Department of Energy
Washington, DC 20585

October 13, 2023

MEMORANDUM FOR MICHAEL D. BUDNEY
MANAGER
SAVANNAH RIVER OPERATIONS OFFICE

FROM: JULIA C. SHENK JULIA SHENK Digitally signed by JULIA SHENK Date: 2023.10.13 09:11:53 -04'00'
HEADQUARTERS CERTIFYING OFFICIAL
DIRECTOR
OFFICE OF PACKAGING AND TRANSPORTATION

SUBJECT: Renewal of Department of Energy Certificate of Compliance Number 9905

In response to the September 15, 2023, email request from Luke Sobus, Savannah River Operations Office, to Dr. James Shuler of my staff, Department of Energy (DOE) Certificate of the Compliance (CoC) Number 9905, Revision 5, for the Model HUFP package is issued for renewal with its Safety Evaluation Report. Changes to the CoC are indicated by vertical bars in the right page margin.

This CoC is issued by DOE under the authority of 49 CFR 173.7(d) and is conditional upon fulfilling the applicable Operational and Quality requirements of 49 CFR Parts 100-199 and 10 CFR Part 71, and the conditions specified in Item 5 of the CoC.

The expiration date of the certificate is January 31, 2029.

If you have any questions, please contact me or Dr. Shuler at (301) 903-5513.

Attachments

cc: Luke Sobus, SR
Matthew Howard, SRNL
James Shuler, EM-4.24
Docket 23-38-9905

U.S. DEPARTMENT OF ENERGY

DOE Packaging Certification Program

CERTIFICATE OF COMPLIANCE
For Radioactive Materials Package

OE F 5822.1
5-85 Formerly EV-618)

1a. Certificate Number	1b. Revision No.	1c. Package Identification No.	1d. Page No.	1e. Total No. Pages
9905	5	USA/9905/B(U)F-96 (DOE)	1	6

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*):	(2) Title and identification of report or application:	(3) Date:
U.S. Department of Energy Savannah River Operations Office P.O. Box A Aiken, SC 29802	Safety Analysis Report for Packaging, Hanford Unirradiated Fuel Package, CHPRC-00164, Revision 1, November 2009; as supplemented [see 5(e)]	November 2009

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: HUFP

(2) Description

The Hanford Unirradiated Fuel Package (HUFP) is designed to transport a core component container (CCC) containing unirradiated MOX driver fuel assemblies (DFAs) or loose fuel pins inside an IDENT-69G container. The HUFP body shell is $^{9}/_{16}$ inch thick, and is fabricated from Type XM-19 austenitic stainless steel. The shell may be fabricated from multiple sections, which are joined using full penetration, volumetrically-inspected welds. A circumferentially continuous doubler plate, constructed of Type XM-19 austenitic stainless steel, is welded to each end of the shell, near the end of each impact limiter. Welded to the doubler plate are impact limiter attachment lugs, six per impact limiter. The doubler plate also serves to provide a tiedown interface with the transportation skid for longitudinal loads.

The seal flange is located at the open end of the body, and consists of a locally thicker wall section to accommodate the closure lid sealing area and the closure bolt threaded holes. The transition between the shell and the seal flange section is nominally a 3.4:1 taper. Polyurethane foam is used to build the outer diameter of the body out to the full diameter of the sealing flange and closure lid. The foam annulus has a density of 30 pounds per cubic foot (pcf), a radial thickness of approximately

6a. Date of Issuance: October 13, 2023	6b. Expiration Date: January 31, 2029

FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address *(of DOE Issuing Office)*	7b. Signature, Name, and Title *(of DOE Approving Official)*
U.S. Department of Energy Office of Packaging and Transportation (EM-4.24) 1000 Independence Avenue, SW Washington, DC 20585	JULIA SHENK Digitally signed by JULIA SHENK Date: 2023.10.13 09:09:10 -04'00' Julia C. Shenk Director Headquarters Certifying Official Office of Packaging and Transportation

1.25 inches, and is protected by a 16-gauge sheet of Type 304 or Type XM-19 austenitic stainless steel. The end of the annulus is protected by a ¼ inch thick plate of Type 304 or Type XM-19 austenitic stainless steel, which contains plastic fire-consumable plugs.

The bottom end plate, constructed of Type XM-19 or Type FXM-19 austenitic stainless steel, is a simple machined circular plate. The thickness of the end plate is 1.5 inches and has a machined transition to the body shell weld. The transition allows for an easily examined full penetration weld.

The closure lid is a weldment constructed of Type XM-19, ¾ inch thick outer plate and ⅝ inch thick inner plate, stiffened with eight, ½ inch thick radial ribs that are three inches deep. A ½ inch thick, 6 inch inner diameter cylinder forms a hub at the inner end of the radial ribs. The ribs are welded on all four edges to the adjacent structure. Each rib has a projection that passes through a slot in the outer plate, and the ribs and outer plate are securely welded together using ½ inch groove welds.

The closure lid inner plate is welded to the outer ring using a full-penetration, volumetrically inspected weld. The seal flange of the closure lid has a minimum thickness of one inch, and provides locations for three closure O-ring seals with the middle seal providing the containment seal. The seals are ⅜ inch diameter butyl rubber O-rings. The closure lid also provides a location for the vent, fill, and test ports. All three ports are closed using ⅜ -16UNC socket head cap screw plugs, fabricated of ASTM B16, half-hard brass, and sealed with butyl rubber sealing washers.

The closure lid is attached to the body using twenty four (24) ¾ -10UNC socket head cap screws (SHCS) fabricated from ASTM A564, Grade 630, Condition H1100, nickel plated bolting material. Hardened washers are utilized with the closure lid SHCS, which engage threaded inserts in the receiving flange.

The Core Component Container (CCC) is a cylindrical structure comprised of six (6) 6 ⅝ OD × 0.375 inch wall Type 304 stainless steel pipes surrounding a 6 ½ OD × 0.120 inch wall Type 304 stainless steel tube in the center. The radial distance from the centerline of the outer CCC pipes to the centerline of the CCC is 6.625 inches. These six (6) pipes and inner tube are welded to a top plate that provides rigid support to the CCC. The top end of the CCC is closed by a 1.63 inch thick, Type 304 stainless steel cover, which is secured to the CCC top plate using twelve (12) ¾-10UNC socket head cap screws (SHCS). At the bottom end, each pipe transitions to a 3½ inch, Schedule 40 Type304 stainless steel pipe, which is closed by a ⅜ inch thick Type 304 stainless steel welded plug. The bottom end of the center tube is closed by a ¾ inch thick Type 304 stainless steel welded plug. The bottom end plugs are then attached to a 1½ inch thick × 18 inch diameter Type 304 stainless steel plate. The top cover is sealed to the body utilizing two face seals: a 0.139 inch cross-sectional diameter × 19.35 inch inner diameter Nitrile O-ring seal, and an aluminum-jacketed metallic seal. The nominal dimensions of the CCC are 20 inches in diameter and 146.0 inches in length.

The CCC-Adapter shell is ¼ inch thick, and is fabricated of Type 304 stainless steel. To provide structural strength, seven (7) ¾ inch thick circular Type 304 stainless steel rings are welded to the shell at regular locations over its length. Near the bottom end is one (1) 1 inch thick Type 304 stainless steel ring, and near the lid end are two (2) 1 inch thick Type 304 stainless steel rings that are welded to the shell.

The CCC-Adapter lid is a weldment constructed of Type 304 stainless steel plates, and is constructed as a weight-efficient structure. The CCC-Adapter lid is constructed with a 1 inch thick top plate, a ½ inch thick bottom plate, a ¼ inch thick outer cylinder, and a 6 inch × SCH 40S pipe in the center. The overall length of the CCC-Adapter lid is 13.5 inches, and is secured to the body with six (6) ½ -13UNC socket head cap screws (SHCS). The top lid has a diameter of 25.5 inches so that it cannot contact the three lugs of the package collar.

The CCC-Adapter bottom end is a weldment constructed of two (2) 1 inch thick Type 304 stainless steel plates, similar in construction to the CCC-Adapter lid. The bottom of the CCC-Adapter is designed to pass over the trunnion (if present) without contact. Therefore, the CCC-Adapter rings rest on the package shell when the package is in a horizontal orientation.

The nominal exterior dimensions of the CCC-Adapter are 28.0 inches diameter × 164.8 inches long. The interior cavity dimensions are 20.4 inches diameter × 146.6 inches long. To ensure that the CCC-Adapter does not function as a pressure boundary, four (4) ¾ inch diameter through holes allow gas exchange between the package cavity and the CCC-Adapter

The impact limiters are installed at each end of the HUFP for thermal and impact protection during transport. The impact limiters are comprised of cylindrical and conical sections. The cylindrical sections correspond to the body-to-impact limiter interface length of 20 inches, and have an outer diameter of 60 inches. The adjacent conical section is 15 inches long with a minimum diameter of 36 inches. The bottom hole is designed to reduce end drop impact loads, and has a diameter of 20 inches and a depth of eight inches. The impact limiter shells are constructed of Type 304 stainless steel. The closure lid end impact limiter has ¼ inch thick shells ($^{5}/_{16}$ inch thick for the end-hole plate) to resist perforation from the HAC puncture drop, and to protect the closure lid and sealing area from puncture and HAC fire damage. The bottom impact limiter has 11-gauge (0.12 inch) thick shells.

Within the impact limiter shells is closed cell, rigid polyurethane foam. The polyurethane foam provides the majority of the energy absorption during the HAC free drop events, and thermal protection of the containment seals during the HAC thermal events. The foam properties are important to the proper function of the impact limiters. The lid end impact limiter has a foam density of 10 pcf, while the bottom end impact limiter has a foam density of 11.5 pcf. Each impact limiter is attached to the body using six (6) 1-8UNC × 24½ inches, ASTM A320, Grade L43 SHCS, with the shank reduced to a diameter of 0.81 inches. The impact limiter bolts are nickel or cadmium plated to inhibit corrosion.

Not considering the closure lid flange area and the impact limiter attachment lugs, the body has a nominal external diameter of 29.62 inches and a nominal length of 171.33 inches, with the closure lid installed. The nominal external diameter of the closure lid flange area is 32.3 inches. The nominal external diameter including the attachment lugs is 38.5 inches. The maximum gross weight of the HUFP may not exceed 14,000 pounds. The maximum payload weight of the HUFP is 3,300 pounds, based on six (6) IDENT-69G containers. This weight bounds the weight of seven (7) DFAs.

(3) Drawings

The packaging design is defined by the following HUFP general arrangement drawings:

4199-10, 1 Sheet, HUFP Assembly, Revision 2

4199-20, 6 Sheets, HUFP Body Assembly, Revision 7

4199-30, 3 Sheets, HUFP Impact Limiter, Revision 5

4199-40, 2 Sheets, HUFP Core Component Adapter, Revision 5

4199-50, 10 Sheets, HUFP Core Component Container, Revision 3

(b) Contents:

(1) Type and Form of Radioactive Material

The contents of the HUFP include up to seven (7) fresh MOX FFTF DFAs or six (6) IDENT-69G containers filled with fresh, loose MOX (or HEU) pins. A DFA is an unirradiated mixed-oxide fuel assembly developed for service within the FFTF breeder reactor, and houses fuel pins securely within its duct body. An IDENT-69G container houses loose fuel pins and includes aluminum dunnage rods to limit the radial motion of the spacers and baskets to limit axial motion. The fissile portion of the HUFP payload comes from the fuel pins. The fuel pellets are ceramic material, and the cladding for all fuel pins is SS316, as well as the DFA duct. The plutonium activity of the contents exceeds 20 Ci and the contents are in solid form. Note that the SS304 IDENT-69G container is considered to be part of the contents rather than part of the packaging. DFAs and IDENT-69G containers shall not be mixed within a single CCC.

There are four types of DFA fuel assemblies: Type 3.1, Type 3.2, Type 4.1, and Type 4.2. DFA physical parameters are the same for all four types and are provided in Table 1.2-1 of the SARP.

There are nine (9) general categories of loose pins transported in the IDENT-69G, as defined in Table 1.2-3 of the SARP. By quantity, approximately 90% of the pins in the current loose pin inventory are comprised of only three (3) groups: DFA, PLS, and TES. For packaging purposes, the loose pins may be segregated into “low” and “high” reactivity groups. Physical and nuclear parameters for these pins vary widely between the various pin types, although the loose pins have a maximum Pu content of 40.3% within the heavy metals (i.e., Pu, U, and Th) and a maximum U-235 enrichment of 97%.

The CCC may transport up to seven (7) DFAs, and any CCC location may accept a DFA.

IDENT-69G containers are described as being either “low” or “high” reactivity, depending upon the type of pins contained. With the exception of high reactivity HEU pins, low and high reactivity pins shall not be mixed within a low-reactivity IDENT-69G. Up to three (3) high-reactivity HEU pins may be transported mixed with low-reactivity pins. An IDENT-69G containing this mixture of low-reactivity pins and three (3) high-reactivity pins is considered a low-reactivity IDENT-69G. However, low-reactivity pins may be placed in a high-reactivity IDENT-69G.

A CCC that contains only low-reactivity IDENT-69G containers is called a “low-reactivity CCC.” The CCC that contains a high-reactivity IDENT-69G is called a “high-reactivity CCC.” The center CCC location must be empty for either the low or high-reactivity CCC. The physical design of the IDENT-69G precludes loading in the center CCC location. A CCC loaded with IDENT-69G containers may be loaded in one of two general loading configurations.

Low-reactivity CCC: Up to six (6) low-reactivity IDENT-69G containers, or

High-reactivity CCC: Up to three (3) low-reactivity IDENT-69G containers and one (1) high-reactivity IDENT-69G container.

Each low-reactivity IDENT-69G is limited to a maximum of 250 fuel pins. The high-reactivity IDENT-69G is limited to a maximum of 150 fuel pins. The pins have a variety of different lengths, and each pin counts as one (1) pin, regardless of length.

(2) Maximum Quantity of Radioactive Material per Package

The contents of the HUFP include up to seven (7) fresh MOX FFTF DFAs or six (6) IDENT-69G containers filled with fresh, loose MOX (or HEU) pins. DFAs and IDENT-69G containers shall not be mixed within a single CCC.

The DFAs have a maximum Pu content of 29.28% within the heavy metals (i.e., Pu, U) and either depleted or natural uranium. Pellet data for each of the four DFA types are provided in Table 1.2-2 of the SARP.

There are nine (9) general categories of loose pins transported in the IDENT-69G, as defined in Table 1.2-3 of the SARP. By quantity, approximately 90% of the pins in the current loose pin inventory are comprised of only three (3) groups: DFA, PLS, and TES. For packaging purposes, the loose pins may be segregated into “low” and “high” reactivity groups. Physical and nuclear parameters for these pins vary widely between the various pin types, although the loose pins have a maximum Pu content of 40.3% within the heavy metals (i.e., Pu, U, and Th) and a maximum U-235 enrichment of 97%.

Bounding physical and nuclear parameters for the loose pins are provided in Table 1.2-4 and Table 1.2-5 of the SARP for the high and low reactivity pins, respectively. With the exception of the RBD pins, the number of known pins of each pin type is provided in these tables “for information only,” although these values do not constitute a limit because all analysis have been performed for bounding pin arrangements. The RBD pin is limited to a maximum of 19 pins per CCC.

Each low-reactivity IDENT-69G is limited to a maximum of 250 fuel pins. The high-reactivity IDENT-69G is limited to a maximum of 150 fuel pins. The pins have a variety of different lengths, and each pin counts as one (1) pin, regardless of length.

The maximum total activity of the payload is 400,000 Ci, and the maximum quantity of fissile constituents (i.e., U-235, Pu-239, and Pu-241) is 120 kg.

(c) Criticality Safety Index

The criticality safety index (CSI) = 100

(d) Conditions

(1) DFAs and IDENT-69G containers shall not be mixed within a single CCC.

(2) The CCC shall not be loaded with more than one high-reactivity IDENT-69G.

(3) Individual pins shall have any wrappers or tape removed, and the pins cleaned as necessary prior to placement in an IDENT-69G. Plastic residues that cannot be removed shall not exceed 5% of the surface area of the pin. Rags, universal polypropylene absorbent pads, or other moderating materials are prohibited from being placed in the IDENT-69G containers.

(4) The center CCC location must be empty for either the low or high-reactivity CCC. The physical design of the IDENT-69G precludes loading in the center CCC location.

(5) In addition to the requirements of Subparts G and H of 10 CFR Part 71, 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 SARP.

(6) Transport by air of fissile material is not authorized.

(7) Transport shall be by exclusive-use.

(8) The maximum allowable decay heat for the HUFP is 400 watts, based on seven (7) DFAs. The maximum decay heat for a payload of six (6) IDENT-69G containers is 275 watts, and the maximum decay heat for an individual IDENT-69G container is 75 watts.

(9) Only DOE elements or persons working under contract to DOE elements shall consign the package for domestic shipment.

(10) Nuclear Regulatory Commission (NRC) or Agreement State licensees shall not consign a DOE certified package for domestic shipment, but can transfer the material onsite to DOE elements or persons working under contract to DOE elements for consignment of the package.

(11) Revision 4 of the Certificate may be used until February 29, 2024.

(e) Supplements

(1) *HUFP CoC Renewal*, email H. Gunter to J. Shuler, dated November 21, 2013

(2) *Application for Renewal of Certificate of Compliance USA/9905/B(U)F-96 for the Hanford Unirradiated Fuel Package (HUFP)*, SRNL-L4500-2018-00100, Rev. 0, September 25, 2018 (submitted to/for DOE-SR)

(3) *9905 5-year CoC Renewal Request*, email Luke Sobus to James Shuler, September 15, 2023