East Building, PHH-23
1200 New Jersey Ave, SE
Washington, D.C. 20590

U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration

COMPETENT AUTHORITY CERTIFICATION FOR A TYPE FISSILE RADIOACTIVE MATERIALS PACKAGE DESIGN CERTIFICATE USA/9330/AF-96, REVISION 2

The Competent Authority of the United States certifies that the radioactive material package design described in this certificate satisfies the regulatory requirements for a Type AF package for fissile material as prescribed in the regulations of the International Atomic Energy Agency[1] and the United States of America[2].

1. Package Identification - ATR FFSC.

2. Package Description and Authorized Radioactive Contents - as described in U.S. Department of Energy Certificate of Compliance No. 9330, Revision 1 (attached).

3. Criticality - The minimum criticality safety index is 4.0, except for small quantity payloads for which the CSI is 25. The maximum number of packages per conveyance is determined in accordance with Table 11 of the IAEA regulations cited in this certificate.

4. General Conditions -

   a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation. The user shall prepare the package for shipment in accordance with the documentation and applicable regulations.

   b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Engineering and Research, (PHH-23), Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, Washington D.C. 20590-0001.

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[1] "Regulations for the Safe Transport of Radioactive Material, 2012 Edition, No. SSR-6" published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

[2] Title 49, Code of Federal Regulations, Parts 100-199, United States of America.

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c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

d. Records of Management System activities required by Paragraph 306 of the IAEA regulations[1] shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors in the United States exporting shipments under this certificate shall satisfy the applicable requirements of Subpart H of 10 CFR 71.

5. Marking and Labeling - The package shall bear the marking USA/9330/AF-96 in addition to other required markings and labeling.

6. Expiration Date - This certificate expires on January 31, 2024. Previous editions which have not reached their expiration date may continue to be used.

This certificate is issued in accordance with paragraph(s) 816 of the IAEA Regulations and Section 173.471 and 173.472 of Title 49 of the Code of Federal Regulations, in response to the December 16, 2019 petition by Department of Energy, Washington, DC, and in consideration of other information on file in this Office.

Certified By:

for William Schoonover
Associate Administrator for Hazardous Materials Safety

December 18, 2019
(DATE)

Revision 2 - Issued to endorse U.S. Department of Energy Certificate of Compliance No. USA/9330/AF-96(DOE), Revision 1 (attached) and to permit air transport of fuel elements or loose plates.

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
9330	1	USA/9330/AF-96 (DOE)	1	5

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 Idaho Operations Office 1955 Fremont Ave. Idaho Falls, ID 83415	Safety Analysis Report — Advanced Test Reactor Fresh Fuel Shipping Container (ATR FFSC), Revision 14, May 2017	May 2017

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: ATR FFSC

(2) Description:

An insulated stainless steel package for the transport of unirradiated research reactor fuel, including intact fuel elements or fuel plates. The packaging consists of (1) a body, (2) a closure lid, and (3) inner packaging internals. The approximate dimensions and weights of the package are:

Overall package outer width and height	8	inches
Overall package length	73	inches
Cavity diameter	5 ¾	inches
Cavity length	68	inches
Packaging weight (without internals)	240	pounds
Maximum package weight (including internals and contents)	290	pounds

The body is composed of two thin-walled, stainless steel shells. The outer shell is a square tube with an 8 inch cross section, a 73 inch length, and a $^{3}/_{16}$ inch wall thickness. The inner shell is a round tube with a 6 inch diameter and a 0.120 inch wall thickness. The inner tube is wrapped

6a. Date of Issuance: 10/3/2018	6b. Expiration Date: January 31, 2024

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	Joanne Lorence Director Headquarters Certifying Official Office of Packaging and Transportation

with ceramic fiber thermal insulation, overlaid with a stainless steel sheet. At the bottom end, the shells are welded to a 0.88 inch thick stainless steel base plate. At the top end (closure end), the shells are welded to a 1.5 inch thick stainless steel flange.

The closure is composed of circular stainless steel plates with ceramic fiber insulation. The closure engages the top end flange by way of four bayonets that are rotated and secured by two spring pins. The closure is equipped with a handle, which may be removed during transport. The closure does not have a gasket or seal.

The package internals consist of either 1) a Fuel Handling Enclosure (FHE) for intact Advanced Test Reactor (ATR), Massachusetts Institute of Technology (MIT), University of Missouri Research Reactor (MURR), Conversion Of Belgian Reactor 2 - an Alternative (COBRA fuel both highly enriched uranium [HEU] and low enriched uranium [LEU]), or Rhode Island Nuclear Science Center (RINSC) fuel elements and Small Quantity Payloads, or 2) a Loose Fuel Plate Basket for ATR fuel plates. The RINSC, MIT, MURR, COBRA, and Small Quantity Payload FHE use ball lock pins and end spacers to lock closed while the ATR FHE uses a spring plunger.

(3) Drawings:

The packaging is constructed and assembled in accordance with the following Areva Federal Services LLC. or Packaging Technology, Inc., Drawing Nos.:

Drawing No.	Revision	Title
60501-10, Sheets 1-5,	3	ATR Fresh Fuel Shipping Container SAR Drawing
60501-20	1	ATR Loose Fuel Plate Basket
60501-30	1	ATR Fuel Handling Enclosure
60501-40	0	MIT Fuel Handling Enclosure
60501-50	0	MURR Fuel Handling Enclosure
60501-60	0	RINSC Fuel Handling Enclosure
60501-70	0	Small Quantity Payload Fuel Handling Enclosure
60501-90	0	COBRA Fuel Handling Enclosure

(b) Contents:

(1) Type and form of material

Unirradiated Mark IV, V, VI, and VII ATR fuel elements – The Mark IV fuel material is composed of U_3O_8 while the Mark V, VI , and VII ATR fuel material is composed of uranium aluminide (UAl_x). The uranium is enriched to a maximum 94 weight percent U-235; the maximum U-234 content is 1.2 weight percent; and the maximum U-236 content is 0.7 weight percent. Intact ATR fuel elements contain 19 curved fuel plates fitted within aluminum side plates, and the maximum channel thickness between fuel plates is 0.087 inch. The fuel meat thickness is a nominal 0.02 inch for all 19 plates, and the fuel meat width ranges from approximately 1.5 inches to 3.44 inches. The nominal active fuel length is approximately 48 inches. The maximum mass of U-235 per intact ATR fuel element is 1200 grams. The ATR fuel element must be contained within the ATR Fuel Handling Enclosure, as specified in 5.(a)(3).

Unirradiated ATR U-Mo fuel elements - The ATR U-Mo fuel element consists of a mixture of high-enriched uranium aluminide (UAl_x) fuel plates and low-enriched uranium and molybdenum alloy (U-Mo) fuel plates, with a maximum mass of U-235 per U-Mo fuel element of 1,240 grams. The ATR U-Mo fuel element contains 19 curved plates fitted within aluminum side plates; plates 1 through 4, and 16 through 18, contain high-enriched UAl_x fuel; plates 5 through 15 contain low-enriched U-Mo fuel; and plate 19 is an aluminum alloy plate. The maximum channel

low-enriched U-Mo fuel; and plate 19 is an aluminum alloy plate. The maximum channel thickness between fuel plates is 0.087 inch. For the high-enriched UAl_x fuel plates, the uranium is enriched to a maximum 94 weight percent U-235; the maximum U-234 content is 1.2 weight percent; and the maximum U-236 content is 0.7 weight percent. For the low-enriched U-Mo fuel plates, the molybdenum content is a nominal 10 weight percent; the uranium is enriched to a maximum 20 weight percent U-235; the maximum U-234 content is 0.26 weight percent; and the maximum U-236 content is 0.46 weight percent. For the high-enriched UAl_x fuel plates, the fuel meat thickness is a nominal 0.02 inch; the fuel meat width ranges from approximately 1.5 inches to 3.44 inches; and the nominal active fuel length is approximately 48 inches. For the low-enriched U-Mo fuel plates, the fuel meat thickness is a nominal 0.013 inch, with a nominal 0.001 inch thick zirconium interlayer present between the fuel meat and the aluminum cladding layer; the fuel meat width ranges from approximately 2.25 inches to 3.28 inches; and the nominal active fuel length is approximately 48 inches. The ATR U-Mo fuel element must be contained within the ATR Fuel Handling Enclosure, as specified in 5.(a)(3).

Unirradiated MIT fuel element – The MIT fuel material is composed of uranium aluminide (UAl_x). The uranium is enriched to a maximum of 94 weight percent U-235; the maximum U-234 content is 1.2 weight percent; and the maximum U-236 content is 0.7 weight percent. Each MIT fuel element contains 15 flat fuel plates fitted within aluminum side plates and the maximum channel thickness between fuel plates is 0.090 inch. The fuel meat thickness is a nominal 0.03 inch for all 15 plates and the fuel meat width ranges from approximately 1.98 inches to 2.17 inches. The nominal active fuel length is 22.375 inches. The maximum mass of U-235 per intact MIT fuel element is 515 grams. The MIT fuel element must be contained within the MIT Fuel Handling Enclosure, as specified in 5.(a)(3).

Unirradiated MURR fuel element – The MURR fuel material is composed of uranium aluminide (UAl_x). The uranium is enriched to a maximum of 94 weight percent U-235; the maximum U-234 content is 1.2 weight percent; and the maximum U-236 content is 0.7 weight percent. Each MURR fuel element contains 24 curved fuel plates fitted within aluminum side plates and the maximum channel thickness between fuel plates is 0.090 inch. The fuel meat thickness is a nominal 0.02 inch for all 24 plates and the fuel meat width ranges from approximately 1.71 inches to 5.72 inches. The nominal active fuel length is 24 inches. The maximum mass of U-235 per intact MURR fuel element is 785 grams. The MURR fuel element must be contained within the MURR Fuel Handling Enclosure, as specified in 5.(a)(3).

Small Quantity Payloads (RINSC fuel elements, ATR Full-size plate In Flux trap Position [AFIP] elements, U-Mo foils, Design Demonstration Elements [DDEs] and similar test elements, MIT, loose fuel element platesCOBRA, or MURR loose fuel element plates) where the maximum mass of U-235 is 400 grams and maximum U-235 enrichment is 94 weight percent. Aluminum plates, shapes, and sheets, miscellaneous steel or aluminum fasteners, and cellulosic material such as cardboard may be used as dunnage to fill gaps between the small quantity payloads and the small quantity FHE. Loose plates may be separated by kraft paper and taped or wire-tied together. Dunnage shall be used to limit motion of the small quanity payload within the FHE to ¼ inch or less. Neoprene rub strips, ⅛ inch thick, may be used between the small quantity FHE and small quantity payloads and/or between the optional aluminum dunnage and the small quantity payload. The ⅛ inch thick neoprene strips shall not be stacked in more than two layers between the small quantity payload and any interior face of the small quantity FHE.

Unirradiated RINSC fuel element — The RINSC fuel material is composed of uranium silicide (U_3Si_2) dispersed in aluminum powder. The uranium is enriched to a maximum of 20 weight percent U-235; the maximum U-234 content is 0.5 weight percent; and the maximum U-236

content, is 1.0 weight percent. Each RINSC fuel element contains 22 flat fuel plates fitted within aluminum alloy side plates and the maximum channel thickness between fuel plates is 0.096 inch. The fuel meat thickness is a nominal 0.02 inch for all 22 plates. The maximum mass of U-235 per intact RINSC fuel element is 283 grams. The RINSC fuel element must be contained within the RINSC Fuel Handling Enclosure, as specified in 5.(a)(3).

AFIP fuel element — The AFIP fuel element is composed of uranium molybdenum alloy in an aluminum-silicon matrix or uranium molybdenum alloy coated with a thin zirconium interlayer. The uranium is enriched to approximately 20 weight percent U-235. Each AFIP element contains 4 curved fuel plates fitted within 6061 aluminum side plates. The maximum mass of U-235 AFIP element is 365 grams. Loose plates from an AFIP fuel element are also permitted. The AFIP fuel element must be contained within the Small Quantity Payload Fuel Handling Enclosure, as specified in 5.(a)(3).

COBRA fuel element — The COBRA HEU fuel element is composed of uranium aluminide (UAl_x) dispersed in aluminum powder, with the uranium enriched to a maximum of 94 weight percent U-235. The COBRA LEU fuel element is composed of uranium silicide (U_3Si_2) dispersed in aluminum powder, with the uranium enriched to a maximum of 20 weight percent U-235. The maximum mass of U-235 is 410.3 grams in the HEU configuration or 435.8 grams in the LEU configuration. The COBRA fuel element weighs a maximum of 20 lb, is bagged, and must be contained within the COBRA Fuel Handling Enclosure, as specified in 5.(a)(3).

U-Mo Foils — The U-Mo foils are composed of uranium molybdenum alloy in an aluminum-silicon matrix or uranium molybdenum alloy and may contain a zirconium coating. The uranium is enriched to a maximum of 94 weight percent U-235. The maximum mass of U-235 is 160 grams. More than one U-Mo foil type may be transported at a time. The U-Mo foils must be contained within the Small Quantity Payload Fuel Handling Enclosure, as specified in 5.(a)(3).

DDEs and similar test elements — The DDEs and similar test elements are composed of uranium molybdenum alloy in an aluminum-silicon matrix or uranium molybdenum alloy. The uranium is enriched to a maximum of 94 weight percent U-235. The maximum mass of U-235 is 365 grams. Loose plates from a DDE or similar test element are also permitted. The DDEs or similar test elements must be contained within the Small Quantity Payload Fuel Handling Enclosure, as specified in 5.(a)(3).

MIT and MURR loose fuel element plates — MIT and MURR loose plates may either be flat or curved and may be banded or wire-tied in a bundle. The MIT and MURR loose plate payload is limited to 400 grams of U-235. The approximate mass of U-235 of each MIT fuel plate is 34.3 grams. The approximate mass of U-235 per each MURR fuel plate is 19 to 46 grams. A mixture of MIT and MURR fuel plates may be shipped together. The fuel plates must be contained within the Small Quantity Payload Fuel Handling Enclosure, as specified in 5.(a)(3).

Mark IV, V, VI, and VII ATR loose fuel plates — ATR loose plates may either be flat or curved and may be banded or wire-tied in a bundle. The ATR loose plate payload is limited to 600 grams of U-235. Additional aluminum plates may be used as dunnage to fill gaps between the fuel plates and the basket payload cavity. The fuel plates must be contained within the ATR Loose Fuel Plate Basket, as specified in 5.(a)(3).

COBRA loose fuel element plates — COBRA loose plates may either be flat or rolled to the geometry required for assembly into the fuel element and may be taped or wire-tied together. The U-235 content per COBRA loose plate is variable and may be HEU or LEU, but the total payload is limited to 400 grams of U-235. COBRA loose plates are transported as Small Quantity Payloads.

The maximum total weight of contents and internals, including dunnage and other secondary packaging, is 50 lbs. Radioactive contents are not to exceed a Type A quantity.

For intact ATR, ATR U-Mo, MURR, RINSC, COBRA, and MIT fuel elements: One fuel element.

For ATR loose fuel plates: A maximum of 600 grams U-235.

For Small Quantity Payloads: A maximum of 400 grams U-235.

(c) Criticality Safety Index (CSI):

For ATR, ATR U-Mo, MURR, COBRA, and MIT fuel elements or ATR loose fuel plates: CSI = 4.0

For Small Quantity Payloads: CSI = 25

(d) Conditions:

(1) Fuel elements and fuel plates may be bagged or wrapped in polyethylene. The maximum weight of the polyethylene wrap shall not exceed 100 grams per package.

(2) Types of small quantity payloads cannot be mixed in a single Fuel Handling Enclosure.

(3) Air transport of fuel elements or loose plates is authorized.

(4) In addition to the requirements of 10 CFR 71 Subpart G:

(a) The package must be loaded and prepared for shipment in accordance with the Package Operations in Section 7 of the Safety Analysis Report (SAR).

(b) The package must be tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Section 8 of the SAR.

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

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

(7) Revision 0 of the certificate may be used until January 31, 2019.

(e) Supplements:

None

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1200 New Jersey Ave, SE
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Pipeline and Hazardous Materials Safety Administration

CERTIFICATE NUMBER: USA/9330/AF-96

ORIGINAL REGISTRANT(S):

Department of Energy
U.S. Department of Energy
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Washington, DC, 20585
USA