March 16, 2011

Dr. James M. Shuler
Manager, DOE Packaging Certification Program
U.S. Department of Energy
Office of Packaging and Transportation
EM-63, CLV-2047
1000 Independence Avenue, S.W.
Washington, DC 20585

SUBJECT: REVISION NO. 10 OF CERTIFICATE OF COMPLIANCE NO. 9315 FOR THE MODEL NO. ES-3100 PACKAGE

Dear Dr. Shuler:

As requested by your letter dated May 3, 2010, as supplemented July 21 and September 29, 2010, January 27 and March 3, 2011, enclosed is Certificate of Compliance (CoC) No. 9315, Revision No. 10, for the Model No. ES-3100 package. By letter dated January 27, 2011, you also requested renewal of the certificate. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. 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.

If you have any questions regarding this certificate, please contact Pierre Saverot of my staff at (301) 492-3408.

Sincerely,

/RA/

Michael Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9315
TAC Nos. L24444, L24517

Enclosures:
1. Certificate of Compliance
No. 9315, Rev. No. 10
2. Safety Evaluation Report
3. Registered Users

cc w/encls 1 and 2: R. Boyle, Department of Transportation
Registered Users

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SAFETY EVALUATION REPORT

Docket No. 71-9315
Model No. ES-3100 Package
Certificate of Compliance No. 9315
Revision No. 10

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SAFETY EVALUATION REPORT

Docket No. 71-9315
Model No. ES-3100 Package
Certificate of Compliance No. 9315
Revision No. 10

SUMMARY

By application dated May 3, 2010, as supplemented July 21, 2010, September 29, 2010, and January 27, 2011, the Department of Energy (DOE or the applicant) requested a revision to Certificate of Compliance (CoC) No. 9315 for the Model No. ES-3100 package. At staff's request, DOE submitted a consolidated application dated March 3, 2011. By letter dated January 27, 2011, DOE also requested the renewal of the certificate.

DOE requested to add a high enriched uranium (HEU) oxide loading of 15.13 kg total oxide and 12.323 kg U-235 with a CSI of 0.4 as authorized contents. Other changes included in the amendment request included updates to the minimum weight payload, the inert gas purity, the drum weight variation, stainless steel heavy can spacer information, sieve options for HEU metal pieces, and drum nut markings.

CoC No. 9315 has been amended and renewed based on the statements and representations in the application and supplements, and staff agrees that the changes do not affect the ability of the package to meet the requirements of Title 10 of the Code of Federal Regulations (10 CFR) Part 71.

EVALUATION

The submittal was evaluated against the regulatory standards in 10 CFR Part 71, including the general standards for all packages, standards for fissile material packages, and performance standards under normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

Based on the statements and representations in the application, as supplemented, and the conditions listed in the CoC, the staff concludes that the design has been adequately described and evaluated, and meets the requirements of 10 CFR Part 71.

REFERENCES

DOE consolidated application dated March 3, 2011.

1.0 GENERAL INFORMATION

1.1 Package Description

Except for the drawing's modifications, as delineated in Section No. 1.2 of this SER, there were no requested specific changes to the packaging design.

1.2 Packaging Drawings

The applicant submitted one revised drawing that addresses the can spacer, i.e., Equipment Specification JS-YMN3-801580-A005, Rev. G "Casting Catalog No. 277-4 Neutron Absorber for the ES-3100 Shipping Package," and a new drawing for the "Heavy Can Spacer Assembly (SST)", i.e., Drawing No. M2E801580-A043, Rev. 0. Those changes were made to allow either carbon steel or stainless steel as the material for the spacer can body. The new drawing shows a heavy can spacer constructed of stainless steel and this drawing is now referenced in the CoC.

1.3 Contents

The specific change requested in this amendment request is the addition of a higher fissile loading for shipments of HEU oxide in the package. The criticality safety evaluation (see Section No. 6 of this SER) supports an HEU oxide loading of 15.13 kg total oxide and 12.32 kg U-235, with a CSI of 0.4, as authorized contents.

1.4 Other Administrative Changes

Statements concerning a minimum payload requirement of 3.6 kg, used as a lower bound for structural, thermal, and containment calculations, have been removed from the application since there is no safety implication for shipping a payload less than 3.6 kg (See Section No. 2 of this SER). Actual mass restrictions for the various authorized contents are listed in Table Nos. 1.3, 1.3a, and 1.3b of the application.

The applicant also requested a change for the purity of the inert gas used for shipping pyrophoric uranium from greater than 99.997% to greater than 99.9% to allow the use of typical nuclear industry-grade gases. There are no safety implications with that change.

Regarding loading restrictions, the application was clarified to state that a sieve is only an option and that HEU metal or alloy pieces must not pass through either a 3/8-in. mesh sieve or an equivalent size-grading method.

1.5 Conclusion

Based on the application and the above discussion (with restrictions as stated), the staff has reasonable assurance that the package will meet the requirements of 10 CFR Part 71.

2.0 STRUCTURAL EVALUATION

The staff reviewed the application to revise the Model No. ES-3100 package structural design and evaluation to assess whether the package will remain within the allowable values or criteria for NCT and HAC, as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 2 (Structural Review) of NUREG-1609.

2.1 Structural Evaluation

The changes reflected in this amendment request did not affect the structural evaluation of the Model No. ES-3100 package. The requested changes relevant to the structural performance of the package included the following: 1) minimum payload weight, and 2) drum weight variation.

A minimum payload weight of 3.6 kg was used, in previous revisions of the application, as a lower bound for structural calculations. Regardless of the value, there are no safety implications for shipping a payload less than 3.6 kg and removing this mass limit from the application has no structural consequence.

The applicant has increased the acceptable drum weight variation from ±6 to ±12 lbs to facilitate maintenance of the package. During maintenance, the drum body and top plug are weighed to determine if the container gained or lost water weight. Increasing the acceptable weight variation does not affect the package weight limits and is therefore acceptable.

In addition, based on considerations of vapor pressure from the allowed content uranyl nitrate, the NCT and HAC analyses for pressure effects have been revised. Since the resultant maximum pressures (173.98 kPa (25.233 psi) for NCT and 494.64 kPa (71.741 psi) for HAC) remain well below the design absolute pressure of the containment vessel (801.17 kPa (116.2 psia)), and as there are very large margins of safety for stresses, staff finds that the package meets the regulatory requirements for NCT and HAC.

In reviewing these structural changes, the staff found that variations were minor and had no effect on the ability of the package to perform its safety function. The staff has reasonable assurance that the package will meet the requirements of 10 CFR Part 71.

2.2 Materials Evaluation

This amendment included four materials related changes: 1) an increase in the U-235 loading, 2) a change in the cover gas purity, 3) the use of stainless steel heavy can spacers, and 4) a change in the method for measuring potentially pyrophoric particulate sizes.

Increase in the U-235 loading – While the U-235 loading would increase, the maximum amount of total uranium oxide would remain the same. The oxide limit was set to limit the potential generation of hydrogen. Since the oxide maximum quantity does not increase, there is no new gas generation concern.

Change in the cover gas purity – The amendment requests that the purity level of the inert cover gas be changed from >99.997% to >99.9%. The reason for the high degree of purity was a concern over the moisture level of the gas that could lead to a pyrophoric reaction. The current CoC limits the moisture content of the cover gas to <5 ppm. This does not change with the request for a less pure cover gas. Since the moisture content of the cover gas does not change, the staff finds no materials issues that would create a risk of pyrophoric reactions occurring.

Use of stainless steel heavy can spacers – Currently only stainless steel is approved as a material for the spacers between multiple cans within a canister. The applicant requested that heavy can spacers fabricated from carbon steel be permitted for use. The usual materials concern with carbon steel is that it has a nil-ductility temperature below which it is no longer suitable for use as a load bearing material. In this case the carbon steel is only being used as a spacer and not a load bearing material so the staff finds no materials issues with the requested change.

Change in the method for measuring potentially pyrophoric particulate sizes – This change requests that alternative methods to size the particulate be allowed. One way of assuring that pyrophoric reactions do not occur is to limit the maximum surface to volume ratio of the particulate. This requires a minimum particulate size. The current CoC specifies that the particulate be sized using a sieve and any material passing through the sieve not be loaded. Visual comparative sizing with standards or equivalents are acceptable to the staff.

The package contains no materials that will result in chemical, radiological, or galvanic reactions. The staff finds that the requested changes do not affect the ability of the package to be in compliance with 10 CFR Part 71.43(d).

2.3 Conclusions

Based on the review of the information presented in the application, the staff has reasonable assurance that the package will meet the structural and materials requirements of 10 CFR Part 71.

3.0 THERMAL EVALUATION

The staff reviewed the Model No. ES-3100 package thermal design to assess whether the package temperatures will remain within their allowable values or criteria for NCT and HAC, as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 3 (Thermal Review) of NUREG-1609.

3.1 Thermal Evaluation

The changes reflected in the Amendment 10 application for the Model No. ES-3100 package did not affect the thermal evaluation. The decay heat of the contents, which include uranium oxides, uranium metal, uranyl nitrate crystals, and fuel elements from TRIGA reactors, remains limited to 0.4 W and there were no significant design changes that would affect temperature or pressure generation within the package.

Previously, the applicant performed numerical analyses and conducted furnace testing of the packaging to confirm package functionality under NCT and HAC. An MSC/PATRAN and ABAQUS finite element model was generated to evaluate temperatures within the package under NCT. The model was also used to evaluate temperatures within the package under HAC based on thermal results of multiple prototype packagings that underwent furnace testing. The ES-3100 test report indicated that many of the furnace thermocouples reached temperatures slightly above 1600ºF in order to ensure that all thermocouples were at least 1475ºF, which is the required temperature per 10 CFR 71.73(4). As a result, thermocouples located at the outer surface of the packaging often measured temperatures of 1600ºF, indicating a 125ºF margin. Considering this margin, the analyses and tests indicated that the components were within their allowable temperatures under NCT (hot and cold) and HAC conditions as described in Table Nos. 3.15, 3.16, and 3.17 of the application. The predicted temperature of the package when exposed to 100ºC ambient temperature and no insolation is less than the 122ºF regulation limit for a non-exclusive use shipment, thereby satisfying 10 CFR 71.43(g).

The applicant also analyzed the pressure within the package. The pressure analyses included the effects of various means for gas generation, such as off-gassing of material within the containment vessel (Teflon bottles, polyethylene bags, etc.) and gas generation due to the presence of uranyl nitrate crystals and radiolysis of water. It was found that the pressures within the package under NCT and HAC conditions were 28.9 psia and 86.4 psia, respectively; both are below the 116.2 psia allowable design pressure. Analyses were also performed to confirm that shipment time periods were such that there would be less than 5% hydrogen gas generation.

3.2 Conclusion

Based on a review of the thermal sections of the application, the staff finds reasonable assurance that the package meets the thermal requirements of 10 CFR Part 71.

4.0 CONTAINMENT EVALUATION

The staff reviewed the application to verify that the package containment design has been described and evaluated under NCT and HAC, as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 4 (Containment Review) of NUREG-1609.

4.1 Description of the Containment Boundary

The containment boundary consists of the containment vessel's body, lid assembly, and inner O-ring. Only the inner O-ring is considered part of the boundary. The outer O-ring is provided to allow a post-assembly verification leak check. The vessel's body and the lid are constructed from Type 304 stainless steel. The closure nut and the retaining ring used in the lid assembly are made of Nitronic 60 stainless steel and Type 302 stainless steel, respectively.

The containment vessel O-rings are manufactured from an ethylene-propylene elastomer. The leaktight capability of the O-rings is maintained over a temperature range of -40 to 205°C (-40 to 401°F), which is greater than the operating temperature range of -40 to 141.22°C (-40 to 286.2°F) of the ES-3100 containment vessel.

4.2 General Considerations

The analysis documented in Appendix 4.6.1 of the application establishes a maximum activity in the package of 3.2427×10^{-1} TBq (8.764 Ci), occurring 10 years after fabrication, while the maximum activity-to-A_2 value (293.99) is reached at approximately 70 years from material fabrication with a corresponding activity of 3.2328×10^{-1} TBq (8.737 Ci).

4.3 Containment under Normal Conditions of Transport

In order to calculate the A_2 value for the HEU mixture containing uranium, transuranics and daughter products, the applicant used a bounding case of 35.2 kg of HEU, with isotopic weight percent values as shown in Table No. 4.3 of the application. The calculated regulatory leakage criteria for NCT of this configuration are found in Table No. 4.5 of the application.

The containment criteria for the package will be leaktight (defined in ANSI N14.5-1997 as having a leakage rate ≤ 1×10^{-7} ref-cm^3/s). The design, fabrication, maintenance and periodic leakage rate limit is 1×10^{-7} ref-cm^3/s air. The “pass criterion” for the preshipment leakage rate test, which demonstrates correct assembly of the containment vessels, is 1×10^{-4} ref-cm^3/s, which exceeds the requirements given in ANSI N14.5.

Compliance with the containment requirements for NCT was demonstrated through testing. The ambient conditions were a nominal pressure of 101.35 kPa (14.70 psia) at 25°C (77°F). The maximum recorded helium leakage rate for this containment vessel was 2.0×10^{-7} cm^3/s after 20 min of testing.

Following fabrication, the containment vessel undergoes hydrostatic pressure testing to 1034 kPa (150 psi) gauge. After this test, the containment vessel and O-ring cavity are dried and each vessel is then leak tested with either air or helium to 1×10^{-7} ref-cm^3/s or 2×10^{-7} cm^3/s, respectively.

The analysis for the generation of combustible gases is not discussed under this containment evaluation, but this section references the package’s compliance with the 5% limit of free gas volume under the thermal evaluation chapter as analyzed in Appendix No. 3.6.7. The calculations for the bounding maximum normal operating pressure (MNOP) are also evaluated under the Thermal review, in Appendix No. 3.6.4 of the application.

After reviewing this evaluation, the staff determined compliance with 10 CFR Parts 71.51 and 71.71, because no radioactive material is released under normal conditions of transport.

4.4 Containment under Hypothetical Accident Conditions

The regulatory leakage criteria for HAC of the bounding configuration were calculated in Appendix No. 4.6.2 and are found in Table No. 4.7 of the application. Compliance with the containment requirements for HAC was demonstrated through testing. The units tested for leakage during HAC verified that the vessels are leaktight in accordance to ANSI N14.5-1997. Thus, there could be no release of radioactive materials from the containment vessels.

The package containment vessel is conservatively rated for an external pressure differential of 150 kPa (21.7 psi), and an internal pressure differential of 699.82 kPa (101.5 psig). This satisfies the requirement of the 15 m (50 ft) water immersion test specified under 10 CFR 71.73 (c).

The staff determined that this evaluation satisfies 10 CFR Parts 71.51 and 71.73 requirements, because no unacceptable quantity of radioactive material is released under HAC conditions.

4.5 Leakage Rate Tests

The containment criteria for the Model No. ES-3100 package will be leaktight, defined in ANSI N14.5 as having a leakage rate ≤ 1 × 10^{-7} ref-cm^3/s, during the prototype tests. This leaktight criterion satisfies the design verification requirement stipulated in ANSI N14.5-1997. The requirements of ANSI N14.5-1997 are used for all stages of containment verification for the ES-3100 (i.e., design, fabrication, maintenance, periodic and preshipment). The design, fabrication, maintenance and periodic leakage rate limit is 1 × 10^{-7} ref-cm^3/s air (or 2.0 × 10^{-7} cm^3/s helium). The "pass criterion" for the preshipment leakage rate test, which demonstrates correct assembly of the containment vessels, is 1 × 10^{-4} ref-cm^3/s.

4.6 Evaluation Findings

The staff has reviewed the evaluation of the containment system under NCT and HAC conditions of transport and concludes that the package is designed, constructed, and prepared for shipment so that under the tests specified in 10 CFR 71.71 the package satisfies the containment requirements of 10 CFR 71.43(f), 10 CFR 71.51(a)(1), and (a)(2) with no dependence on filters or a mechanical cooling system.

The staff has reasonable assurance that the addition of new authorized contents, i.e., an HEU oxide loading of 15.13 kg and 12.32 kg U-235, has no impact on the containment efficiency of the package. The package has been adequately evaluated to demonstrate that it satisfies the containment requirements of 10 CFR Part 71, and meets the containment criteria of ANSI N14.5-1997.

5.0 SHIELDING EVALUATION

The staff reviewed the Model No. ES-3100 package application to verify that the shielding design has been described and evaluated under NCT and HAC, as required in 10 CFR Part 71, for the proposed increase of the shipping limit of HEU oxide. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 5 (Shielding Review) of NUREG-1609.

5.1 Shielding Evaluation

The Model No. ES-3100 package is designed to transport bulk highly enriched uranium (HEU) contents. Authorized contents are in the form of HEU metal and alloys, HEU oxide, uranyl nitrate crystals, or fuel pellets from the Training, Research, Isotopes, and General Atomics (TRIGA) reactor elements. The package consists of stainless steel convenience cans loaded with HEU material, spacer assemblies, the containment vessel, and an insulation filled drum. The shielding model used for NCT is a simplified cylindrical model as denoted in Figure No. 5.1 of the application. Under HAC, the applicant assumed that the containment vessel and contents remain intact, but all exterior packaging materials are removed.

As part of this revision, the applicant proposes to increase the HEU oxide content having a bulk density ≥ 2.0 g/cm^3 from 11 kg HEU oxide (9,682 g ^{235}U) to 15.13 kg HEU oxide (12,323 g ^{235}U). This is bounded by the shielding evaluation performed, in Section No. 5.0 of the application, with 24 kg of HEU oxide powder. The results listed in Table No. 5.2 of the application show that the external dose rates for the package are within the limits specified in 10 CFR 71.47. No impacts to the package external radiation level are expected as part of this revision. Furthermore, the methodology used by the applicant to evaluate the shielding of the package as part of the previous package revision is judged to remain adequate for the proposed oxide quantities listed in Revision 10 of this application.

5.2 Conclusion

Based on review of the statements and representations in the application, the staff concludes that the shielding design has been adequately described and evaluated and that the package continues to meet the external radiation requirements of 10 CFR Part 71.

6.0 CRITICALITY EVALUATION

The objective of this review is to verify that the changes made to the package contents meet the criticality safety requirements of 10 CFR Part 71 under NCT and HAC.

Appendix No. 6.9.9 was included in the application as part of this amendment request which increases the shipping limit of HEU product oxide content, with a bulk density ≥ 2.0 g/cm^3, from 9,682 g ^{235}U to 12,323 g ^{235}U by specifying a Criticality Safety Index (CSI) =0.4.

The criticality analysis supporting the proposed increase in the shipping limit was taken from the methodology and calculations performed previously in Section No. 6.4 through 6.6 of the application.

6.1 Description of Criticality Design

The package is designed to transport bulk highly enriched uranium (HEU) contents. Authorized contents are in the form of HEU metal and alloys, HEU oxide, uranyl nitrate crystals, or fuel pellets from the Training, Research, Isotopes, and General Atomics (TRIGA) reactor elements. Authorized contents are stored in either convenience cans or polyethylene bottles.

The package criticality design features as discussed in Section No. 6.1.1 have not changed as part of this revision.

6.2 Benchmark Evaluation

Calculations performed as part of this revision to support the increased shipping limit were performed using SCALE 5.0 with the 238-group ENDF/B-V cross-section library on newer workstations. Criticality calculations generated during earlier revisions of this application were performed using SCALE 4.4a on older workstations which have since been retired from service. The criticality validation for SCALE 5.0 was carried out exactly as was SCALE 4.4a. The benchmark experiments used were those documented in the OECD Handbook

[NEA/NSC/DOC(95)03]. As with the earlier version of SCALE 4.4a, SCALE 5.0 was run using the same input (e.g., number of neutrons per generations, number of generations skipped, etc.).

6.3 Staff Evaluation

Appendix No. 6.9.9 of the application states, in part, that the general considerations in Section No. 6.3 of the application regarding the assumptions about the ES-3100 packaging are still valid. The methodology used in the calculation evaluation is not impacted by the increase in HEU oxide content. No design changes are required for the NCT or HAC containment vessel, single-unit, or packaging array models. The material specification for the HEU product oxide remains unchanged as well.

6.3.1 Single Package Evaluation

The criticality analysis performed in Section No. 6.4.3 of the application evaluated the effects of moderation and reflection on a single unit package with assumed conditions for NCT and HAC. The package was modeled as being loaded with three convenience cans having a total of 24 kg UO_2 (21,125 g ^{235}U). Section No. 6.1.2 states, in part, that the moisture fraction was varied from dry to flooded conditions inside the containment vessel and outside the package. Results concluded that the bounding reactivity for a single unit package occurred for the reflected package having optimum moderation within the containment vessel. As part of that earlier analysis, the HEU oxide was evaluated at allowable densities of 2.0, 3.0, 4.0, 5.0, and 6.54 g/cm^3, respectively. It was determined that the bounding reactivity occurred for a density of 2.0 g/cm^3.

As part of the criticality evaluation presented in Appendix No. 6.9.9 of the application, the bounding NCT model of the Model No. ES-3100 package was taken from Section No. 6.4 and modeled with 14 kg of HEU oxide (12,323 g ^{235}U). This model was used to evaluate the change in oxide density from 2.0, 3.0, 4.0, 5.0, and 6.54 g/cm^3, respectively. The results listed in Table No. 6.9.9.8-2 of Appendix No. 6.9.9 show that the bounding reactivity for NCT and HAC are bounded by the Upper Subcritical Limit (USL) of 0.924.

6.3.2 Array Package Evaluation (NCT and HAC)

To support a CSI=0 for packages having an oxide content with a bulk density ≥ 2.0 g/cm^3 and a maximum ^{235}U content of 9,682 g, infinite arrays of these packages were shown to be subcritical under NCT and HAC (Section Nos. 6.5 and 6.6 of the application). As part of the present revision to increase the shipping limit to 12,323 g ^{235}U, finite arrays were evaluated as a requirement for establishing a non-zero CSI value. These arrays were evaluated for varying amounts of oxide mass between 11 kg (9,682 g ^{235}U) and 15 kg (13,203 g ^{235}U). The oxide densities were also evaluated for 2.0, 3.0, 4.0, 5.0, and 6.54 g/cm^3.

Results showed that a 9x9x4 array of HAC packages support establishing a CSI value of 0.4 for the HEU oxide content having a bulk density ≥ 2.0 g/cm^3 and a maximum content of 15.13 kg of HEU (12,323 g ^{235}U).

6.4 Evaluation Findings

The criticality evaluation previously performed in earlier subsections of Chapter No. 6 of the application was not impacted as a result of the increase of the shipping limit from 11 kg of HEU oxide (9,682 g ^{235}U) to 15.13 kg of HEU (12,323 g ^{235}U) by establishing a non-zero CSI value of 0.4. The bounding HAC arrays containing the newly proposed HEU oxide content are shown to be less than the USL of 0.924.

Based on the review of the information and representations in the application, the staff finds reasonable assurance that the package design with the new proposed contents meets the subcriticality requirements of 10 CFR Part 71.

7.0 PACKAGE OPERATIONS

The staff reviewed Chapter No. 7 of the application to verify that it continues to meet the requirements of 10 CFR Part 71 and is adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

To support this revision request, Section No. 7.1.2 of the application was revised to include equivalent size grading methods. The new purity requirement of 99.9% for inerting gases is indicated to insure that typical nuclear industry-grade gases are allowed.

Based on the statements and representations in the application, the staff has reasonable assurance that the package operations meet the requirements of 10 CFR Part 71 and that they 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

The staff reviewed Chapter No. 8 of the application to verify that the revised acceptance tests for the packaging meet the requirements of 10 CFR Part 71.

Annual periodic leak tests must be conducted to verify the containment integrity of the package, while all other inspection activities described in the maintenance program must be conducted after each use of the package. The drum and top plug will be weighed during each periodic refurbishment to evaluate density variations in the Kaolite or the Cat 277-4 material. The acceptable weight variation is now +/- 12 lbs, as confirmed by the criticality calculations which have assumed a fully flooded configuration well above the 12 lb additional water in the system.

The maintenance program now requires that certification markings on the bronze nuts, used to attach the lid to the drum body of the confinement boundary, are inspected periodically. The applicant has clarified the required marking on these nuts and has revised drawing No. M2E801580-A005 to specify the correct markings.

Based on the statements and representations in the application, the staff has reasonable assurance that the package acceptance tests and maintenance operations meet the requirements of 10 CFR Part 71 and that they are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

CONDITIONS

The CoC has been revised as follows:

Item No. 3(b) was modified to reference the consolidated application dated March 3, 2011.

Condition No. 5(a)(3)(vi): The manufacturing process specification for casting Kaolite was revised to Revision G.

Condition No. 5(a)(3)(vii) was added to include the new Drawing No. M2E801580-A043 for the Heavy Can Spacer Assembly.

Condition No. 5(b)(2)(i) was added to clarify one of the two loadings authorized.

Condition No. 5(b)(2)(ii) was added to include the additional loading of 15.13 kg of oxide, with a maximum mass of 12.32 kg U-235 (no carbon) and a CSI of 0.4.

Condition No. 15 was modified to allow the use of Revision 9 of this certificate for one year.

Condition No. 16 was modified to include the new expiration date of the certificate, i.e., April 30, 2016

The Reference Section was modified to include the consolidated application dated March 3, 2011.

CONCLUSION

Based on the statements and representations in the application, as supplemented, and the conditions listed above, the staff concludes that the Model No. ES-3100 package design has been adequately described and evaluated and that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9315, Revision No. 10,
on March 16, 2011.