UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 9, 2012

Dr. James Shuler, Manager
Packaging Certification Program
Safety Management and Operations
Office of Environmental Management
U.S. Department of Energy
Washington, DC 20585

SUBJECT: REVISION NO. 5 OF CERTIFICATE OF COMPLIANCE NO. 9330 FOR THE MODEL NO. ATR FFSC PACKAGE

Dear Dr. Shuler:

As requested by your application dated June 23, 2011, as supplemented August 18, 2011, and January 10, 2012, enclosed is Certificate of Compliance No. 9330, Revision No. 5, for the Model No. ATR FFSC package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471 have been provided a copy of this certificate.

If you have any questions regarding this certificate, please contact me or Jennie Rankin of my staff at (301) 492-3268.

Sincerely,

Christine Lipa, Acting Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9330
TAC No. L24545

Enclosures:
1. Certificate of Compliance No. 9330, Rev. No. 5
2. Safety Evaluation Report

cc w/encls: R. Boyle, Department of Transportation
Registered Users

NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9330	5	71-9330	USA/9330/AF-96	1	OF	5

2.. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. 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

a. ISSUED TO *(Name and Address)*
U.S. Department of Energy
Washington, DC 20585

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
U.S Department of Energy consolidated application dated June 23, 2011, as supplemented.

4. CONDITIONS
This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.
(a) Packaging

(1) Model No.: 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	5-3/4 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 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.

5.(a)(2) Description (Continued)

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 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 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.:

60501-10, Sheets 1-5, Rev. 3	ATR Fresh Fuel Shipping Container SAR Drawing
60501-20, Rev. 1	ATR Loose Fuel Plate Basket
60501-30, Rev. 1	ATR Fuel Handling Enclosure
60501-40, Rev. 0	MIT Fuel Handling Enclosure
60501-50, Rev. 0	MURR Fuel Handling Enclosure
60501-60, Rev. 0	RINSC Fuel Handling Enclosure
60501-70, Rev. 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 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

5.(b)(1) Type and Form of Material (continued)

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), 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. 1/8" neoprene strips 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 1/8" 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

5.(b)(1) Type and Form of Material (continued)

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. The DDEs 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 are also permitted. The DDEs 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, 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, MURR, MIT fuel elements or ATR loose fuel plates: 4.0

For Small Quantity Payloads: 25

6. 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.

7. Types of small quantity payloads cannot be mixed in a single Fuel Handling Enclosure.

8. Air transport of fissile material is not authorized.

9. 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 application.

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

10. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

11. Revision No. 4 of this certificate may be used until March 31, 2013.

12. Expiration date: May 30, 2014.

REFERENCES

U.S. Department of Energy consolidated application dated June 23, 2011, as supplemented: August 18, 2011, and January 10, 2012.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Christine Lipa

Christine Lipa, Acting Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: March 9, 2012

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT
Docket No. 71-9330
Model No. ATR FFSC Package
Certificate of Compliance No. 9330
Revision No. 5

SUMMARY

By application dated June 23, 2011, as supplemented August 18, 2011, and January 10, 2012, the U.S. Department of Energy (DOE) submitted an amendment request to add Small Quantity Payloads as authorized content of the Model No. ATR FFSC (Advanced Test Reactor Fresh Fuel Shipping Container) package. Small Quantity Payload is defined as fuel with a maximum U-235 loading of 400 g, and a maximum U-235 enrichment of 94 wt%. Fuel that qualifies as Small Quantity Payload includes Rhode Island Nuclear Science Center (RINSC) fuel, Massachusetts Institute of Technology (MIT) or Missouri University Research Reactor (MURR) fuel plates, Advanced Test Reactor (ATR) Full-size plate In Flux trap Position (AFIP) elements, uranium-molybdenum (U-Mo) foils, and design demonstration elements (DDEs). In addition, the request also includes changes to the maximum width of the ATR, MIT, MURR, and RINSC fuel elements and updates the isotopic compositions of the RINSC fuel element.

During the review of this application, DOE submitted a separate amendment request to expedite the approval of a change to the channel width of the MIT fuel which was included in the application dated June 23, 2011. Revision No. 4 to Certificate of Compliance (CoC) No. 9330 was issued with letter dated November 21, 2011.

The package was evaluated against the regulatory standards in 10 CFR Part 71, including the general standards for all packages, and performance standards for fissile material packages under normal conditions of transport (NCT) and hypothetical accident conditions (HAC). Based on the statements and representations in the application, and the conditions listed below, the staff concluded that the package meets the requirements of 10 CFR Part 71.

1.0 GENERAL INFORMATION

The package is composed of a six (6) inch (outer diameter) stainless steel cylindrical tube surrounded by one (1) inch thick insulation in an 8 inch x 8 inch stainless steel square tube that is 73 inches in length. The wall thickness of the square tube is 3/16 inch. The Small Quantity Payload contents are contained in an aluminum Small Quantity Payload fuel handling enclosure (FHE). Optional aluminum plates, shapes, and sheets dunnage are used to fill the gaps between the Small Quantity Payload and the FHE. Optional neoprene strips are used between the FHE and the Small Quantity Payload and/or the optional dunnage to minimize fretting of the contents during transportation. The package closure seats into the end of the base and engages the packaging using four lugs in a bayonet-style design. The closure of the packaging does not have any gaskets or seals. There are no neutron poisons in the package. Licensing Drawing No. 60501-70 provides information on the structure, materials, and dimension of the

Small Quantity Payload FHE. RINSC fuel falls under the category of a Small Quantity Payload; however, has its own dedicated FHE. The RINSC fuel element U-235 enrichment was changed from 19.94 wt% to 20 wt%. The remaining uranium isotopes were changed to 0.5 wt% U-234 (maximum), 1.0 wt% U-236 (maximum), with the balance U-238.

2.0 STRUCTURAL

The applicant requested that Small Quantity Payload and corresponding FHE be added as approved contents for the ATR FFSC package. The applicant does not take credit for the presence of the FHE for structural integrity purposes and any and all potential damage to the proposed contents is accounted for in the criticality evaluation, as verified by staff. Furthermore, the mass of the Small Quantity Payloads is bounded by previously approved contents and the general construction arrangement of the FHE is similar in both geometry and materials of construction and is therefore bounded by previously approved evaluations.

3.0 THERMAL

The staff reviewed the updated Safety Analysis Report (SAR) description of the Small Quantity Payload content and FHE thermal effects. For NCT, the applicant did not perform additional thermal analysis beyond the previous MURR package calculations; rather, the applicant provided a qualitative analysis. The applicant stated that the Small Quantity Payload package and MURR package have similar payload weights, payloads (fuel elements, plates, foils, etc.), and FHE construction. As a result, the applicant stated that maximum temperatures associated with the Small Quantity Payload are bounded by the MURR payload, as presented in Tables 3.6-5 and 3.6-7 of the SAR. The staff considers this qualitative thermal analysis acceptable for the Small Quantity Payload along with the large thermal margin.

The staff noted the potential for the polyethylene and neoprene content to combust during a fire associated with HAC. The applicant performed additional analyses which showed that, due to limited availability of oxygen, the complete combustion of polyethylene and neoprene would not occur. The analyses included the amount of oxygen that could potentially diffuse through the package during and after the fire event. It was reported that the amount of oxygen that could enter the package was small. This quantity of oxygen would result in minimal amounts of polyethylene combustion and only small temperature increases, such that components would be well below allowable temperatures. In addition, the applicant performed an analysis that determined the pressure rise due to expansion of the gas during a fire associated with HAC and due to the thermal decomposition of polyethylene and neoprene. The reported pressure rise due to both scenarios was less than 1 psi, resulting in negligible effects.

The sections in the SAR that discussed the analytical thermal model, developed using the lumped parameter, network-based simulation package, SINDA/FLUINT (Cullimore & Ring Technologies, Inc.), did not mention the potential for air to be convectively induced into the package. However, the staff believed there was potential for air ingress, especially due to the dynamics associated with fire behavior; an internal flow field could be induced by rising hot gases along the package face containing the vent openings. In order to better understand this potential phenomenon, the staff constructed a simplified three-dimensional computational model, specifically focusing on the flow regions associated with the applicant-specified vent openings. FLUENT (ANSYS, Inc.), which is a computational fluid dynamics code that solves the Navier-Stokes and energy equations of individual control cell volumes that comprise the flow and solid volumes of the package geometry, was used to model the flow dynamics. The model was run as a transient in order to observe the changing flow pattern within the package. The temperature and velocity boundary conditions of the hot gases rising along the package face were set at 1073 K and 10 m/sec. Results indicate that hot combustion gases could enter the package during a 30 minute fire. However, subsequent models showed that the low flow rate of the hot gases (i.e., low thermal mass) into the package did not have sufficient energy to result in large temperature increases of the relatively heavy FHE (i.e., large thermal mass). In addition, low flow rates into the package would not provide sufficient oxygen to cause rapid and complete combustion of polyethylene and neoprene.

Based on a review of the relevant thermal sections of the application, and supported by independent staff analyses, the staff finds reasonable assurance that the package meets the thermal requirements of 10 CFR Part 71.

4.0 CONTAINMENT

The containment system for the Small Quantity Payload is identical to the previously approved payloads; therefore, the previous containment evaluation for the package is not affected.

5.0 SHIELDING

The package contains non-irradiated fuel; therefore, a shielding analysis is not required.

6.0 CRITICALITY

This request for amendment is to add Small Quantity Payloads as authorized contents to the ATR FFSC package. In addition, the applicant requests amendment to the maximum width of the thermal channels of the ATR, MIT, MURR, and RINSC fuel elements that are authorized under the current license. The new maximum thermal channel widths requested are 0.087 inches for ATR fuels, 0.114 inches for the MIT fuels, 0.09 inches for the MURR fuels, and 0.096 inches for the RINSC fuels, respectively. The MIT fuel element with expanded thermal channel width was approved under CoC No. 9330, Rev. 4.

The objective of the criticality safety evaluation is to determine that the package with the requested contents meets the criticality safety requirements of 10 CFR Part 71.

6.1 Description of Criticality Design

The ATR fresh fuel package is a type AF package. The ATR Small Quantity Payload fresh fuel package is designed to transport any type of Small Quantity Payload as defined in the content definition with the payload enclosed in a single fuel handler. The Small Quantity Payload includes RINSC fuel elements, loose MIT and MURR fuel plates, AFIP elements, uranium-molybdenum foils, and DDEs. All are transported in the Small Quantity Payload FHE with exception of the RINSC fuel elements, which are transported in the RINSC FHE.

For the packages of the ATR and MIT fuel elements with expanded thermal channel widths, the packages, i.e., the contents plus packaging and fuel handle enclosure (FHE), remain the same. The only change requested is the thermal channel width of the respective fuel elements.

Polyethylene plastic wrap may be used to wrap fuel, but the total quantity of the plastic wrap shall not exceed 100 grams. Operating procedures are prescribed to ensure this requirement is met. The closure of the packaging does not have any gaskets or seals. There are no neutron poisons in the package. Neoprene is used as padding material to prevent the contents from vibrating during transportation. License drawing 60501-70 provides information on the structure, materials, and dimensions of the Small Quantity Payloads fuel element handling enclosure. Package tolerances are described on the engineering drawings included in the application.

6.2 Fissile Material Contents

The applicant describes the proposed contents in Sections 6.2.1 and 6.11.2 of the SAR for the Small Quantity Payloads ATR FFSC package. Only one Small Quantity Payload (type and quantity), is allowed per package; mixed fuel contents are not permitted. The maximum U-235 quantity per package is 400 grams and the maximum enrichment of the fuel is 94 wt% of U-235.

For the packages containing fuel elements with expanded thermal channel widths, the content remains the same. The only change is to the thermal channel width of the fuel element.

6.3 Criticality Safety Evaluation

The applicant provided the results of the criticality evaluation for a single package and arrays of packages with the Small Quantity Payloads contents under NCT and HAC in Section 6.11 of the SAR.

The applicant modeled the content with a mass of 400 grams U-235 and an enrichment of 94 wt% as a homogeneous uranium/water mixture in the criticality safety analyses. The structural materials of the fuel were conservatively neglected in the criticality safety analysis of the package. A maximum quantity of 100 grams of polyethylene wrap was assumed. No further considerations regarding the tolerances and uncertainties of the fuel enrichment and the fuel element dimensional parameters were included in the criticality safety analysis.

Tables 6.11-4 and 6.11-5 of the SAR provide summaries of the criticality safety analysis results. The results show that the calculated maximum k_{eff} values, including two standard deviations, for a single package under NCT and HAC are 0.64775 and 0.72441, respectively. The k_{eff} for both of the cases are less than the Upper Subcritical Limit (USL) which is 0.9209.

The applicant used a (3x3+1)x1 array and a 2x2x1 array of packages for the NCT and HAC safety analyses, respectively. For the purposes of determining a Criticality Safety Index (CSI), the array of packages under HAC is the most limiting. The applicant determined that a CSI of 25.0 is appropriate.

Staff reviewed the fuel enrichment and dimensional data provided by the applicant and finds the values used in the criticality safety analyses bound all of the actual fuel and packaging for the Small Quantity Payload packages. Staff also reviewed the approach employed in the safety analysis and finds it conservative. The staff performed independent analysis to confirm both the applicant's results and that the most reactive conditions have been correctly identified. The staff used the SCALE 5.1 CSAS26 criticality sequence, with the KENO-VI geometry and multi-group cross sections of the SCALE 5.1 system in the analyses. Staff used the SCALE 5.1, 238-group cross section library derived from ENDF/B-VI data and the CENTRM continuous energy neutron spectrum for cross section processing. The staff performed independent criticality safety analyses for single package and an array of the RINSC ATR fuel packages under HAC. The staff also performed a search for the optimal H/U ratio to confirm that the applicant correctly identified the most reactive package configuration.

The applicant calculated the reactivity effect of the ATR fuel, MURR fuel, and RINSC fuel packages with expanded thermal channel widths and determined that the packages continue to meet the criticality safety requirements of 10 CFR Part 71.

The staff examined the reactivity of the array of partially flooded packages under HAC. The results indicate that partial flooding with a water density of 0.7 grams/cm^3 will result in a more reactive system than the one with other water densities in the FHE and the void space between the insulation and outer package wall in the corner areas of the package. The difference in reactivity, however, is within the range of the statistical uncertainties of the calculations.

The staff reviewed that applicant's calculations for the CSI. Based on the applicant's analysis, the staff finds that the applicant correctly derived the package CSI and that a CSI of 25.0 is acceptable for the Small Quantity Payload. The CSI for the packages of the ATR fuel, MURR fuel, and RINSC fuel with extended thermal channel widths remains 4.0.

In addition, the staff created separate models with the actual fuel enrichment and payload. The results show that results of the analyses modeling 400 grams of U-235 in fuel with 94 wt% enrichment are conservative in comparison with that of the actual fuel element. Because there is no need for crush test for this package, the package was assumed to retain its dimensions under HAC. As such, a model of a square pitch array of damaged package suffices the need for the determining the CSI. It is not necessary to model a triangular pitch arrangement of the undamaged or damaged packages.

The staff compared the packages containing the ATR, MURR, and RINSC fuel with expanded thermal channel widths with the package containing the MIT fuel element with expanded channel width. Among all of the contents the MIT fuel has the largest thermal channel width and the other three fuel elements have similar structure. Because the criticality safety analyses demonstrated that the increase in thermal channel width has a positive reactivity effect, the MIT fuel element bounds the other three fuel elements in terms of reactivity effect due to channel enlargement. The staff also examined a case with all cladding being removed from the MIT fuel. The results show that the increase in k_{eff} is not significant and the package remains subcritical with a safety margin comparable with that of a package with the original thermal channel width.

The applicant determined that the neoprene sheets in the packaging have a negative net reactivity effect for the package. The staff verified this conclusion with explicit modeling of the neoprene sheets in the package. However, no credit has been taken for the neoprene in the criticality safety analysis.

The staff also notes the update of the RINSC fuel element from 19.94 wt% U-235 to 20 wt% U-235 and finds that this does not significantly affect the criticality safety of the package.

Based on the information provided in the safety analysis report and its own independent confirmatory calculations, the staff finds that the ATR FFSC package with the proposed Small Quantity Payload contents and the fuel elements with expanded thermal channels (ATR fuel elements, MURR fuel element, and RINSC element), continue to meet the criticality safety requirements of 10 CFR Part 71 with the following condition:

- The maximum weight of the polyethylene wrap used in the packaging shall not exceed 100 grams per package.

6.4 Conclusion

Based on the statements and representations contained in the application, and the conditions listed above, the staff determined with reasonable assurance that the Model No. ATR FFSC packaging, containing one type of RINSC fuel element, AFIP elements, U-Mo foils, DDEs, MIT loose fuel element plates, and MURR loose fuel element plates in a quantity that meets the Small Quantity Payload definition continues to meet the criticality safety requirements of 10 CFR Part 71. The MIT fuel element with expanded thermal channel width was approved under CoC No. 9330, Rev. 4.

7.0 PACKAGE OPERATIONS

Changes to the package operations include addition of the loading procedure for the Small Quantity Payload and specification of less than 100 grams of polyethylene per ATR FFSC package.

The staff reviewed the package operations and concludes that the operating procedures meet the requirements of 10 CFR Part 71 and that these procedures are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

Changes to the acceptance tests and maintenance program include visual inspection of the ball lock pin on the Small Quantity Payload FHE. This is consistent with the other FHEs.

The staff reviewed the description of the acceptance tests to be performed prior to first use of the package and the quality assurance program applicable to maintenance of the packaging for the Small Quantity Payload and concludes they meet the requirements of 10 CFR Part 71.

CONDITIONS

The following changes are included in Revision No. 5 to Certificate of Compliance No. 9330:

Item No. 3(b) was modified to identify the latest revision of the package application dated June 23, 2011, as supplemented.

Condition No. 5.(a)(2) was modified to include the fuel handling enclosure for the Small Quantity Payload.

Condition No. 5.(a)(3) was modified to reference Drawing No 60501-70, Rev. 0, for the Small Quantity Payload fuel handling enclosure.

Condition No. 5.(b)(1) was modified to (i) update the maximum channel thickness for ATR, MURR, and RINSC fuel plates, and (ii) include the Small Quantity Payloads (RINSC fuel elements, AFIP elements, U-Mo foils, DDEs, MIT loose fuel element plates, and MURR loose fuel element plates).

Condition No. 5.(b)(2) was modified to include a maximum quantity of material per package for the Small Quantity Payload.

Condition No. 5.(c) was modified to include a CSI of 25 for the Small Quantity Payload. The CSI of 4 for a package containing ATR, MURR, MIT fuel elements or ATR fuel plates remains unchanged.

Condition No. 6 was modified to specify that the maximum weight of polyethylene wrap shall not exceed 100 grams per package.

A new Condition No. 7 was included in the certificate of compliance to clarify that types of small quantity payloads cannot be mixed within a single FHE. As a consequence of the inclusion of new Condition No. 7, the previous Condition Nos. 7-11 was renumbered to Condition Nos. 8-12, respectively.

Condition No. 11 allows the previous revision of the certificate to be used for a period of approximately one year.

The expiration date of the certificate was not changed. The References section was modified to include the consolidated application dated June 23, 2011, as supplemented August 28, 2011, and January 10, 2012.

CONCLUSION

Based on the statements and representations contained in the application, and the conditions listed above, the staff concluded that the Model No. ATR FFSC package meets the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9330, Revision No. 5
on March 9, 2012