Department of Energy
Washington, DC 20585

JAN 17 2014

MEMORANDUM FOR RICHARD B. PROVENCHER
MANAGER
IDAHO OPERATIONS OFFICE

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

SUBJECT: Revision 0 to Certificate of Compliance Number 9330

Attached is Revision 0 to Department of Energy (DOE) Certificate of Compliance (CoC) Number 9330, Package Identification No. USA/9330/AF-96 (DOE), for the Model ATR FFSC (Advanced Test Reactor Fresh Fuel Shipping Container) and its Package Certification Approval Record. DOE approval is based on Nuclear Regulatory Commission CoC Number 9330, Revision 7.

DOE CoC Revision 0 and a subsequent request to the U. S. Department of Transportation for a Competent Authority Certificate are the first steps of a multi-step process to support shipments of TerraPower™ fresh fuel from the Idaho National Laboratory to the Russian Federation BOR60 reactor for irradiation.

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 Revision 0 is January 31, 2019.

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

Attachment

cc w/att.:
Daryn Moorman, DOE-ID
Craig Tyler, INL
Donald Darrington, INL
Steve Bellamy, SRNS

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	0	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 10, September 2013	September 2013

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: JAN 17 2014	6b. Expiration Date: January 31, 2019

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-33 1000 Independence Avenue, SW Washington, DC 20585	Stephen C. O'Connor Headquarters Certifying Official

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), 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, 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

(b) Contents:

(1) Type and form of material

Unirradiated Mark VII ATR fuel - The 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 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 plates, 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, and miscellaneous steel or aluminum fasteners may be used as dunnage to fill gaps between the small quantity payloads and the small quantity FHE. 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).

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).

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).

(2) Maximum quantity of material per package

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, 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, 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 fissile material is not 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.

PACKAGE CERTIFICATION APPROVAL RECORD
for
Department of Energy
Certificate of Compliance Number 9330, Revision 0
Package Identification No. USA/9330/AF-96 (DOE)
Model ATR FFSC
Docket 14-04-9330

Revision 0 to Department of Energy (DOE) Certificate of Compliance (CoC) Number 9330, Package Identification No. USA/9330/AF-96 (DOE), for the Model No. ATR FFSC (Advanced Test Reactor Fresh Fuel Shipping Container) is approved, based on Revision 7 of the Nuclear Regulatory Commission (NRC) CoC Number 9330.

The safety basis for NRC CoC Revision 7 is their 10 CFR Part 71 regulatory compliance reviews of the following documents (i.e., Safety Analysis Report [SAR] and supplements):

1. DOE letter to NRC dated June 23, 2011 with SAR Revision 6 (consolidated SAR) requesting a revision to NRC CoC Rev 5.
2. DOE letter to NRC dated August 18, 2011 with SAR Revision 7 (page changes and complete SAR) in response to NRC request for additional information (RAI).
3. DOE letter to NRC dated January 10, 2011 with SAR Revision 8 (page changes and complete SAR) in response to NRC RAI.
4. DOE letter to NRC dated July 23, 2013 requesting inclusion of Design Demonstration Elements or Similar Test Elements and Fuel Plates in the CoC content definition.
5. DOE letter to NRC dated September 15, 2013 with SAR Revisions 9 and 10 (page changes and complete SAR) in response to NRC RAI for a revision to NRC CoC Rev 6 to add the U-Mo demonstration element as an allowable content.

This certificate is issued by DOE under the authority of 49 CFR 173.7(d).

The expiration date for Revision 0 is January 31, 2019.

Stephen C. O'Connor
Headquarters Certifying Official
Director, Office of Packaging and Transportation

Date: JAN 17, 2014