-case concentrations of each radionuclide, and the activity of that nuclide for a 500 cc sample. These concentrations are derived in Part B, Section 4.3 of the SARP. The contents may be either Type A or Type B quantity.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-14. Onsite Transfer Cask and Cask Transfer Container.

H9505010.44

Figure 6-15. Tiedown Arrangement for Onsite Transfer Cask.

H9505010.45

COMMON NAME: 225 B Waste Cask

OFFICIAL NAME: 225 B Waste Transfer Cask

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-044

DRAWINGS: H-2-66706, H-2-66707, and H-2-66704

DESCRIPTION:

This containment system features a lined and sealed standard 208 L (55 gallon), DOT-17C drum, and an outer shielding cask. The outer cask is a double-walled ASTM-A36 steel, upright cylinder (Figure 6-16). Each of the walls are made of 0.95 cm (3/8 in.) steel. Between the walls, lead is poured to a thickness of approximately 15.2 cm (6 in.). The top of the cask has two steel walls with 15.2 cm (6 in.) of lead shielding between the walls. The bottom of the cask is a double-door system to allow access into the cask. The cask doors are essentially nested-edge, lead-filled, double-walled steel rectangles. These doors are manually cranked open to allow placement of the 208 L (55 gallon) drum into and out of the cask.

The cask internal dimensions are approximately a 68.6 cm (27 in.) ID by 109 cm (43 in.) height, large enough to contain a 208 L (55 gallon) drum. The drum is raised by an electrically operated winch attached on top of the cask. A 0.48 cm (3/16 in.) cable goes through the cask top inside a guide tube. A specially built drum hook attaches to a drum bail that carries the drum up into or down out of the cask. The maximum gross weight of the loaded drum is 195 kg (430 lb) and the gross weight of the loaded cask is approximately 9,299 kg (20,500 lb).

APPROVED CONTENTS:

The 225 B Waste Transfer System is used to transport radioactively contaminated wastes with up to a maximum of 15,000 Ci of Cesium, Strontium, or combinations of these isotopes. This shipment allows up through HRCQ of radioactive material. The 208 L (55 gallon) drum is limited to 195 kg (430 lb) gross weight. Content weight is limited to 160 kg (353 lb). Gross weight of the package is approximately 9,307 kg (20,500 lb). Contents will be failed equipment contaminated with dry solids of radioactive material usually in the form of fluorides, or chlorides with a small amount of oxides. A limit of less than 15 g of fissile material for the entire package ensures that this shipment is classified fissile excepted.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: 0.10 mm (4 mils) or more

REUSABLE: Yes; The cask is reusable, but not the drum.

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-16. 225-B Waste Transfer Cask.

COMMON NAME: BUSS Cask

OFFICIAL NAME: Beneficial Uses Shipping System (BUSS)

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: DOE CoC USA/9511/B(U)
SAND 83-0698 (TTC-0430) (SNL 1991)
DRAWINGS: See Table 6-4

Table 6-4. Beneficial Uses Shipping System Drawings.

Drawing number	Description
S54774-040 S54774-060 S54774-120 S54774-160	Cask In Cradle
S54773-000	Cask With Impact Limiters
S48929-000, sheets 1, 2 and 3	Impact Limiters
S48981-040 S48981-060 S48981-120 S48981-160	Cask Assembly
S50057-000 S50058-000 S50059-000 S50060-000	Basket Assembly 4 Hole Basket Assembly 6 Hole Basket Assembly 12 Hole Basket Assembly 16 Hole

DESCRIPTION:-

The major components of the Beneficial Uses Shipping System (BUSS) cask system include the cask body and lid, basket, impact limiters, personnel barrier, and skid. The maximum gross weight of the basic system for which certification was requested is 14,936 kg (32,900 lb). An exploded view of the packaging is given in Figures 6-17 and 6-18. General information on the BUSS cask is given in Table 6-5.

The BUSS cask body is a one-piece, cylindrical forging with envelope dimensions of 138 cm (54.3 in.) OD and 125 cm (49 in.) height. Eleven circumferential fins are situated symmetrically about the axial midplane of the cask body. The fins are an integral, non-welded part of the container walls and are complete except at locations where portions of the fins are removed to enable attachment of the trunnions and lift fixtures and placement on the skid. The cask body has a cylindrical cavity with dimensions (with the lid in place) of 51.4 cm (20.3 in.) ID and 58.4 cm (23 in.) height for an internal volume of 0.122 m³ (4.31 ft³). Besides the opening for the lid, there are two other penetrations into the interior of the cask body -- a 3.2 cm (1.3 in.) diameter inlet port near the lid end of the container and a

diametrically opposite identical drain port at the bottom of the cask cavity. Both ports are fitted with a thermal cover (shield), bolted port cover, and recessed seal. The walls and closed end of the cask body are a minimum of 33 cm (13 in.) thick.

Table 6-5. General Information for the BUSS Cask.

Maximum gross weight	15,286 kg (33,700 lb)
Coolant system	Helium
Coolant volume	0.028 to 0.037 m ³ (1.0 to 1.3 ft ³)
Maximum normal operating pressure	50 psi = 344 KPa
Cask model number	BUSS R-1

APPROVED CONTENTS:

The contents of the BUSS cask are certified Special Form Waste Encapsulation Storage Facility (WESF) capsules of melt-cast cesium chloride or pressed-filled strontium fluoride. About 1/3 of the cesium recovered in WESF processing is radioactive ¹³⁷Cs and the remainder of the cesium is stable ¹³³Cs with less than 1% of ¹³⁴Cs and about 10% of ¹³⁵Cs. Consequently, the most significant radioactive source in the cesium capsules is ¹³⁷Cs. In the SARP, Table 1.2.3-1 summarizes the container load limits for each type of contents. One of four baskets may be used depending on the thermal power of the capsules to be transported.

APPROVED FOR OFFSITE: Yes; LSA, Type A, Type B, HRCQ

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-17. Principal Structural Members of the Beneficial Uses Shipping System.

Component	Envelope Dimensions (cm/in.)		Estimated Weight (Kg/lb)
Body & Lifting Attachments	137.8 cm (54.25 in.) dia	124.5 cm (49.00 in.) high	9300 Kg (20,500 lbs)
Lid	73.1 cm (28.78 in.)	32.61 cm (12.84 in.) high	680 Kg (1,500 lbs)
Basket	50.67 cm (19.95 in.)	57.98 cm (22.83 in.)	730 Kg (1,600 lbs)
Impact Limiters*	215.04 cm (84.66 in.)	99.06 cm (39.00 in.)	2,730 Kg (6,000 lbs)
Personnel Barrier			140 Kg (300 lbs)
Skid	201.9 cm (79.5 in.) L x 192.0 cm (75.6 in.) W x 34.3 cm (13.5 in.) H		1,545 Kg (3,400 lbs)
Contents (maximum)			185 Kg (400 lbs)
	Estimated Maximum Total Loaded Weight		15,310 Kg (33,700 lbs)

*(Two impact limiters are required: Envelope dimensions are for one, weight for two.)

H9505010.49

Figure 6-18. Tiedown Configuration for BUSS Cask Assembly.

H9505010.52

COMMON NAME: K Basin Cask/Well Car

OFFICIAL NAME: Irradiated Fuel Cask Car

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-014

DRAWINGS: H-1-34671, H-1-34672, and H-1-34673

DESCRIPTION:

A K Basin cask is shown in Figure 6-19. The sides and bottom of the cask are 25.4 cm (10 in.) thick lead clad on the inside with 0.95 cm (3/8 in.) thick carbon steel and on the outside with 1.3 cm (1/2 in.) thick carbon steel. Tubes penetrate the sides of the cask to allow cooling water circulation around the fuel. The cask lid is 25.4 cm (10 in.) thick lead clad with 1.9 cm (3/4 in.) carbon steel. The lid is held in place by locking cogs operated with an impact wrench. This cask must be transported in a well car.

The overall dimensions of the cask are approximately 150 cm (59 in.) by 145 cm (57 in.) by 191 cm (75 in.) high. The lid weighs approximately 2,588 kg (5,700 lb) and the cask 17,842 kg (39,300 lb) for a total weight, empty, of approximately 20,430 kg (45,000 lb). The cask cavity, which is divided into three sections by two carbon steel dividers, will hold three short fuel canisters. Up to three K Basin casks can be shipped in a single well car.

APPROVED CONTENTS:

The cask will be used to ship irradiated N Reactor fuel in canisters. These fuel elements are metallic uranium clad in Zircalloy-2, and are fabricated in two basic designs, Mark IV and Mark V. They are differentiated primarily by fuel weight and ²³⁵U content. They are of a "tube-in-tube" design, as shown in Figure 6-20. They are of two different enrichments. The two fuel elements have different diameters and various lengths. The specifications of size and weight, along with the relative proportion of each type of fuel element processed, are given in Table 1 of the SARP.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-19. K Basin Fuel Cask.

H9505010.51

Figure 6-20. Typical N Reactor Fuel Element.

H9505010.53

COMMON NAME: NPR Basin Cask

OFFICIAL NAME: Irradiated Fuel Cask Car

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-014

DESCRIPTION:

An NPR Basin cask is shown in Figure 6-21. The sides and bottom of the cask consist of 25.4 cm (10 in.) thick lead, clad on the inside with 1.3 cm ($\frac{1}{2}$ in.) thick stainless steel and on the outside with 1.9 cm ($\frac{3}{4}$ in.) carbon steel. There are penetrations in the side of the cask to allow cooling water circulation around the fuel. These casks are transported in rail cask cars.

The cask lid is 25.4 cm (10 in.) thick lead clad with 1.3 cm ($\frac{1}{2}$ in.) carbon steel. The lid is held in place by locking cogs operated with an impact wrench. The overall dimensions of the cask are approximately 145 cm (57 in.) by 198 cm (78 in.) by 325 cm (128 in.) high. The lid weighs approximately 3,746 kg (8,250 lb) and the cask 43,334 kg (95,450 lb) for a total weight, empty, of approximately 47,080 kg (103,700 lb).

The cask cavity, which is divided into four sections by a stainless steel insert containing 1% boron for neutron absorption, will hold four tall or 12 short canisters. The short canisters are 71.1 cm (28 in.) long and made of aluminum. The tall canisters are 180 cm (71 in.) long and made of stainless steel.

APPROVED CONTENTS:

The cask will be used to ship irradiated N Reactor fuel in canisters. These fuel elements are metallic uranium clad in Zircalloy-2, and are fabricated in two basic designs, Mark IV and Mark V. They are differentiated primarily by fuel weight and ^{235}U content. They are of a tube-in-tube design. They are of two different enrichments. The two fuel elements have different diameters and various lengths. The specifications of size and weight, along with the relative proportion of each type of fuel element processed, are given in Table 1 of the SARP.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-21. 100 N Cask, Divider, and Cask Car.

H9505010.54

COMMON NAME: 208-L (55-Gallon) Lead-Lined Drum

OFFICIAL NAME: Drum, 208-L (55-Gallon), DOT 17C, Lead-Lined/21PF-1A
or -1B Overpack

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-WM-SARP-001

DRAWING: H-3-52300

DESCRIPTION:

The lead-lined drum primary container is built in accordance with drawing H-3-52300, Revision 0. It contains a 25.4 cm (10 in.) diameter by 52.1 cm (20 ½ in.) high schedule 80 carbon steel pipe cavity (0.021 m³ [0.815 ft³]). The pipe is welded on the bottom to a 1.3 cm (½ in.) steel plate. This arrangement provides an annulus of approximately 15 cm (5.9 in.) between the wall of the pipe and the wall of the carbon steel drum, and a space between the bottom of the support plate and the bottom of the drum of approximately 15.2 cm (6 in.). These void spaces are filled with lead to provide shielding.

A 19.1 cm (7 ½ in.) thick lead plug is provided to shield the top of the container. The plug is held in place by a 1.3 cm (½ in.) steel retaining plate, which is bolted down with 12 bolts. The rubber gasket is placed between the flange and the retaining plate. The plug retaining plate is equipped with a Nucfil⁴ filter, and the plug is notched on the top and bottom to allow for venting of the container in the event of gas generation. A carbon filter is provided for the lid to allow for the venting of the gases that pass through the filter. The primary containment boundary consists of the 25.4 cm (10 in.) steel pipe with threaded holes, rubber gasket, retaining plate, and the Nucfil filter. The weight of the contents is limited to 45.4 kg (100 lb). The total weight of the lead-lined drum is 2,111 kg (4,650 lb), see Figure 6-22.

APPROVED CONTENTS:

The lead-lined drum can contain an HRCQ of TRU-contaminated radioactive material. The fissile content is limited to a maximum of 100 g per drum. All radioactive isotopes are limited to 6,000 times A₂. Restricting the contents in the lead-lined drum to 6,000 A₂ will ensure exposure levels will not be exceeded in the event of an accident in which a release occurs.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

⁴Nucfil is a trademark of Nuclear Filter Technology, Incorporated.

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-22. Lead-Lined Drum.

H9505010.55

COMMON NAME: AL-M6 Container

OFFICIAL NAME: Drum, AL-M6, 45- (12-) or 208-L (55-gallon), steel DOT 17C Models 5790 and 5791

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-RE-SAP-083

DRAWINGS: MRC AYD 750138-12G, MRC AYD 750148-55G

DESCRIPTION:

The two shipping containers are basically the same design, but differ in size. In both sizes, the packaging consists of an O-ring-sealed cylindrical steel inner container centered within glued insulation board in a carbon steel drum. The packaging model number is AL-M6 (see Figure 6-23). The outer drum is provided with 12 vent holes which are sealed with waterproof tape.

The smaller AL-M6 container, Package Type 5790, consists of a stainless steel inner container 12.7 cm (5.0 in.) in diameter by 36.8 cm (14.5 in.) high (internal volume of $4.7 \times 10^{-3} \text{ m}^3$ [0.165 ft³]) centered within the glued insulation inside a 45.4 L (12 gallon) drum. The overall dimensions of the package are 37.1 cm (14.6 in.) in diameter by 53.6 cm (21.1 in.) high. The maximum gross weight of the 5790 package is 40.9 kg (90 lb). See Figures 6-24 and 6-25.

The larger AL-M6 container, Package Type 5791, consists of a stainless steel inner container 17.8 cm (7.0 in.) in diameter by 46.4 cm (18.3 in.) high (internal volume of $1.15 \times 10^{-2} \text{ m}^3$ [0.408 ft³]) centered within the glued insulation inside a 208 L (55 gallon) drum. The overall dimensions of the package are 60.7 cm (23.9 in.) in diameter by 88.4 cm (34.8 in.) high. The maximum gross weight of the 5791 package is 136 kg (300 lb).

APPROVED CONTENTS:

The packagings are intended primarily for shipment of Type B solids and large quantity solids in normal or special form; however, solid Type A quantities and lesser amounts would be authorized.

The authorized contents are limited only on a basis of physical, chemical, and radiation characteristics (i.e., thermal output; physical form and density; behavior of radioactive material under conditions that could be encountered under normal and accident conditions; and penetrating radiation and subsequent shielding required) such that all conditions specified in the SARP are met. Liquid radioactive materials are not authorized.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 6-23. AL-M6.

H9505010.56

Figure 6-24. Structure of Inner Container for AL-M6 (208 Liter).

H9505010.57

Figure 6-25. Tiedown Configuration for AL - M6.

H9505010.58

COMMON NAME: Doorstop

OFFICIAL NAME: Doorstop Sample Carrier System, 208-L (55-Gallon) 17H/N-55 Overpack

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-MP-SARP-001

DESCRIPTION:

The Doorstop Sample Carrier System is a multi-containment system consisting of an N-55 Overpack, DOT 17H Drum, and Doorstop Containers that contain radioactive material either packaged in Doorstops, or bottles packaged in a slip lid; food pack, or paint can. The Doorstop Sample Carrier System has a gross weight of approximately 325 kg (715 lb), see Figure 6-26.

The basic exterior of the package is an N-55 overpack, which is manufactured by Nuclear Packaging Inc. (NuPac) of Federal Way, Washington. The overpack is a right circular cylinder 122 cm (48 in.) high by 81.3 cm (32 in.) in diameter with a 87.6 cm (34½ in.) high by 61.0 cm (24 in.) diameter cavity (internal volume of 0.256 m³ [9.03 ft³]) constructed of a 0.91 mm (20 gauge) galvanized steel shell filled with 48.1 kg/m³ (3 lb/ft³) rigid polyurethane foam.

The second packaging component is a DOT Specification 17H 208 L (55 gallon) drum (stainless steel or galvanized). The drum lid contains a 0.95 cm (3/8 in.) tubular NEOZAN gasket. The space inside the drum is occupied by three separate sections of expanded polystyrene beadboard. A layer of plywood over the bottom beadboard provides a base on which the Doorstop container rest. The second layer of beadboard has seven cavities sized to fit Doorstop containers. The third solid section of beadboard with a plywood face fills the rim.

The third packaging component is the Doorstop Container (stainless steel or lead-lined) which is considered the containment boundary. The container is 29.0 cm (11.4 in.) high by 16.2 cm (6.38 in.) in diameter and weighs approximately 15 kg (32 lb). The upper end of the Doorstop Container is faced, threaded, and machined and provides an O-ring seal. A handle is attached to permit handling manually or by hoist. Absorbent is placed inside the container to absorb twice the amount of liquid in the event of a spill.

APPROVED CONTENTS:

The allowable maximum quantity for the stainless steel and lead-lined Doorstops are 1.6 ml. The radioactive material for the stainless steel Doorstop is limited to 2.5 A₂s. The radioactive material for the lead-lined Doorstop 16.5 A₂s. Radionuclides in both containers are limited to those with an atomic number between, and including, 1 and 83.

The following contents restrictions apply to all packaging configurations:

- A maximum of seven Doorstop Containers per N-55 Overpack is allowed.

- Chemical Form:

- Water
- hydrogen peroxide
- sodium hydroxide
- sodium nitrite
- tri-butyl phosphate (TBP)
- normal paraffin hydrocarbon (NPH)
- nitric acid

- Physical Form:

- Liquids with small amounts of solids (e.g., sludge, slurry)

- Moderator Ratio

- No limitations

- Maximum Decay Heat

- 3 watts

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-26. Doorstop Sample Carrier System.

H9505010.59

COMMON NAME: Sample Pig

OFFICIAL NAME: Sample Pig Carrier System, 208-L (55-Gallon) 17H/N-55 Overpack

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-001

DRAWINGS: See Table 6-6

Table 6-6. Sample Pig Drawings.

Drawing number	Drawing title
H-2-74448, Rev, 2	Pig Shipping Container
H-2-74449, Rev, 0	Inner Drum Assembly
H-2-35369, Rev.4	Shielding Cap and Lead Liner Bulk Sample
X-60-200D, Rev. 3	Model M-55 Type B Overpack (NuPac)
H-2-36076, Rev. 3	Assy. and Details, Shielding Pig for Bulk Sampler
H-2-73010, Rev. 2	Transport Container Tiedown and Frame Assy.
H-2-73009, Rev. 2	Transport Container Tiedown Frame
H-2-99129, Rev. 0	Yoke Arrangement N-55 Lifting and Tiedown

DESCRIPTION:

The packaging system consists of an N-55 Overpack, a DOT 17H 208 L (55 gallon) drum with foam inner spacers, a Sample Pig Shipping Container, and a Sample Pig. The Sample Pig Carrier System has a gross weight of approximately 261 kg (576 lb).

The basic exterior of the package is an N-55 overpack, which is manufactured by Nuclear Packaging, Inc. (NuPac) of Federal Way, Washington. The overpack is a right circular cylinder 122 cm (48 in.) high by 81.3 cm (32 in.) in diameter with a 87.6 cm (34½ in.) high by 61.0 cm (24 in.) diameter cavity (internal volume of 0.256 m³ [9.03 ft³]) and is constructed of a 0.91 mm (20 gauge) galvanized steel shell filled with 48.1 kg/m³ (3 lb/ft³) rigid polyethylene foam.

The second package component is a DOT Specification 17H 208 L (55 gallon) drum (stainless steel or galvanized). The drum lid contains a 0.95 cm (3/8 in.) tubular NEOZAN gasket. Inside the drum is a spacer assembly made of ceiling tile.

The third packaging component is the Sample Pig Shipping Container. It fits snugly into the cavity created by the drum's inner space assembly. The container is constructed from 304 L stainless steel and is 34.9 cm (13 3/4 in.) high by 20.3 cm (8 in.) in diameter.

The fourth packaging component is the Sample Pig. The Sample Pig is constructed of a stainless steel shell with poured lead inside of approximate thickness of 4.8 cm (1.9 in.). The Sample Pig is approximately 31.1 cm (12.3 in.) high by 15.2 cm (6 in.) in diameter and is placed inside the Sample Pig Shipping Container. The internal cavity of the Sample Pig is 5.23 cm (2.06 in.) in diameter by 12.4 cm (4.88 in.) long providing an internal volume of 267 cm³ (16.3 in³). See Figures 6-27 and 6-28.

APPROVED CONTENTS:

Table 6-7 gives the allowable limits of the contents for each of the three different packaging configurations for the Sample Pig Transport System. Contents other than those specified in this document are not permitted. Fissile material is limited to 15 g maximum, or shall be restricted to fissile exempt quantities. Plutonium in excess of 20 Ci shall be shipped in solid form. Determination of the maximum A₂ quantities authorized was based on radiation dose rate calculations under hypothetical accident conditions for each of the packaging configurations.

Table 6-7. Allowable Limits for Packaging Configurations.

Packaging configuration	Maximum activity (Ci)
Sample Pig	1,040 A ₂
Sample Pig with lead liner-contents > 1.3 cm (½ in.) in dimension (i. e., liquids, solids, slurries, powders)	130 A ₂
Sample Pig with lead liner - contents > 1.3 cm (½ in.) in dimension	2,500 A ₂
Sample Pig with lead liner and pipette	162 A ₂

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-27. Sample Pig and Sample Pig Shipping Container.

Figure 6-28. Sample Pig Transport System.

H9505010.61

COMMON NAME: Model 60

OFFICIAL NAME: USA/6387/B()F, Model 60

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: DOE CoC USA/6387/B()F
WHC-SD-FF-SARP-005 (to be issued)
DRAWINGS: H-3-32429, H-3-39691, and H-3-44280

DESCRIPTION:

The packaging consists of a metal birdcage enclosing a steel containment vessel for non-irradiated special form fuel pins. The stainless steel containment vessel is a 15.2 cm (6 in.) diameter, 257 cm (101 in.) long, schedule 40 pipe for an internal volume of 0.048 m³ (1.69 ft³). One end is closed with a 2.5 cm (1 in.) thick cover plate, closed with bolts to a welded, 68.1 kg (150 lb), neck-type flange. The gasket is a spiral-wound stainless steel asbestos filter. The cover plate is fitted with a rupture disk assembly designed for up to 1,965 kPa (285 lb/in²). The containment vessel is centered inside a metal birdcage (45.7 cm [18 in.] by 45.7 cm [18 in.] by 286 cm [112 in.] prismatic cage frame made of 1.3 cm [$\frac{1}{2}$ in.] by 12.7 cm [5 in.] by 0.64 cm [$\frac{1}{4}$ in.] angle iron), supported by six 0.48 cm (0.188 in.) steel support plates welded perpendicular to its longitudinal axis and equally spaced along its body, and by 10.2 cm (4 in.) schedule 80 stainless steel pipe spoke at each end. The outer spacer cage is covered with expanded steel mesh. The empty weight of the Model 60 is 303 kg (670 lb) and with the maximum payload, the loaded weight is 454 kg (1000 lb).

APPROVED CONTENTS:

Generally, the contents of each package authorized by this certificate consist of HRCQ of fissile and up to or including Type B quantities of other radioactive materials as noted in the certificate.

APPROVED FOR OFFSITE: Yes; LSA, Type A, Type B, HRCQ

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

COMMON NAME: ¹⁹²Ir Camera

OFFICIAL NAME: Iriditron Model AI520

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: CoC USA/9007/B(U)

DESCRIPTION:

The ¹⁹²Ir camera is a uranium-shielded radiographic device consisting of an ovated 12.7 cm (5 in.) OD by 0.32 cm (1/8 in.) thick steel tube welded to two 3.40 mm (10 gauge) end plates. An opening on each plate gives access to the "S"-shaped titanium tubing that houses the source capsule, source capsule assembly, and the end plug. The two end openings are closed with threaded end caps. A lock mechanism is provided at the source cable attachment.

The dimensions are as follow:

- Length - 25.4 cm (10 in.)
- Width - 13.4 cm (5.3 in.)
- Height - 17.8 cm (7 in.)

APPROVED CONTENTS:

The contents of this cask consist of ¹⁹²Ir special form sealed source. It can hold Type A or Type B low level solid materials. Maximum quantity per package is 120 Ci.

APPROVED FOR OFFSITE: Yes; Type A, Type B

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

COMMON NAME: Gammatron ^{60}Co Camera

OFFICIAL NAME: Gammatron ^{60}Co Camera, Model 100A

APPROVAL DOCUMENTS/SPECIFICATIONS:

OTHER: CoC USA/9127/B(U), Gamma Ind., 821-1001-128, Rev. 2;
sheets 1 and 2

DESCRIPTION:

A steel-encased, uranium-shielded radiographic device. The shipping container is approximately 53.3 cm (21 in.) long, 58.4 cm (23 in.) wide and 107 cm (42 in.) high. The radioactive source assembly is housed in a Zircalloy or titanium "S" tube. The tube is surrounded by depleted uranium metal as shielding material. The depleted uranium shield assembly is encased in a steel housing. The void space between the depleted uranium shield assembly and the outer container is filled with a polyurethane foam. The gross weight of the container is 227 kg (500 lb).

APPROVED CONTENTS:

The contents are ^{60}Co as sealed sources that meet the requirements of special form radioactive material, either Type A or Type B. The material must be a low-level solid. Maximum radioactive contents is 100 Ci ^{60}Co .

APPROVED FOR OFFSITE: Yes; Type A, Type B

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

COMMON NAME: N Reactor/Single Pass Reactor Cask

OFFICIAL NAME: ChemNuclear CNS 1-13G Cask

APPROVAL DOCUMENTS/SPECIFICATIONS:

SEP: WHC-SD-TP-SEP-028

OTHER: CoC USA/9216/B()F, Revision 3

DESCRIPTION:

The CNS 1-13G packaging consists of a cask and an overpack. An inner container is used to assist in maintaining the fuel in a non-reactive environment and to limit its motion while in the shipping cask. The gross weight of the cask and overpack is 11,577 kg (25,500 lb). A view of the packaging and inner container are provided in Figure 6-29.

The cask consists of a right circular cylinder 173 cm (68 in.) high by 98 cm (38 ½ in.) in diameter. The cask cavity is 137 cm (54 in.) high by 67 cm (26 ½ in.) in diameter. The cask side wall consists of 1.3 cm (½ in.) thick outer steel shell, a 13.2 cm (5 in.) lead shell and a 1.3 cm (½ in.) thick inner steel shell. The outer base of the cask is comprised of a 0.32 cm (1/8 in.) thick steel shim plate, backing ring, and a 1.3 cm (½ in.) steel plate welded to form a 1.6 cm (5/8 in.) thick base which is integrally welded to the outer steel shell of the side wall. The cask lid is a lead-filled flanged plug. The cask closure is sealed by a silicone rubber gasket. Positive closure is accomplished by 15.2 cm (6 in.) diameter studs. The cask is equipped with a cavity drain line and plug. For lifting, the cask is provided with two ears bolted and seal-welded to the cask body 180° apart. The closure device is provided with a single lifting lug.

During transport, an overpack provides additional protection for the cask. The overpack consists of a double-walled steel cylinder which encloses the cask and is bolted to a steel pallet with 5.1 cm (2 in.) diameter studs. The overpack is equipped with two rectangular lifting loops and two tiedown ears.

The Single Fuel Element Container (SFEC) is constructed of stainless steel. It consists of a 68.6 cm (27 in.) right circular cylinder 10.2 cm (4 in.) in diameter equipped with a lid-locking mechanism and lifting hoop. With the lid in place, the total height of the canister is 75.2 cm (29.6 in.), and the maximum width is 17.4 cm (6.9 in.). The internal cavity is 68.6 cm (27 in.) long by 9.9 cm (3.9 in.) in diameter for an internal volume of $5.3 \times 10^{-3} \text{ m}^3$ (0.19 ft³).

APPROVED CONTENTS:

The CNS 1-13G is permitted to carry up to two inner and two outer fuel elements or three outer fuel elements per shipment held in up to three SFECs, provided that the total amount of ²³⁵U fissile material is less than 500 g. Additionally, the contents shall be restricted so that the concentration of hydrogen within the CNS 1-13G will not exceed 2.5%.

The fuel portion of the elements that will be shipped in the CNS 1-13G contain significant amounts of transuranic materials such as ^{240}Pu and ^{239}Pu as well as fission productions such as $^{137}\text{Cs}/\text{Ba}_m$. The cladding will contain activated material such as ^{60}Co . Table A3-1 in the SEP provides a list of the worst expected activity level for a shipment with 500 ^{235}U equivalent g of fissile material. The total activity for a worst case payload is 3,095 Ci. The worst case payload will be comprised of approximately 13,000 A_2s of radioactive material, which classifies the payload as Type B, HRCQ.

For storage of fuel, corrosion of the fuel combined with the hydrolysis of water possibly has created UH_3 . This material has pyrophoric properties similar to that of metallic uranium. The SFEC is configured in a manner that will preserve the chemical integrity of the fuel samples to the greatest possible extent.

APPROVED FOR OFFSITE: Yes; Type A, LSA, Type B, HRCQ

APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, HRCQ

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-29. CNS 1-13G Cask.

H9505010.84

COMMON NAME: LR-56 Cask System

OFFICIAL NAME: LR-56 Cask System

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-009 (Draft)
OTHER: French CoC F/309/B(U)F

DESCRIPTION:

The LR-56 Cask System is licensed in France for Type B liquids by French CoC F/309/B(U)F. For use on the Hanford Site, an approved SARP will authorize the use of the LR-56 for transfer of liquid radioactive waste.

The general configuration of the LR-56/H Cask is that of a horizontally positioned right circular cylinder with round ends. The cask includes a 8 mm (0.3 in.) thick stainless steel primary containment vessel of nominal 4000 L (1060 gallon) capacity, surrounded by a 6 mm (0.2 in.) thick stainless steel secondary confinement vessel offset from the primary vessel by 20 mm (0.8 in.) centering tubes. The vessel structure is further surrounded by 35 mm (1.4 in.) of lead and 30 mm (1.2 in.) carbon steel strength vessel, both of which provide the majority of the shielding. A 150 to 550 mm (5.9 to 21.7 in.) thick layer of sequoia and balsa wood acts as the thermal shield and impact limiter. Finally, a 6 mm (0.2 in.) outer casing of carbon steel protects the wood layer. The exterior of the LR-56/H Cask (including thermal/impact shield) is 3.7 m (12.1 ft) long and 2.15 m (7.0 ft) in diameter. Three wells are located on the top of the structure to provide access to cask support systems. The cask is secured to a U.S. DOT compliant trailer by engineered saddles and a front brace structure.

The tare weight of the empty cask is 18,100 kg (39,800 lb). The gross weight of the cask is limited to 23,100 kg (50,800 lb) for a payload weight of 5,000 kg (11,000 lb). See Figure 6-30.

APPROVED CONTENTS:

The onsite payload for the LR-56 will consist primarily of pumpable supernatant and interstitial liquids from Hanford SSTs. The liquids will include nitrate and nitrite salts and radionuclides such as ¹³⁷Cs. Approximately 46 of the 49 SSTs contain pumpable liquid.

Smaller quantities of sludge and slurry may also be present, depending on the efficiency of screening during the pumping operation. The sludge generally contains the insoluble components of the waste primarily metal oxides, hydroxides, and insoluble radionuclides such as ⁹⁰Sr. Sludge has a consistency ranging from a thick mud to a nearly dry-hard substance. Slurry is a mixture of supernatant and sludge.

The SARP will provide the physical characteristics of the tank waste and a combined maximum concentrations of radionuclides.

APPROVED FOR OFFSITE: Yes, up to Type A

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-30. LR56 - Transport System.

Overall Dimensions	
Cask Length	368.8 cm (12.1 ft)
Diameter	213.4 cm (7 ft)
Capacity	4,000 L (1,056 Gallons)

H9505010.76

COMMON NAME: ECOROK

OFFICIAL NAME: ECOROK

APPROVAL DOCUMENTS/SPECIFICATION:

SARP: TO BE ISSUED

DESCRIPTION:

The Ecorok Packaging consists of a 5 cm (2 in.) thick carbon steel inner container, and a modified Scientific Ecology Group Ecorok 25-11 container.

The Ecorok 25-11 is 152.4 cm (60 in.) diameter by 178.4 cm (70.25 in.) high cylinder constructed of reinforced concrete, with an integral .48 cm (3/16 in.) thick polyethylene liner on the cavity base and walls. The cavity is 96.5 cm (38 in.) in diameter, and 116.8 cm (46 in.) tall. Four 2.54 cm (1 in.) bolts hold the neoprene gasketed lid to the body. There are three lifting/tie down attachments spaced at 120°, and located 15.2 cm (6 in.) from the top of the body. The Ecorok 25-11 (SEG drawing STD-41-001) lid assembly will be modified to add a second filter (a 5.1 cm [2 in.] NucFil filter). See Figure 6-31.

The Inner Container is a standard 5.1 cm (2 in.) thick carbon steel liner (SEG drawing STD-27-008) that has been modified to serve as a containment barrier. The modifications will include addition of a NucFil filter to the lid, addition of four 3/4-10 bolts to hold the lid to the body, addition of a nitrile gasket to the closure, addition of alignment pins and holes, addition of painted serial numbers, and addition of closeable drain ports to the body assembly.

APPROVED CONTENTS:

The contents will consist of cartridge filters from the K Basins water purification system, contaminated with Highway Route Controlled Quantities of basin contamination products.

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, LSA, Type B, HRCQ

LINER: None

REUSABLE: No

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 6-31. Ecorok.

30.5 cm (12 in.) Thick Base
116.8 cm (46 in.) Cavity Height Inside
152.4 cm (60 in.) Diameter
27.9 cm (11 in.) Thickness of Sides

H9505010.67

7.0 LINERS

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8.0 OVERPACKS

COMMON NAME: 21PF-1 Overpack/JWP

OFFICIAL NAME: DOT 21PF-1A or -1B Overpack

APPROVAL DOCUMENTS/SPECIFICATIONS:

SAP: WHC-SD-RE-SAP-054 (for 21PF-1 EBR-II)

DESCRIPTION:

The DOT 21PF-1 Overpack has overall dimensions of 109 cm (43 in.) diameter by 231 cm (91 in.) long with a 78.7 cm (31 in.) diameter by 211 cm (83 in.) long cavity (internal volume of 1.15 m³ [40. ft³]). It is constructed of steel, wood, and phenolic foam. It is depicted in Figure 8-1. The 21PF-1 Overpacks were renovated to prevent water in-leakage. The resulting overpacks were designated as 21PF-1A for the carbon-steel-shelled version and 21PF-1B for the stainless-steel-shelled version. The JWP Overpack is a slightly modified version of the 21PF-1A for onsite use only.

APPROVED CONTENTS:

The 21PF-1A, -1B, or JWP are used to transport EBR-II casks with spent fuel or Zircalloy hulls.

APPROVED FOR OFFSITE: Yes; LSA, Type A, Type B, HRCQ (except JWP)

APPROVED FOR ONSITE: Yes; LSA, Type A, Type B, HRCQ

REUSABLE: Yes

TECHNICAL CONTACT:

PORT
(509) 376-0298
(509) 373-0371
(509) 376-2690

Figure 8-1. The 21PF - 1 Overpack.

Average Weights	
Blocking and Bracing	454 Kg (1,000 lbs)
Shipping Container Weight	795 Kg (1,750 lbs)
Filled LLD	2,111 Kg (4,650 lbs)
Total Weight	3,360 Kg (7,400 lbs)

H9505010.62

COMMON NAME: N-55 Overpack

OFFICIAL NAME: N-55 Overpack

APPROVAL DOCUMENTS/SPECIFICATIONS:

SARP: WHC-SD-TP-SARP-001 (for Sample Pig) and
WHC-SD-MP-SARP-001 (for Doorstop)

DESCRIPTION:

The N-55 Overpack is manufactured by Nuclear Packaging Inc. (NuPac) of Federal Way, Washington. The overpack is a right circular cylinder that is 122 cm (48 in.) high by 81.3 cm (32 in.) in diameter with a 87.6 cm (34½ in.) high by 61.0 cm (24 in.) diameter cavity (internal volume of 0.256 m³ [9.03 ft³]) constructed of a 0.91 mm (20 gauge) galvanized steel shell filled with 48.1 kg/m³ (3 lb/ft³) of rigid polyurethane foam. Closure of the upper and lower (lid and body) sections of the overpack is provided by four toggle clamps and a neoprene gasket at the stepped joint between the two sections. The N-55 Overpack carries a CoC, USA/9070/B(U). This approval constitutes authority to use the package for the shipment of radioactive material and to be shipped in accordance with the provision of 49 CFR 173.471 (requirements for NRC-approved packages). See Figure 8-3.

APPROVED CONTENTS:

The Doorstop Sample Carrier System (Figure 8-2) is a multi-containment system consisting of the following:

- N-55 Overpack
- DOT Specification 17H Drum
- Doorstop Containers that contain radioactive material either packaged in Doorstops, or bottles packaged in a slip-lid, paint can, or food-pack can

Only the materials specifically identified in WHC-SD-MP-SARP-001 are authorized for shipment by this packaging. The following contents restrictions apply to all packaging configurations:

- A maximum of seven Doorstop Containers per N-55 Overpack is allowed.
- Chemical Form:
 - Water
 - Hydrogen peroxide
 - Sodium hydroxide
 - Sodium nitrite
 - Tri-butyl phosphate (TBP)
 - Normal paraffin hydrocarbon (NPH)
 - Nitric acid

- Physical Form:
 - Liquids with small amounts of solids (e.g., sludge, slurry)
- Moderator Ratio
 - No limitations
- Maximum Decay Heat
 - 3 watts

The Sample Pig Transport System is a multi-containment system consisting of the following:

- N-55 Overpack
- DOT Specification 17H Drum with foam inner spacers
- Sample Pig Shipping Container
- Sample Pig

Only the materials specifically identified in WHC-SD-TP-SARP-001 are authorized for shipment by this packaging. The following restrictions apply to all packaging configurations:

- Chemical Form:
 - Aqueous solutions or solid mixtures of oxides, nitrites, nitrates, phosphates, sulfates, fluorides, chlorides, tricalcium aluminate, or organic compounds or extraction liquids that meet the requirements of Section 1.2.2.5
- Physical Form:
 - Liquid, slurry, powder, solid
- Maximum Decay Heat:
 - 3 watts
- Maximum Pressure Build-up:
 - 5.8 psig

APPROVED FOR OFFSITE: No

APPROVED FOR ONSITE: Yes; Type A, Type B

LINER: None

REUSABLE: Yes

TECHNICAL CONTACT:

PORT

(509) 376-0298

(509) 373-0371

(509) 376-2690

Figure 8-2. N-55 Overpack Shown Used With the Doorstop Sample Carrier System.

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Figure 8-3. Tiedown Configuration for N-55.

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