

SAFETY EVALUATION REPORT

Docket No. 71-9315
Model No. ES-3100 Package
Certificate of Compliance No. 9315
Revision No. 14

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SUMMARY

By application dated March 24, 2016, 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. DOE consolidated its application by letter dated March 2, 2016.

There were no changes to the packaging design but DOE requested to increase the mass of Teflon bottles used for shipping high enriched uranium (HEU) crystals. Other changes included in the amendment request included administrative updates to the licensing of drawings and specifications and a change to an entry in the table of loading limits for solid metal or alloy in the form defined as broken metal, as well as other administrative changes.

CoC No. 9315 has been amended based on the statements and representations in the application, 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, 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

Consolidated Nuclear Security, LLC., application "Safety Analysis Report, Y-12 National Security Complex, Model ES-3100 package with Bulk HEU Contents, Y/LF-717, Revision 5," dated March 24, 2016.

1.0 GENERAL INFORMATION

1.1 Package Description

The applicant requested a correction to the thickness of the third tier height of the cavity, created between the second and third tier liners, which accommodates the containment vessel flange, from "5.99 cm (2.36 in.)" to "3.00 cm (1.18 in.)." Upon review of the referenced licensing drawing (M2E801580A003), which did not change in this revision, the requested change is indeed a correction and is consistent with the drawing.

1.2 Packaging Drawings

The applicant updated the revisions for the drawings: from Rev. B to Rev. C for Drawing M2E801580A001, from Rev. D to Rev. E for Drawing M2801580A005, from Rev. C to Rev. D for Drawing M2E801580A009, from Rev. B to Rev. D for Drawing M2E801580A013, from Rev. B to Rev. C for Drawing M2E801580A024, and from Rev. 0 to Rev. B for Drawing M2E801580A043.

The applicant added Appendix 1. 4.11 to address the EPDM containment vessel O-rings in the Equipment Specification SPC M801580-0002.

The applicant also deleted the drawing for the "Heavy Can Spacer Assembly", i.e., Drawing No. M2E801580A026, Rev. C., to remove the carbon-steel can spacer option.

1.3 Contents

The specific changes requested in this amendment request are (i) the increase in the mass of each Teflon bottle- from 330g to 400g - used for shipping HEU crystals, (ii) the increase of the total mass of off-gassing material from 1490 g to 1600 g when Teflon bottles are used as convenience containers, (iii) the decrease of the polyethylene bagging mass for 500g to 400g and (iv) the removal of the carbon-steel can spacer option.

Additionally, the applicant corrected a mass limit in Table 1.3 for broken HEU metal or alloy (>70 , $\leq 80\%$ enrichment, $CSI = 3.2$) from 27.692 kg to 27.443 kg, which will be reviewed in the criticality safety evaluation (Section No. 6 of this SER). The applicant also updated the maximum normal operating pressure (MNOP).

1.4 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 and NUREG-1617.

2.1 Structural Evaluation

There are no changes to the packaging design since the last revision of the CoC. The staff reviewed the requested changes pertaining to the structural design as shown in Chapter 2 of the Safety Analysis Report (SAR) Revision 5, dated March 24, 2016, and the staff findings are as listed below:

- Increasing the mass of each Teflon bottle (allowed for shipping HEU crystals) from 330g to 400g, and decreasing the polyethylene bagging mass from 500g to 400g is acceptable as it will not affect the overall weight limits, and the results of the NCT and the HAC analyses, as previously accepted by the staff.
- Revising the maximum normal operating pressure and maximum internal pressure differential will not affect the previously accepted analyses for the NCT and HAC analyses, and as such, the package will continue to comply with the regulations in 10 CFR 71.43(c).
- The removal of the carbon steel spacer option is inconsequential to the overall structural performance of the package previously accepted by the staff for the NCT and HAC analysis, and is therefore acceptable.

2.2 Conclusion

Based on the minor changes listed above, and in view of the fact that adequate margins of safety for stresses in the analyses previously accepted, the staff has a reasonable assurance that the package will comply with the structural requirements of the regulations as applicable in 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 and NUREG-1617.

3.1 Thermal Evaluation

There were no substantive changes to the thermal analyses in the amendment request for the Model No. ES-3100 transportation package. The applicant's edits to SAR Section 3 included incorporating minute changes in mass, volume, pressure and molar gas quantities related to containment vessel arrangement 7 (CVA 7), including its three Teflon bottles, which is limited to 1600g of off-gassing material. For example, Table 5 on SAR page 3-155 indicated that the molar quantity of gas generated due to the Teflon bottle off-gassing would be 4.729E-6 lb-mole larger than the value found in the previous SAR version. Staff concludes that the minute changes do not change the previous thermal conclusions by staff.

3.2 Conclusion

Based on the above, 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. The applicant requested several changes to the Model No. ES-3100 package in this amendment and only those changes that affect the containment system are discussed in this section.

4.1 Containment Evaluation

In this revision the applicant updated the maximum normal operating pressure to 98.84 kPa. The calculation for this change is documented in the thermal section of the SAR. The updated maximum normal operating pressure is used to revise the calculations in Appendix 4.6.2 for " P_N " and " P_A " to be consistent with the normal conditions of transport and hypothetical accident condition pressures calculated for CVA 7. These updated values are used throughout the subsequent calculations in Appendix 4.6.2 for the containment vessel's regulatory reference air leakage rates for both NCT and HAC. Table 1 of Appendix 5.6.2 and Tables 4.5 and 4.7 of the SAR are revised with the updated reference air leakage rates for NCT and HAC, respectively.

Although the applicant makes these changes, they do not affect SAR Sections 8.1.4 and 8.2.2 where the containment criteria for the ES-3100 package is identified as leaktight. The changes requested in this revision do not have any impact on the previously accepted containment boundary, containment leak tests or leakage criteria of the Model No. ES-3100 package.

After reviewing the requested changes to the 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 and with 10 CFR Parts 71.51 and 71.73, because no unacceptable quantity of radioactive material is released under HAC conditions.

4.2 Conclusion

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 requested changes have 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 is consistent with the provisions of ANSI N14.5-1997.

5.0 SHIELDING EVALUATION

The applicant's proposed changes to Chapter No. 5 are administrative in nature (updates to the revisions of the *Code of Federal Regulations* and similar changes discussed in Section 1.4 of this SER) and there are no safety implications from these proposed changes.

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.

6.1 Criticality Evaluation

This revision to the Model No. ES-3100 package contains several minor changes affecting the original criticality safety evaluation. The applicant made several editorial corrections, one content change that increased the mass of the Teflon bottles used to ship HEU crystals, and removed the carbon steel spacer can option, but made no changes to the packaging design.

The applicant corrected the mass limit identified in Table 6.2a for solid HEU metal that was characterized as broken metal ($>70, \leq 80\%$ enrichment, $CSI=3.2$) from 27.692 kg to 27.443 kg ^{235}U , which makes it consistent with the results shown in Tables 6.1c and 6.9.1.1. This is the correct mass limit as demonstrated by the applicant's modeled case nc5bmt11_35_1_5_3, and is an appropriate change that was corrected throughout the application.

The option for the carbon steel spacer can identified by drawing M2E801580A026 was removed, but the other spacer can configurations are still utilized in the ES-3100 and this change does not affect the criticality safety of the package.

Teflon bottles are used to package UNH crystals, and have a mass of approximately 303 grams according to several sections in Chapter 6. Teflon is a source of hydrogenous material, and therefore must be adequately analyzed as a content in the loaded ES-3100 package. For the purposes of the applicant's safety evaluation, they assumed a maximum quantity of hydrogenous material allowed within the containment vessel, regardless of source, of 500 grams of equivalent polyethylene.

Since the change of the maximum mass of the Teflon bottles up to 400 grams in other sections of the SAR is below this maximum 500 grams equivalent polyethylene mass limit, and the fact that the Teflon bottle is not credited for maintaining geometry, but rather only for the hydrogenous content, the criticality safety analysis remains unchanged by this revision to the Teflon mass limit.

6.2 Conclusion

Based on the staff review of the proposed changes in this revision, the Model No. ES-3100 package continues to meet the requirements of 10 CFR Part 71.

7.0 PACKAGE OPERATIONS

7.1 Package Operations Evaluation

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.

The applicant has revised Step 12 of Section 7.1.2.2 to attach either one or two TIDs through the drum TID lugs. This revision is consistent with the existing language in the CoC.

7.2 Conclusion

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.

Further, the CoC is conditioned to specify that the package must be prepared for shipment and operated in accordance with the Package Operations in Chapter No. 7 of the application.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

8.1 Acceptance Tests and Maintenance Program Evaluation

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.

The applicant's proposed changes to Chapter No. 8 are administrative in nature (updates to the revisions of the *Code of Federal Regulations* and the distribution list) and there are no safety implications from these proposed changes.

8.2 Conclusion

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.

CHANGES TO THE CERTIFICATE OF COMPLIANCE

The following changes are included in Revision No. 14 to Certificate of Compliance No. 9315:

Item No. 3(b) identifies the Consolidated Nuclear Security, LLC, application dated March 24, 2016.

CONDITIONS

Condition No. 5(a)(3) has been revised to remove the references to BWXT Y-12, delete drawing No. M2E801580A026, Rev. C, "Heavy Can Spacer Assembly.", renumber subsequent drawings accordingly, and update the revisions numbers of the licensing drawings.

Condition No. 5(b) was modified to increase the mass of Teflon bottles, and associated off-gassing materials. A foot note (c) was added to the table of concentration limits to specify that the maximum concentration of U-235 was for 100 weight per cent U-235. A statement was also added regarding the use of hydrogenous material in the containment vessel when shipping uranium in the form of broken metal.

Condition No. 5(b)(1) was modified to (i) remove reference to drawing M2E801580A026, and (ii) correct in Table 2 the mass limit for solid HEU metal characterized as broken metal (uranium enrichment >70 and ≤ 80 wt. % U-235, CSI = 3.2) to 27.443 kg.

Condition 15 was modified to authorize the use of Revision 13 of this certificate until April 30, 2017.

Condition 16, previously numbered as Condition 15, was added: the expiration date of the certificate is not changed.

The "Safety Analysis Report, Y-12 National Security Complex, Model ES-3100 Package with Bulk HEU Contents, Y/LF-717, Revision 5" is referenced in the Reference Section of this certificate.

CONCLUSION

Based on the statements and representations in the application, 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. 14,
on June 8, 2016.