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

October 29, 2015

Mr. T. J. Tate
Manager – Environmental, Health, Safety, & Licensing
AREVA Inc.
2101 Horn Rapids Rd.
Richland, WA 99354

SUBJECT: AUTHORIZATION FOR SHIPMENT OF THE MODEL NO. 51032-2 PACKAGE FROM CRYSTAL RIVER 3 TO OCONEE NUCLEAR POWER PLANT

Dear Mr. Tate:

As requested by your letter dated June 30, 2015, pursuant to Title 10 of the *Code of Federal Regulations* Part 71, the Certificate of Compliance (CoC) No. 9252 for the Model No. 51032-2 package is amended by letter to allow AREVA MkB-HTP-1 15x15 assemblies with assembly average enrichments of up to 4.55 wt% and 4.95 wt% to be shipped in two shipping campaigns from the Crystal River 3 nuclear power plant to the Oconee nuclear power plant. AREVA MkB-HTP-1 15x15 fuel assemblies up to 4.80 wt% assembly average enrichment are already authorized contents in the CoC. The CoC is also amended by letter to allow for additional loading procedures to be performed at Crystal River 3. All other conditions of CoC No. 9252 shall remain the same. This authorization is valid for packages to be shipped between July 1, 2016, and September 30, 2016, and between July 1, 2017, and September 30, 2017. It is limited by the additional following conditions:

1. 40 AREVA MkB-HTP-1 15x15 fuel assemblies, with assembly average enrichments of up to 4.55 wt% and 36 AREVA MkB-HTP-1 15x15 fuel assemblies, with assembly average enrichments of up to 4.95 wt% are authorized to be shipped.
2. Each package will contain up to two fuel assemblies where the most bounding loading configuration is one fuel assembly with assembly average enrichment of 4.55 wt% and another fuel assembly with assembly average enrichment of 4.95 wt%. One fuel assembly with assembly average enrichment of either 4.95 wt% or 4.55 wt%, or two assemblies each with assembly average enrichments of 4.55 wt%, can also be shipped in each package.
3. Duke Energy tracks the enrichment of each fuel assembly via serial numbers.
4. The packages will be loaded in accordance with a "Fuel Container Loading Plan" prepared by Crystal River 3 and approved by AREVA Richland, AREVA TN, and Duke Energy representatives.
5. Duke Energy personnel at Crystal River 3 will prepare transfer sheets that govern each transfer operation and oversee AREVA Fuel Services performing that function.
6. Duke Energy personnel at Crystal River 3 will initiate NRC Form 741 accountability records.
7. AREVA Fuel Services will load the containers in accordance with the Duke Energy transfer sheets.
8. AREVA TN and Duke Energy on-site representatives will independently verify loading has been performed in accordance with the transfer sheets.

9. AREVA off-site Fuels personnel will approve shipping documentation prior to shipment, including review of the NRC 741 forms.
10. All fuel assemblies will be verified to not exceed an A_2 quantity of radionuclides through decontamination, if necessary.
11. The CSI for packages shipped under this authorization is 0.4.

If you have any questions regarding this authorization, please contact me or Huda Akhavannik at (301) 415-5253.

Sincerely,

for Michele Sampson, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9252
TAC Nos. L25032

Enclosure: Safety Evaluation Report

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

SAFETY EVALUATION REPORT
Docket No. 71-9252
Model No. 51032-2
Certificate of Compliance No. 9252

SUMMARY

By application dated June 30, 2015, AREVA Inc. (AREVA, or the applicant), requested a one-time authorization to ship two campaigns of AREVA MkB-HTP-1 15x15 fuel assemblies with average assembly enrichments of up to 4.55 wt% and 4.95 wt%. The 4.95 wt% assembly average enrichment is greater than the 4.80 wt% assembly average enrichment authorized in the current Certificate of Compliance (CoC) No. 9252, for the Model No. 51032-2 transportation package.

A one-time letter authorization has been granted to authorize these shipments based on the statements and representations in the application. The staff agrees that the change does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

EVALUATION

By application dated June 30, 2015, AREVA requested a one-time authorization to ship two campaigns of AREVA MkB-HTP-1 15x15 fuel assemblies with average assembly enrichments of up to 4.55 wt% and 4.95 wt%. The 4.95 wt% assembly average enrichment is greater than the 4.80 wt% assembly enrichment authorized in the current CoC. The shipments will be from the Crystal River 3 nuclear power plant to the Oconee nuclear power plant.

There are 76 fuel assemblies in total: 40 AREVA MkB-HTP-1 15x15 fuel assemblies with average assembly enrichment of 4.55 wt% and 36 AREVA MkB-HTP-1 15x15 fuel assemblies with average assembly enrichment of 4.95 wt%. The applicant requested and performed bounding analyses supporting each package to contain two fuel assemblies: one fuel assembly with assembly average enrichment of 4.55 wt% and another fuel assembly with average assembly enrichment up to 4.95 wt%. Other loading options include one fuel assembly enriched to either 4.95 wt% or 4.55 wt%, or two assemblies enriched to 4.55 wt%. Additionally, as these assemblies were placed in the core but were never irradiated, the applicant provided additional analyses to demonstrate that the fuel meets the 10 CFR 71.4 definition of unirradiated uranium.

To ensure that the correct assemblies are placed in each package, the applicant provided additional loading procedures to be performed at Crystal River 3. The additional loading procedures are as follows:

1. Duke Energy tracks the enrichment of each fuel assembly via serial numbers.
2. The packages will be loaded in accordance with a "Fuel Container Loading Plan" prepared by Crystal River 3 and approved by AREVA Richland, AREVA TN, and Duke Energy representatives.
3. Duke Energy personnel at Crystal River 3 will prepare transfer sheets that govern each transfer operation and oversee AREVA Fuel Services performing that function.

4. Duke Energy personnel at Crystal River 3 will initiate NRC Form 741 accountability records.
5. AREVA Fuel Services will load the containers in accordance with the Duke Energy transfer sheets.
6. AREVA TN and Duke Energy on-site representatives will independently verify loading has been performed in accordance with the transfer sheets.
7. AREVA off-site Fuels personnel will approve shipping documentation prior to shipment, including review of the NRC 741 forms.
8. All fuel assemblies will be verified to not exceed an A_2 quantity of radionuclides through decontamination, if necessary.

Staff has determined that these extra operational procedures will provide reasonable assurance that the packages will be loaded correctly.

Criticality

The applicant provided criticality analyses demonstrating that single packages and arrays of packages under both normal conditions of transport and hypothetical accident conditions would remain adequately subcritical. The applicant considered two content configurations: (1) a single 4.95 weight percent enriched B&W 15x15 UO_2 fuel assembly in one package channel, with the second channel empty; and (2) a 4.95 weight percent enriched B&W 15x15 UO_2 fuel assembly in one package channel, with a 4.55 weight percent enriched B&W 15x15 UO_2 fuel assembly in the other channel.

The fuel assembly model incorporated the most reactive materials and geometry configuration, including:

- Limiting pellet diameter
- Minimum clad thickness
- Maximum active length
- Axial blankets modeled as full enrichment
- End fittings and other fuel assembly hardware ignored
- Flooding of the fuel pellet-to-clad gap (when water present inside the package)

The applicant modeled the package conservatively, ignoring structural components other than the steel shells of the package, as other components would serve to absorb neutrons and lower reactivity. The applicant assumed package steel to be carbon steel rather than the actual stainless steel in the package, as carbon steel absorbs fewer neutrons.

The applicant evaluated single packages under normal conditions of transport and hypothetical accident conditions, in both cases fully reflected by 30 centimeters of water. The applicant modeled the package under normal conditions of transport assuming the package is dry internally. The applicant's hypothetical accident conditions model included the effects of the drop, puncture, and fire tests, and considered the package fully flooded. An additional model evaluated the normal conditions model fully flooded, in order to satisfy the requirements of 10 CFR 71.55(b). In all cases, single package k_{eff}s were less than the calculated Upper Safety Limit (USL) of 0.9404.

The applicant modeled a 15x15x3 array of 675 packages under normal conditions of transport. The applicant modeled the package without water in-leakage, but with optimum interspersed

moderation and a 30-centimeter water reflector. The array model included the most reactive positioning of each fuel assembly. Under normal conditions of transport, the applicant's array model produced a system k_{eff} of no more than 0.8030, which is less than the calculated USL of 0.9404.

The applicant modeled a 12x12x2 array of 288 packages under hypothetical accident conditions, with optimum internal and interspersed moderation and a 30-centimeter water reflector. For this model, the applicant considered a reduced package diameter due to damage from the hypothetical accident conditions drop and puncture tests, resulting in closer fuel assembly spacing in the array. The applicant also determined that the array was more reactive when the fuel assembly strongback was modeled shifted laterally towards the package outer shell. Additionally, the applicant performed a sensitivity analysis evaluating system reactivity as a function of which channel the higher enrichment fuel assembly was located in. This study demonstrated that the higher enrichment assembly on the left hand side of the strongback resulted in a higher system k_{eff}. Under hypothetical accident conditions, the applicant's array model produced a system k_{eff} of no more than 0.9370, which is less than the calculated USL of 0.9404.

The applicant's array analyses determined a number "N" under normal conditions of transport and hypothetical accident conditions, per the requirements of 10 CFR 71.59. N is 135 under normal conditions of transport and 144 under hypothetical accident conditions. The limiting Criticality Safety Index (CSI) is therefore 0.4.

The applicant used the CSAS25 sequence of the SCALE 6.0 code package, with the KENO V.a three-dimensional Monte Carlo transport code and the 44-group ENDF/B-V cross section library for all criticality calculations. The applicant benchmarked this code and cross section library for the 51032-2 package by modeling 92 critical configurations of low enriched UO_2 rods in water. The benchmarking analysis included a trending evaluation against various independent parameters, including: average energy of fission group, fuel rod pitch, assembly separation, ^{235}U enrichment, soluble boron concentration, and moderator-to-fuel ratio. This analysis demonstrated that there is no significant relationship between calculated system k_{eff} and any of the independent parameters evaluated. Therefore, the applicant's benchmarking analysis resulted in a constant USL of 0.9404.

The staff performed confirmatory calculations using the CSAS25 sequence of the SCALE 6.1 code system, with the KENO V.a three-dimensional Monte Carlo transport code and the continuous energy ENDF/B-VII cross section library. Using assumptions similar to the applicant's, staff confirmed that single packages and arrays of packages will remain adequately subcritical under both normal conditions of transport and hypothetical accident conditions.

Based on the statements and representations in the applicant's letter authorization request, and on the staff's own confirmatory analyses, the staff finds that the Model No. 51032-2 package meets the criticality safety requirements of 10 CFR Part 71, for packages containing: (1) a single 4.95 weight percent enriched B&W 15x15 UO_2 fuel assembly in one package channel, with the second channel empty; or (2) a 4.95 weight percent enriched B&W 15x15 UO_2 fuel assembly in one package channel, with a 4.55 weight percent enriched B&W 15x15 UO_2 fuel assembly in the other channel. The CSI for packages shipped under this authorization is 0.4.

CONDITIONS

CoC No. 9252 has been amended by letter. The following conditions apply:

1. 40 AREVA MkB-HTP-1 15x15 fuel assemblies, with assembly average enrichments of up to 4.55 wt% and 36 AREVA MkB-HTP-1 15x15 fuel assemblies, with assembly average enrichments of up to 4.95 wt% are authorized to be shipped.
2. Each package will contain up to two fuel assemblies where the most bounding loading configuration is one fuel assembly with assembly average enrichment of up to 4.55 wt% and another fuel assembly with assembly average enrichment of up to 4.95 wt%. One fuel assembly with assembly average enrichment of up to either 4.95 wt% or 4.55 wt%, or two assemblies each with assembly average enrichments of up to 4.55 wt%, can also be shipped in each package.
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4. The packages will be loaded in accordance with a "Fuel Container Loading Plan" prepared by Crystal River 3 and approved by AREVA Richland, AREVA TN, and Duke Energy representatives.
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7. AREVA Fuel Services will load the containers in accordance with the Duke Energy transfer sheets.
8. AREVA TN and Duke Energy on-site representatives will independently verify loading has been performed in accordance with the transfer sheets.
9. AREVA off-site Fuels personnel will approve shipping documentation prior to shipment, including review of the NRC 741 forms.
10. All fuel assemblies will be verified to not exceed an A_2 quantity of radionuclides through decontamination, if necessary.
11. The CSI for packages shipped under this authorization is 0.4.

All other conditions of CoC No. 9252 shall remain the same. This authorization is valid for packages to be shipped between July 1, 2016, and September 30, 2016, and between July 1, 2017, and September 30, 2017.

CONCLUSION

CoC No. 9252 has been amended by letter to authorize shipment of Model No. 51032-2 packages containing 40 AREVA MkB-HTP-1 15x15 fuel assemblies with average assembly enrichments of up to 4.55 wt% and 36 AREVA MkB-HTP-1 15x15 fuel assemblies with average assembly enrichments of up to 4.95 wt%. This authorization is valid for packages to be shipped between July 1, 2016, and September 30, 2016, and between July 1, 2017, and September 30, 2017.

Based on the statements and representations in the application, and with the conditions listed above, the staff agrees that this change does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued on 10/29/15.

9. AREVA off-site Fuels personnel will approve shipping documentation prior to shipment, including review of the NRC 741 forms.
10. All fuel assemblies will be verified to not exceed an A_2 quantity of radionuclides through decontamination, if necessary.
11. The CSI for packages shipped under this authorization is 0.4.

If you have any questions regarding this authorization, please contact me or Huda Akhavannik at (301) 415-5253.

Sincerely,

/RA/

Michele Sampson, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9252
TAC Nos. L25032

Enclosure: Safety Evaluation Report
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