



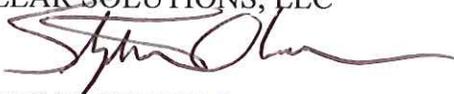
Department of Energy
Washington, DC 20585

NOV 01 2012

MEMORANDUM FOR JOHN S. BELLAMY

MANAGER, PACKAGING TECHNOLOGY &
PRESSURIZED SYSTEMS
SAVANNAH RIVER NATIONAL LABORATORY
SAVANNAH RIVER NUCLEAR SOLUTIONS, LLC

FROM:

STEPHEN C. O'CONNOR 
HEADQUARTERS CERTIFYING OFFICIAL
DIRECTOR, OFFICE OF PACKAGING AND TRANSPORTATION

SUBJECT:

Revision 3 to DOE CoC USA/9979/AF-96 (DOE)

Per your August 12, 2012 request to Dr. James M. Shuler of my staff, attached is Revision 3 of Department of Energy (DOE) Certificate of Compliance (CoC) USA/9979/AF-96 (DOE) for the 9979 and its Safety Evaluation Report. This revision is being issued to incorporate revised drawings resulting from the DOE Packaging Certification Program Quality Assurance Audit performed at the fabricator, Paragon Die and Engineering, on August 15-18, 2011; and the revised Data Sheet that lists the Acceptance Criteria for Commercial Items. These changes will be made in the next revision of the 9979 Safety Analysis Report for Packaging

This revision also approves the option to use the seal-sensor feature of the DOE ARG-US Radiofrequency Identification tag as a Tamper-Indication Device.

The expiration date of Revision 3 is June 30, 2015.

If you have any questions, please call me at (301) 903-7854, or Dr. James M. Shuler at (301) 903-5513.

Attachment

cc w/att.:
Maxcine Maxted, SR
Allen Gunter, SR
Yung Liu, ANL
Paul Blanton, SRNS



CERTIFICATE OF COMPLIANCE For Radioactive Materials Package

Table with 5 columns: 1a. Certificate Number (9979), 1b. Revision No. (3), 1c. Package Identification No. (USA/9979/AF-96 (DOE)), 1d. Page No. (1), 1e. Total No. Pages (9)

2. PREAMBLE

- 2a. This certificate is issued under the authority of 49 CFR Part 173.7(d).
2b. The packaging and contents described in Item 5 below meet the safety standards set forth in subpart E, "Package Approval Standards" and subpart F, "Package, Special Form, and LSA III Tests" Title 10, Code of Federal Regulations, Part 71.
2c. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. This certificate is issued on the basis of a safety analysis report of the package design or application — (1) Prepared by (Name and Address): U.S. Department of Energy, Savannah River Operations Office, P.O. Box A, Aiken, South Carolina 29808; (2) Title and identification of report or application: Safety Analysis Report for Packaging Model 9979 Type AF-96, S-SARP-G-00006, Revision 2, October 2011; (3) Date: October 2011

4. CONDITIONS

This certificate is conditional upon fulfilling of the applicable Operational and Quality Assurance requirements of 49CFR parts 100 – 199 and 10CFR Part 71, and the conditions specified in Item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Transport Index, other Conditions, and References:

(a) Packaging

(1) Model Number: 9979

(2) Description:

The Model 9979 Type AF shipping package replaces the UN1A2/DOT 7A drum specification of 49 CFR 173.417 (2004) used formerly by the DOE for packaging and shipment of Type A quantities of fissile materials over public highways. Major packaging components include an internally insulated 55-gallon overpack drum and a 30-gallon confinement drum that secures the payload. A steel liner protects foam insulation material within the 55-gallon overpack. The 30-gallon drum is positioned both radially and axially within the 55-gallon overpack liner. The 9979 Packaging configuration is depicted graphically in Figure 1.

The 9979 Type AF packaging design incorporates two sizes of commercial removable-head drums (30- and 55-gallon) produced in accordance with DOT Identification code 1A2 for packaging per 49 CFR 178.504 and satisfies the specification 7A Type A packaging provisions of 49 CFR 178.350. The 55-gallon drum is modified to include a steel liner welded to the inside of the drum body and under its closure lid. Polyurethane foam insulation fills the cavities formed between the liner and drum components.

6a. Date of Issuance: NOV 01 2012

6b. Expiration Date: June 30, 2015

FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address (of DOE Issuing Office) U.S. Department of Energy Office of Packaging and Transportation, EM-33 1000 Independence Avenue, SW Washington, DC 20585

7b. Signature, Name, and Title (of DOE Approving Official) [Signature] Stephen C. O'Connor Headquarters Certifying Official

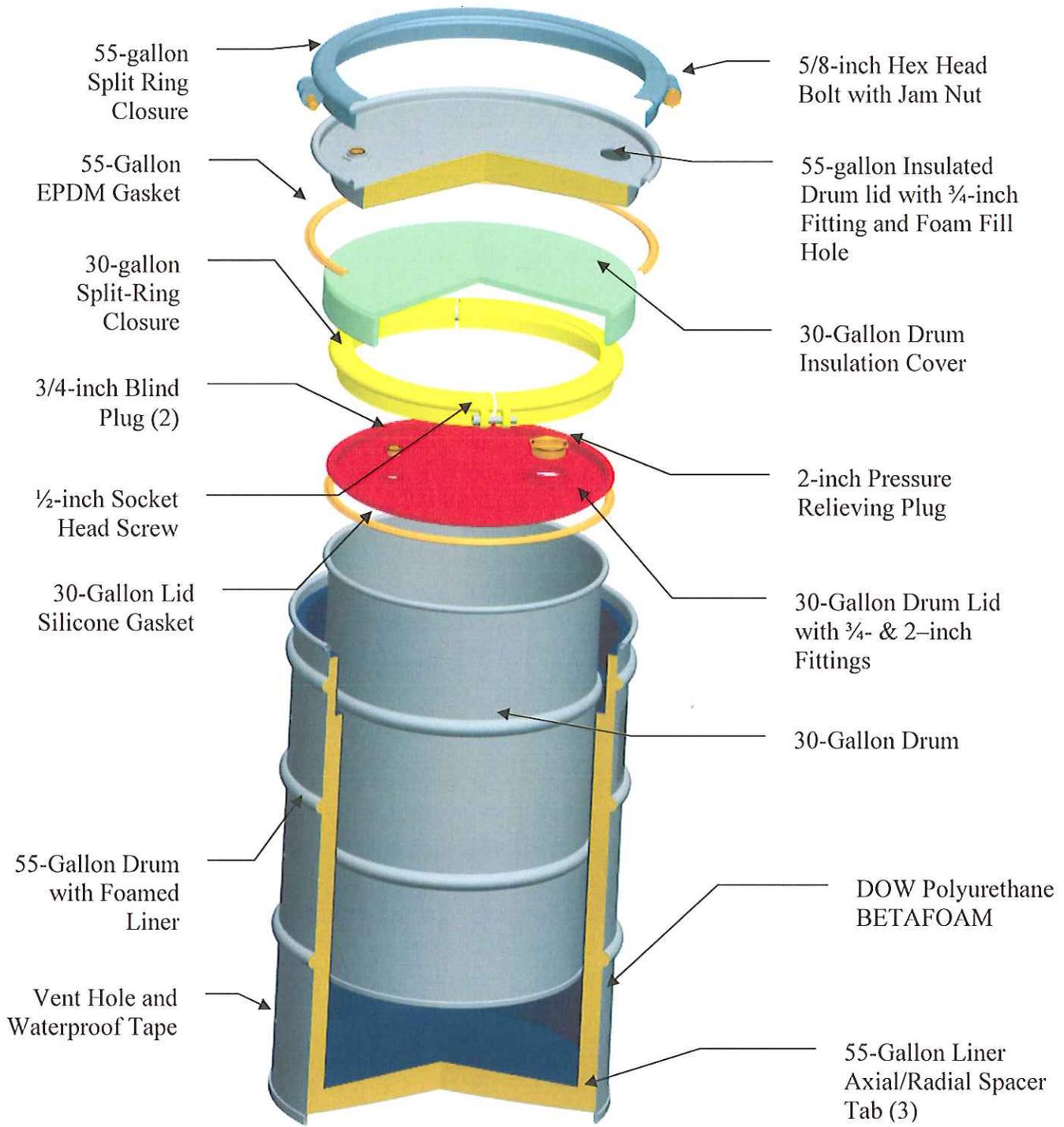


Figure 1 – 9979 Type AF Shipping Packaging Configuration

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The insulated 55-gallon overpack drum encloses the 30-gallon drum, and the 30-gallon drum functions as the confinement boundary for the package's radioactive contents.

The general outside dimensions of the 55-gallon overpack drum are 24 inches in diameter by 34½ inches high when closed. The 55-gallon overpack drum body and lid both incorporate liners fabricated from carbon steel. The liner assemblies are welded to the inside of the drum body and lid forming cavities filled with 24 lb/ft³ Dow Automotive polyurethane foam called BETAFOAM™. In addition, nondestructive methods such as thermal imaging, ultrasonic evaluation, or radiography are used to verify complete filling of each production drum and drum lid.

The 55-gallon overpack drum body is fabricated from 16 gauge carbon steel and the welded liner is fabricated from 16 and 18 gauge carbon steel. The 55-gallon overpack drum wall has nine ¾-inch holes spaced uniformly in the wall and one 1-inch diameter foam fill holes is in the drum bottom, all covered with 2.0 mil polystyrene waterproof tape. In the event the package is exposed to a severe thermal environment, the tape will disintegrate allowing the overpack to vent gases generated from the thermal decomposition of the insulation. The estimated weight of the 55-gallon overpack drum without its lid is 140.3 lb (Drawing R-R2-G-00057).

The 55-gallon overpack drum closure lid is fabricated from 16 gauge carbon steel and incorporates a shallow pan formed from 16 gauge carbon steel. The pan is nominally 2 inch deep × 20¾ inch diameter is welded to the bottom of the closure lid. The formed cavity is filled with the 24 lb/ft³ BETAFOAM™. The 55-gallon overpack drum closure lid incorporates a threaded ¾-inch commercial (bung) flange and 1-inch hole to facilitate foam filling. The flange is closed with ¾-inch blind bung fitting and foam filling hole is sealed with 2.0 mil polystyrene waterproof tape. The 55-gallon overpack drum lid weighs 24.2 lb. When installed the lid assembly extends into the drum body liner (Drawing R-R2-G-00059). An ethylene propylene diene M-class (EPDM) gasket seals the overpack closure (Drawing R-R1-G-00029).

The 55-gallon overpack drum is closed with a split-ring closure device fabricated from 12 gauge carbon steel. The closure device is similar to standard commercial C-ring closures used on most open-head drums but is halved and incorporates two 1-inch flange extensions, one extending horizontally and the other vertically from the C-ring. Lugs are welded at each end of the two split-ring. Each split-ring is identical, with one 1½-inch lug threaded with 5/8-11UNC-2B thread and the other with a ¾-inch diameter through hole. The closure device secures the closure lid to the drum via two 3½ inch long, 5/8 carbon steel hex head bolts and jam nuts. Each lug includes a 0.13 inch hole to receive a tamper-indicating device (TID). The 55-gallon split-ring closure weighs approximately 9.8 lb.

The estimated nominal weight of the 9979 55-gallon overpack assembly (body, closure lid and split-ring closure device) is calculated to be 174.5 lb (Drawing R-R1-G-00029).

The general outside dimensions of the 30-gallon confinement drum is 18.6 inches in diameter by 29 inches high when closed. The drum and its closure lid are fabricated from 16 gauge carbon steel. The lid incorporates two standard commercially stamped and threaded bung hole flanges, one is ¾-inch in diameter and the other is 2 inches in diameter. The 2 inch bung hole is fitted with a 2 inch pressure relieving plug that vents between 12-15 psig to limit buildup of internal pressure during HAC. The ¾-inch fitting is sealed with a standard ¾-inch non-venting drum plug. A formed silicon gasket seals the 30-gallon confinement drum closure. The 30-gallon drum with lid and split-ring closure weighs 50 lb.

The 30-gallon confinement drum split-ring closure device is similar to the 55-gallon drum overpack's closure device except for its smaller size and low profile lugs. The 30-gallon confinement drum split-ring closure device is fabricated from 12 gauge carbon steel. Low profile lugs are welded at each end of the two split rings. Each split-ring is identical, with one lug threaded with ½-13UNC-2B thread and the other with a through hole. The split-ring secures the

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closure lid to the drum via two 2½ inch long, 1/2-inch carbon steel socket head screws. Each lug includes a 0.13 inch hole to receive a tamper-indicating device (TID). The 30-gallon split-ring closure weighs approximately 7.2 lb.

A lifting device may be necessary for loading the 30-gallon confinement drum into the 55-gallon overpack drum. Users may develop their own lifting apparatus but must obtain final approval from the Savannah River Packaging Technology (SRPT) Design Authority prior to use.

Installation of the split-ring requires striking each half with a rubber hammer as the bolts are torqued, and the process continues until sustaining torque values in accordance with Drawings R-R1-G 00028 and R-R1-G 00029 given in Appendix 1.3.1 of the SARP. The repeated striking and torque sequence is necessary to overcome the static friction between the drum closure and split-ring connection. With fully applied torque, the ends of the split-ring halves must retain a visually discernable gap. Jam nuts are then tightened against the unthreaded lugs on the 55-gallon drum. (The 30-gallon confinement drum split-ring closure does not include jam nuts.)

Two weights limits are applicable to the 9979. The gross weight of a fully loaded 9979 package shall not exceed 415 lb. The package contents including radioactive material, dunnage, packing, and thermal insulating bag if used is limited to 200 lb.

The content envelope limits, listed in Table 1, restrict package contents to materials with low decay-heat rates. Heat transfer by the 9979 package to its ambient surroundings is passive.

Payload decay heat is limited to a maximum of 3.5 watts. Moisture within the payload is limited to a maximum of one weight percent.

The 9979 package design does not incorporate a pressure-retaining leak-testable containment boundary because its radioactive contents are limited to not exceed an A₂ value. The 30-gallon drum functions as a confinement barrier for the radioactive contents. The 30-gallon confinement drum closure lid includes a pressure relieving plug to ensure that an over pressure condition does not occur during transport.

The 9979 package design does not incorporate any specific shielding features. Distance between the contents and points external to the package provides sufficient dose-rate attenuation.

The 9979 package design does not incorporate any specific criticality-control features. The 9979 package design ensures subcriticality by limiting package contents and maintaining a minimum distance between adjacent fissile material sources.

Option to use the ARG-US radiofrequency identification (RFID) system: The option to use the ARG-US RFID system is authorized. The RFID guide [See 5(e)(1)] provides procedures for using the ARG-US RFID tag. The ARG-US RFID tag is not considered a part of the package. The ARG-US RFID tag is equipped with a suite of sensors to monitor seal integrity, temperature, humidity, shock, radiation, and battery status. The seal sensor is a thin, flexible membrane that is pressed by washers when installed on one of the bolts used to clamp the split closure rings of the outer 55-gallon drum. The seal sensor may be credited as a Tamper-Indicating Device (TID) for enhanced security and safeguards, and the seal has been evaluated, and judged to be adequate, following the NRC Regulatory Guide 5.80 "Pressure Sensitive (PS) and Tamper Indicating Device Seals for Material Control and Accounting (MC&A) of Special Nuclear Material," dated December 2010. Therefore, the ARG-US RFID tag may be used as TID seal [See 5(e)(3)]. The ARG-US RFID tag has a robust plastic front cover and the stainless-steel back plate which provide adequate protection of the tag against damage under normal handling and transport. The tag weighs approximately 2.4 lb (with four batteries) and is approximately 8 inches wide x 7 inches high x 1.5 inches tall. Appendix B of the RFID guide provides documentation that the batteries

used in the ARG-US RFID tag are not subject to the hazardous material regulations and also contains the Material/Product Safety Data Sheet for the batteries.

(3) Drawings:

The 9979 Packaging design is defined by the following Savannah River Site drawings. The drawing revisions listed below supersede the Engineering Drawings listed in Appendix 1.3 of S-SARP-G-00006, Revision 2 and the drawings listed below shall be used for procurements of 9979 packagings.

Drawing Number	Revision Number	Title
R-R5-G-00006	3	9979 Type AF Package Tree (U)
R-R1-G-00026	4	9979 Type AF 30-Gallon Container Split Ring Assembly (U)
R-R1-G-00027	4	9979 Type AF 55-Gallon Drum Lid Split Ring Assembly (U)
R-R1-G-00028	5	9979 Type AF 30-Gallon Drum Assembly (U)
R-R1-G-00029	5	9979 Type AF 55-Gallon Drum Assembly (U)
R-R1-G-00030	3	9979 Type AF Packaging Assembly (U)
R-R2-G-00057	6	9979 Type AF 55-Gallon Drum Sub-Assembly and Weldment (U)
R-R2-G-00058	3	9979 Type AF 30-Gallon Drum (U)
R-R2-G-00059	4	9979 Type AF 55-Gallon Drum Lid Sub-Assembly and Weldment (U)
R-R2-G-00060	4	9979 Type AF 30-Gallon Drum Lid with Dual Bung Closures (U)
R-R4-G-00062	3	9979 Type AF 30-Gallon Drum Lid Gasket (U)
R-R4-G-00064	3	9979 Type AF Insulation Bag
R-R4-G-00065	3	9979 Type AF Insulation Cover Assembly for 30-Gallon Drum (U)
R-R4-G-00066	2	9979 Type AF Package Identification Plate (U)

Note: U is unclassified

(b) Contents

(1) Type and Form of Radioactive Material:

The payload for the 9979 package includes all radioactive (fissile and non-fissile) and non-radioactive materials confined within the 30-gallon confinement drum. The radioactive contents for the 9979 package are grouped broadly into two payload categories as listed in Table 1: non-combustible materials, and combustibles materials. A general description of the content payload is listed in Table 1.

Table 1-Radioactive Content Description

Payload Categories	Material Form	General Description
COMBUSTIBLE	Filters	Roughing, sock, demister, HEPA and other uranium filters
	Rubber, Plastics, Cellulose Products	Clothing, gaskets, bottles, filter frames, paper, wood, mop heads etc.
	Floor Sweepings	Miscellaneous materials collected from cleaning activities
	Process Solids	Furnace residues. (pan filter cloth and scrapings, wipes/sponges, etc.)
NON-COMBUSTIBLE	Graphite/Carbon	Carbon and graphite scrap molds
	Slag and Liner	Residue that contains magnesium oxide, calcium fluoride and/or lithium fluoride
	Ceramics/Glass	Crucibles, glassware and borosilicate rings
	Borax Pellets	From analytical x-ray operations.
	Reduction Sand	granular magnesium oxide (MgO)
	Asbestos/Firebrick	Insulation, floor tiles, etc.
	Solid Compounds	Uranyl Fluoride, UO ₄ , ammonium diuranate and residues and solid mixtures
	Standards and Sources	Encapsulated calibration standards

Non-radioactive contents include all secondary containers, wrapping, shoring, convenience cans, plastic bagging, polyurethane foam and other dunnage material.

(2) Maximum Quantity of Radioactive Material per Package:

The radioactive material and payload mass limits for the 9979 package are defined in Table 2.

Table 2 –Content Envelope Limits

Feature	Material	Mass (g)			
Radioisotopes	Tc-99	1,430			
	Th-232	90,000			
	U-232	5.00E-05			
	U-233	16.7			
	U-234	26.1			
	U-235	350			
	U-236	2,500			
	U-238	90,000			
	Np-237	76.9			
	Pu-238	1.59E-03			
	Pu-239	0.435			
	Pu-240	0.119			
	Pu-241	1.58E-02			
	Am-241	7.69E-03			
Impurities	Carbon	1,000 ^d	unlimited ^b e	1,000 ^d	90,000 ^{c,e}
	Beryllium		0		0
	Hydrocarbons ^f	1,000.	1,000	Unlimited ^e	1,000
Total Mass ^a	Fissile Material [U-235 (eq)]*	350	350	300	150
	Radioactive Material	90,000			
	Package Payload	90,000			
Note: With the exception of U-235 and U-232, the mass of each isotope listed is based on a single A ₂ or 90,000 grams.					

- a Package contents are limited to specified mass of U-235 (eq) and to a maximum composite A₂ of one.
* U-235(eq) = U-235 + [4.1 × U-233] + [4.1 × Pu]
[The sum of U-233 and Pu must be ≤ 5 wt% total fissile mass.] All other fissile isotopes are only allowed in trace quantities (i.e., <0.015 grams)
- b Fissile material must be fixed on graphite pieces.
- c Fissile material is not fixed on graphite pieces.
- d This limit applies to sum of beryllium and carbon in the payload.
- e Subject to payload limit.
- f Materials predominantly containing hydrogen and carbon (i.e., molecular formula involving C_xH_y...) such as plastics, polyethylene, and oil.

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All contents are required to be packaged in the 9979 30-gallon confinement drum. For all contents categorized as combustible a thermal insulating bag as described in Section 1.2.4 of the SARP is required. Drawing R-R4-G-00064 given in Appendix 1.3.1 of the SARP defines the insulation bag design. This bag is optional dunnage for non-combustible contents.

(c) Criticality Safety Index

The Criticality Safety Index CSI is 1.0, i.e., CSI=1.0.

(d) Conditions

- (1) The maximum allowable radioactive decay heat rate is 3.5 watts.
- (2) Two weights limits are applicable to the 9979. The gross weight of a fully loaded 9979 package shall not exceed 415 lb. The package contents including radioactive material, dunnage, packing, and thermal insulating bag, if used, is limited to 200 lb.
- (3) Pyrophoric materials, cryogenic liquids, compressed gasses, visible liquids, and chemically reactive substances are prohibited as content in the 9979 package.
- (4) Transport of fissile material by air in the 9979 package is not authorized.
- (5) Moisture within the payload is limited to a maximum of one weight percent.
- (6) In addition to the requirements of Subparts G and H of 10 CFR Part 71, and except as specified in section 5(d) of this certificate, each package must be fabricated, acceptance tested, operated, and maintained in accordance with the Operating Procedures requirements of Chapter 7, Acceptance Tests and Maintenance Program requirements of Chapter 8, and packaging-specific Quality Assurance requirements of Chapter 9 of the Model 9979 Type AF shipping package SARP.
- (7) All combustible contents are required to be packed inside a thermal insulating bag which is placed inside the 30-gallon drum as described in Section 1.2.4 of the SARP. Drawing R-R4-G-00064 given in Appendix 1.3.1 of the SARP defines the thermal insulating bag design. This bag is optional dunnage for non-combustible contents. Bag installation is performed by folding a portion of the fabric top outside the 30-gallon drum and cinching the bag tight under the drum curl with the supplied draw cord. This secures the bag to the top of drum preventing the insulation bag from obstructing loading operations. Following loading operations an attached insulated top is folded in on top of the packaged materials and the bag is then cinched closed.
- (8) The following are requirements for payload packing configurations:
 - Sharp edges and corners must be padded.
 - Liquid waste and waste containing free liquids must be processed to a solid form or be collected on sorbent material sufficient to retain twice the volume of the liquid. Sorbents must be non-biodegradable in accordance with 40 CFR 265.314(e).
 - Handling containers must be packed with closures upright.
- (9) The 9979 packagings with serial numbers 0600 and higher are authorized for use.
- (10) The 2.0 mil polystyrene waterproof tape shall be replaced on any 9979 packaging that is to be re-used.
- (11) The shipper shall verify prior to shipment that the 2.0 mil polystyrene waterproof tape is in place over all venting and fill holes in the 55-gallon drum.

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- (12) The remaining 9979 packagings with serial numbers from 0100-0599 shall be repaired to conform to the following conditions:
- The pressure relieving plug shall be replaced with a plug conforming to Revision 2 of the SARP.
 - The three ¼ inch holes in the 55-gallon drum below the drum curl shall be permanently plugged with solid rivets or fasteners [rivets or fasteners shall be aluminum, carbon steel (CS), or CS coated with zinc] or by weld repairs.
 - The repairs shall be approved by the Design Agency, Design Authority and the QA of SRNL and included in the documentation package(s).
 - The shipper shall verify prior to shipment that the 2.0 mil polystyrene waterproof tape is in place over all venting and fill hole in the 55-gallon drum.
- (13) The design agency shall maintain a database of all packagings with serial numbers from 0100-0599 (all inclusive) for repair or use as-is with the history of loading, transportation and disposal.
- (14) Revision 1 of this certificate may be used until June 30, 2013 and Revision 2 of this certificate may be used until October 31, 2013.
- (15) If the option is chosen to attach an ARG-US RFID tag to the 9979 packaging, the operating procedures must follow the guide to RFID monitoring system [See 5(e)(1)]. The user shall complete the prescribed training to become qualified and to be certified for operation of the RFID monitoring system. The training course will be administered by Argonne National Laboratory on behalf of the Headquarters Certifying Official.
- (16) The ARG-US RFID may be used as a Tamper-Indicating Device Seal [See 5(e)(3)].
- (17) The engineering drawings listed in Section (3) Drawings of this CoC supersede the engineering drawings listed in Appendix 1.3 of S-SARP-G-00006, Revision 2. The engineering drawings listed in Section (3) Drawings of this CoC, and the Procurement Data Sheet M-DS-G-00060, Revision 2, dated October 10, 2012, shall be used for procurement of Commercial Grade items.

(e) References

- (1) Guide to the RFID Monitoring System (Models 9975, 9977, and 9978 Packages), Argonne National Laboratory, ANL/DIS-09-5, December 3, 2009 and its Supplements.
- (2) Request for Revision to 9979 Certificate of Compliance (CoC)(Revised), Memorandum SRNL-L4500-2012-00093, October 16, 2012.
- (3) DOE Packaging Certification Program Qualification/Accreditation of ARG-US Tag as a TID Seal, July 30, 2012.