

**Safety Evaluation Report for  
Amendment 4 of USA/9315/B(U)F-96(DOE):  
Change of <sup>233</sup>U Concentration Limit**

Docket No. 12-25-9315

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## SUMMARY

The National Nuclear Security Administration (NNSA), Office of Fissile Materials Disposition (NA-26), submitted a letter dated June 12, 2012, requesting an amendment of the Certificate of Compliance (CoC) USA/9315/B(U)F-96(DOE) for the Model ES-3100 Type B package.<sup>1</sup> Along with the request for amendment, the ES-3100 Safety Analysis Report for Packaging (SARP) Page Change, identified as SP-PKG-801940-A001 Revision 0, Page Change 3, dated June 21, 2012, was submitted with the intent to provide the necessary documentation.<sup>2</sup>

The request for amendment of the CoC USA/9315/B(U)F-96(DOE) included three topics:

- 1) Change of <sup>233</sup>U concentration limit in oxide contents;
- 2) Add bulk highly enriched uranium (HEU) oxide as an authorized content for air transport and add uranium silicide as an authorized content for ground transport; and
- 3) Add Viton GLT-S as an optional O-ring for extended maintenance of two years, increase the amount of <sup>235</sup>U in U-Al reactor fuel, make allowance for convenience cans with diameters larger than 4.25 inches along with the potential off-gassing materials in the ES-3100 Containment Vessel (CV), and add the option of applying radio frequency identification (RFID) system, etc.<sup>1</sup>

The first topic of the request for amendment, which has the highest priority, is to change the <sup>233</sup>U concentration bounding limit in oxide contents to 0.006 g/gU from 200 ppm. With this change, the <sup>233</sup>U concentration limit of 0.006 g/gU in oxide contents will be equal to the approved concentration of <sup>233</sup>U in all other HEU contents of the ES-3100 package, as specified in Table 1.1 of the SARP Page Change 3. The calculations in the ES-3100 SARP Revision 0 had already accounted for the 0.006g/gU <sup>233</sup>U concentration bounding limit for oxide contents.

On the basis of the statements and representations in the request for Amendment 4, the SARP Page Change 3, and the Department of Energy (DOE) Packaging Certification Program (PCP) staff's confirmatory evaluation as summarized in this Safety Evaluation Report (SER), DOE PCP finds that the request to change the bounding concentration limit of <sup>233</sup>U in oxide contents to 0.006 g/gU from 200 ppm is acceptable, and will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

## References

1. Request for Amendment 4 of USA/9315/B(U)F-96(DOE), submitted to James M. Shuler, Manager of Packaging Certification Program, Office of Packaging and Transportation of Department of Energy, by the National Nuclear Security Administration (NNSA), Office of Fissile Materials Disposition, June 12, 2012.
2. Safety Analysis Report for Packaging for Model ES-3100 Package with Bulk HEU Contents, SP-PKG-801940-A001 Rev. 0, Page Change 3, Babcock & Wilcox Technical Services Y-12. LLC, Y-12 National Security Complex, June 21, 2012.

## **1. GENERAL INFORMATION AND DRAWINGS**

Detailed packaging descriptions, drawings and contents can be found in the SARP. The components of the packaging include an outer drum, impact-limiting and thermal-insulating materials, neutron-absorbing materials, a CV and content containers.

The change to the SARP for “Page Change 3” for the first topic of the request for Amendment 4 is in Table 1.2 on page 1-11. The bounding concentration limit of isotope  $^{233}\text{U}$  has been changed to 0.6 wt% (0.006 g/gU) from 200 ppm, so that it is equal to Table 1.1, which shows that the  $^{233}\text{U}$  concentration limit is 0.006 g/gU in other HEU contents.

On the basis of the review of the information presented in the request for Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no general information and drawings-related issues that need to be addressed relative to this request.

Evaluations of design and performance of the package for safety and regulatory compliance in structural, thermal, containment, shielding, criticality safety, operating procedures, acceptance tests and maintenance, and quality assurance are given in the remaining sections of this SER.

## **2. STRUCTURAL**

On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP staff finds that there are no structural issues related to the change of  $^{233}\text{U}$  concentration limit in Addendum 4.

## **3. THERMAL**

The change of the  $^{233}\text{U}$  concentration bounding limit in oxide contents from 200 ppm to 0.006 g/gU does not change the maximum content decay heat of 5W, nor does it affect the thermal design and performance of the ES-3100 package. On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no thermal issues related to the change of  $^{233}\text{U}$  concentration limit in Addendum 4.

## **4. CONTAINMENT**

On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no containment issues related to the change of  $^{233}\text{U}$  concentration limit in Addendum 4.

## **5. SHIELDING**

DOE PCP staff reviewed Chapter 5 of the ES-3100 SARP Page Change 3, and found that Chapter 5 has included the 0.006 g/gU  $^{233}\text{U}$  concentration bounding limit in both metal and oxide contents for the shielding evaluation. Specifically:

1. Table 5.3 on page 5-5 lists the radioisotope specification for the ES-3100 package analysis source calculations. The listed  $^{233}\text{U}$  value is 0.6 wt%, which is equivalent to a  $^{233}\text{U}$  content of 0.006 g/gU in the source specification;
2. The ORIGEN-S input listing in Appendix 5.5.1 on page 5-19 matches Table 5.3, and lists the  $^{233}\text{U}$  content of the input source composition as 0.006 g/gU;
3. Table 5.4 on page 5-5 lists the photon source per gram of HEU content computed by ORIGEN-S, and Table 5.5 on page 5-6 lists the neutron source per gram of HEU content computed by ORIGEN-S. These photon and neutron sources are used for all contents (metal, oxide, etc.) in the Monte Carlo N-Particle Transport Code (MCNP) shielding calculations;

4. Appendix 5.5.2 on page 5-23 through 5-38 lists four MCNP input files for
  - a) NCT for 36 kg metal neutron case,
  - b) NCT for 24 kg oxide photon case,
  - c) HAC for 36 kg metal photon case, and
  - d) HAC for 24 kg oxide neutron case.

In all cases, the MCNP input photon source matches the photon source listed in Table 5.4 and the MCNP input neutron source matches the neutron source listed in Table 5.5; therefore, it is concluded that the 0.006 g/gU <sup>233</sup>U concentration bounding limit in oxide contents has been covered in Chapter 5 for the shielding evaluation for the ES-3100 SARP Page Change 3.

On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3 and DOE PCP staff's confirmatory evaluation, DOE PCP finds that the change of the <sup>233</sup>U limit from 200 ppm to 0.006 g/gU for oxide content in Table 1.2 is acceptable and will provide reasonable assurance that the regulatory requirements in 10 CFR Part 71 have been met.

## **6. CRITICALITY**

DOE PCP staff reviewed the criticality safety analysis in Chapter 6 of the SARP Page Change 3, and found that it is conservative for the 0.006 g/gU <sup>233</sup>U concentration bounding limit in oxide contents. On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no criticality issues related to the change of <sup>233</sup>U concentration limit in Addendum 4.

## **7. PACKAGE OPERATIONS**

On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no package operations issues related to the change of <sup>233</sup>U concentration limit in Addendum 4.

## **8. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM**

On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no acceptance tests and maintenance program issues related to the change of <sup>233</sup>U concentration limit in Addendum 4.

## **9. QUALITY ASSURANCE**

On the basis of the review of the information presented in Amendment 4 and the SARP Page Change 3, DOE PCP finds that there are no quality assurance issues related to the change of <sup>233</sup>U concentration limit in Addendum 4.