



EM Environmental Management

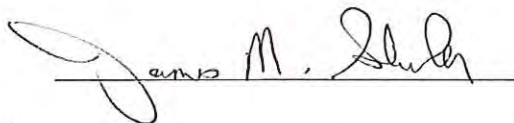
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DOE Packaging Certification Program

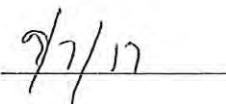
**Safety Evaluation Report for
Request to Authorize Highly Enriched Uranium Oxide
(U₃O₈) with Residual Uranium Metallic Particles for
Shipment in the ES-3100 Package**

Docket No. 17-14-9315

Prepared by:



Date:

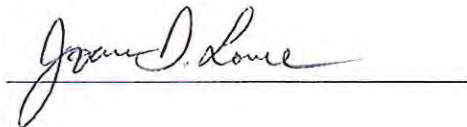


James M. Shuler

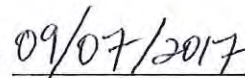
Manager, Packaging Certification Program

Office of Packaging and Transportation

Approved by:



Date:



Joanne D. Lorence

Headquarters Certifying Official

Director

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This Safety Evaluation Report (SER) documents the U.S. Department of Energy (DOE) Packaging Certification Program (PCP) independent technical review of the application submitted by the National Nuclear Security Administration Office of Material Management and Minimization (NA-23) to amend DOE Certificate of Compliance (CoC) Number 9315, Revision 12, to authorize highly enriched uranium (HEU) oxide (U₃O₈) with residual uranium metallic particles for shipment in the Model ES-3100 package.

Summary

By letters ^[1, 2] dated March 3, 2017 and May 24, 2017, the National Nuclear Security Administration Office of Material Management and Minimization (NA-23) requested the Department of Energy (DOE) Package Certification Program (PCP) to amend DOE Certificate of Compliance (CoC) Number 9315, to authorize HEU oxide (U₃O₈) with residual uranium metallic particles (a.k.a., clinkers and screenings) for shipment in the Model ES-3100 package, under the content category defined in the CoC as “broken HEU metal or alloy”.

The applicant demonstrated compliance with the requirements of 10 CFR Part 71 for this content amendment by comparison with the existing Safety Analysis Report for Packaging (SARP) ^[3], as supplemented ^[4, 5], and DOE CoC Number 9315 Revision 12. There are no changes to the packaging design or operational features required for this amendment to the CoC.

Based on the statements and representations in the application and PCP staff’s confirmatory evaluation, and the conditions listed in this Safety Evaluation Report (SER), staff finds that the request to authorize HEU oxide with residual uranium metallic uranium particles (clinkers and screenings) for shipment in the Model ES-3100 package is acceptable, and will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

Evaluation

By letters dated March 3, 2017 and May 24, 2017, NA-23 requested the DOE PCP to amend DOE CoC Number 9315 Revision 12, to authorize HEU oxide (U₃O₈) with residual metallic uranium particles for shipment in the Model ES-3100 package, under the content category defined in the CoC as “Broken HEU metal or alloy”. The application for this content amendment consists of these two letters from NA-23, with no changes to the SARP.

This content is HEU oxide in the form of U₃O₈ with residual uranium metallic particles, and is also referred to as “clinkers and screenings.” This material is produced from a DOE metal casting operation, where uranium metal is melted in a graphite crucible inside a furnace at high temperature. After the operation is complete the crucibles are cleaned of residual material. The residual material is passed through a sieve: the finer oxide particles that pass through is called “skull oxide” whereas the particles too large to pass through are called “clinkers and screenings.” Clinkers and screenings are predominately HEU oxide, but often will have small particles of uranium metal which did not react during the casting operation. DOE intends to ship the clinker and screening material to commercial facility for down-blending it from HEU into low enriched uranium for use as commercial fuel.

The applicant proposed to include this material under the content defined in the CoC as “broken HEU metal or alloy”, instead of HEU oxide, due to the pyrophoricity of uranium metallic

particles. To address pyrophoricity, the applicant proposed to package this material in a convenience can authorized for broken HEU metal pieces and seal the can under an inert cover gas in accordance with Condition 5.(d)(4) of the CoC.

The applicant stated that from a nuclear criticality safety standpoint the models used for calculating HEU oxide would be the same as models for HEU oxide with small uranium metallic particles, and concluded that the calculations for the clinkers and screenings would have the same analytical results as pure HEU oxide.

To address the HEU oxide component of this content with respect to gas generation the applicant proposed that a shipment of clinkers and screenings must be completed within 12 months after sealing the containment vessel in order to prevent the buildup of hydrogen gas beyond 5 mol %. This condition is required for HEU oxide and is listed in footnote "h" in Tables 1.3 and 1.3b of the CoC.

PCP staff performed a section-by-section confirmatory review of the SARP, as supplemented, and this application, and found that this content amendment does not affect the safety performance of the package.

Based on the statements and representations in the application, SARP, as supplemented, and PCP staff's confirmatory evaluation, staff finds that the request to authorize HEU oxide with residual uranium metallic particles (clinkers and screenings) for shipment in the Model ES-3100 package is acceptable, and will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

Conditions of Approval

The certificate revision was changed from Revision 12 to Revision 13, with only the following changes:

- Condition 5.(d)(13) revised – "Revision 10 or 11 of the certificate may be used until June 30, 2018. Revision 12 of the certificate may be used until December 31, 2018." Note – use of Revision 12 is extended for completion of shipments from the United Kingdom under DOT Compentent Authority Certification (CAC), Certificate USA/9315/B(U)F-96, Revision 11.
- Condition 5.(d)(19) added – "HEU oxide with residual particles of metallic uranium (a.k.a., clinkers and screenings) and meeting the requirements of Table 1.3 footnote "j" and Table 1.3b footnote "i" of this certificate must be prepared for shipment in accordance with the authorized content and loading limits for "Broken HEU metal or alloy" in Table 1.3 (for ground transport) or Table 1.3b (for air transport) and Condition (4) of this certificate, and must be shipped within the seal time per footnote "h" of the aforementioned tables."
- Supplements 5.(e)(1) and 5.(e)(2) edited to include "Safety Analysis Report for Packaging" in the title.
- Supplement 5.(e)(3) added – "Request for Shipment of a variation of HEU oxide in the ES-3100 Package, CoC USA/9315/B(U)F-96 (DOE), Revision 10, Letter Kilmartin to Shuler, May 24, 2017"

Conclusion

Based on the statements and representations in the application, SARP, as supplemented, and PCP staff's confirmatory evaluation, staff finds that the request to authorize HEU oxide with residual uranium metallic particles (clinkers and screenings) for shipment in the Model ES-3100 package is acceptable, and will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

References

- [1] *Request for Shipment of a variation of HEU oxide in the ES-3100 Package, CoC USA/9315/B(U)F-96 (DOE), Revision 10*, Letter Kilmartin to Shuler, March 3, 2017
- [2] *Request for Shipment of a variation of HEU oxide in the ES-3100 Package, CoC USA/9315/B(U)F-96 (DOE), Revision 10*, Letter Kilmartin to Shuler, May 24, 2017
- [3] *Safety Analysis Report for Packaging, Y-12 National Security Complex, Model ES-3100 Package with Bulk HEU Contents*, SP-PKG-801940-A001 Rev. 1, Consolidated Nuclear Security LLC, September 3, 2015.
- [4] *Safety Analysis Report for Packaging, Y-12 National Security Complex, Model ES-3100 Package with Bulk HEU Contents*, SP PKG 801940 A001, Revision 2, dated September 8, 2016.
- [5] *Safety Analysis Report for Packaging Y-12 National Security Complex, Model ES 3100 Package with Bulk HEU Contents*, SP PKG 801940 A001, Revision 2, Page Change 1, dated June 26, 2017.