



**EM Environmental Management**

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**DOE Packaging Certification Program**

**Safety Evaluation Report for  
Depleted Uranium Content Amendment to Certificate of  
Compliance Number No. 9315**

**Docket No. 22-42-9315**

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## Evaluation

By letter <sup>[1]</sup> dated June 9, 2022, National Nuclear Security Administration Production Office (NPO) requested an amendment to DOE Certificate of Compliance (CoC) No. 9315 for the Model No. ES-3100 package to authorize use of the package for air shipment of limited quantities of depleted uranium (DU) samples. The NPO request is supported by a supplemental safety evaluation <sup>[2]</sup> performed by Y-12 National Security Complex (Y-12), as supplemented <sup>[3]</sup>, that sufficiently demonstrates that the proposed DU contents are bounded by the CoC and the ES-3100 Safety Analysis Report for Packaging <sup>[4]</sup> for highly enriched uranium (HEU) metal turnings, fines, or powders.

NPO intends to ship approximately 1.5 kg of normal form DU in Type A quantities ( $\leq 10^{-3}$  A<sub>2</sub> mixture per package – approximately 500 grams of DU) by air shipment. Since DU is pyrophoric, Type B packaging is required for air shipment per 49 CFR 173.418(e). The Model ES-3100 is not currently authorized for shipments of DU; consequently, NPO requested an amendment to the CoC to authorize use of the package for air shipment of limited quantities of DU samples.

The isotopic composition of the DU is shown in the table below as compared with the uranium concentration limits authorized in the CoC (Table 1.1). The DU is bounded by CoC Table 1.1.

| Radionuclide     | DU Isotopic Composition Maximum (wt.%) | CoC Uranium Concentration Limit (wt.%) |
|------------------|--|--|
| <sup>232</sup> U | 0                                      | 4 $\mu$ g/gU ( $4 \times 10^{-6}$ )    |
| <sup>233</sup> U | 0.002                                  | 0.006 g/gU (0.6)                       |
| <sup>234</sup> U | 0.002                                  | 0.02 g/gU (2.0)                        |
| <sup>235</sup> U | 0.2                                    | 1.00 g/gU (100)                        |
| <sup>236</sup> U | 0.004                                  | 0.4 g/gU (40)                          |
| <sup>238</sup> U | 99.804                                 | 1.00 g/gU (100)                        |

The applicant proposes to use the ES-3100 packaging for shipment of limited quantities of DU in normal form ( $\leq 10^{-3}$  A<sub>2</sub> mixture per package – approximately 500 grams of DU). The maximum decay heat from this activity of DU is approximately 9 microwatts which is significantly bounded by the authorized package maximum decay heat of  $\leq 5.0$  watts.

The DU consists of uranium metal in the form of turnings, fines, or powders (i.e., solids) and is limited by NPO to  $\leq 10^{-3}$  A<sub>2</sub> mixture per package to keep the fissile mass to  $\leq 2$  grams (U-233 + U-235  $\leq 2$  grams) per package. Therefore, the DU contents meet the requirements of §173.418(a) to be in solid form and fissile excepted per §173.453(a).

The DU contents meet the requirements of §173.418(b) by being packaged sealed and corrosion resistant receptacles with positive closures, (c) free of water and contaminants that would

increase the reactivity of the material, and (d)(2) inerted to prevent self-ignition during transport by filling the innermost receptacle with an appropriate inert gas, as follows.

The DU metal turnings, fines, or powders will be loaded in a sealed (i.e., leaktight) container under an inert cover gas (argon). This container (and the DU) is free of water (CoC Condition 11), compatible with uranium, and authorized in the CoC (i.e., constructed from tin-plated carbon-steel, stainless-steel, aluminum, or nickel-alloy; Teflon convenience bottles; or Teflon bottles inside metal convenience cans.). Each sealed, inerted container will be loaded into a convenience can (e.g., 4.25-in. OD × 8.75-in. tall) and up to three convenience cans may be loaded into the ES-3100 containment vessel. The sealed containers, convenience cans, and containment vessel shall be inerted with argon of high purity (> 99%) and with low moisture (< 5 ppm moisture), in accordance with CoC Condition 5.(d)(16).

DOE PCP staff confirmed that this DU loading configuration meets the requirements of §173.418.

The applicant performed a chapter-by-chapter evaluation of the DU contents relative to the SARP to demonstrate that it is bounded by the SARP and CoC. DOE PCP staff confirmed by document review that it is bounded by the SARP and CoC due to its relatively small radioactivity and fissile mass (Type A quantity of  $\leq 10^{-3}$  A<sub>2</sub> mixture and  $\leq 2$  g, respectively, per package), and negligible decay heat (approximately 9 microwatts maximum per package).

There are no changes to the package design or packaging components for shipment of the proposed DU contents.

Based on the statements and representations contained in the supplemental safety evaluation to the SARP and the conditions listed below, DOE PCP staff has reasonable assurance that the regulatory requirements of 49 CFR 173.418 and 10 CFR Part 71 have been met and recommends amendment of the CoC by the DOE Headquarters Certifying Official (HCO).

### **Conditions of Approval**

To add DU as an authorized content in CoC 9315, Rev 18 of the CoC must be revised as follows:

- Section 5(b), Contents, 2<sup>nd</sup> paragraph – Revise to: Depleted Uranium (DU) samples or HEU metal or alloy ... (added DU)
- Section 5(b), Contents, Table 1.3, Uranium Compounds, last row – Revise to: U<sub>3</sub>Si, U<sub>3</sub>Si-Al (correct error in the CoC - U<sub>3</sub>Si<sub>2</sub>, U<sub>3</sub>Si<sub>2</sub>-Al).
- Section 5(d)(13), Revise to: Revision 18 of the certificate may be used until November 30, 2023. For export or import use of this package under a Department of Transportation

Competent Authority Certification (CAC), previous revisions of the CAC may continue to be used until their expiration date, unless otherwise specified in the CAC.

- Section 5(d)(13), Added (21): The package is authorized for air transport, in accordance with 49 CFR 173.418(e), of a limited quantity ( $\leq 10^{-3}$  A<sub>2</sub> mixture per package) of normal form solid DU samples in the form of metal or alloy turnings, fines, or powders, with a fissile mass  $\leq 2$  grams per package (i.e., fissile excepted). These contents shall be in a sealed inerted container: the Teflon bottles, the metal convenience cans, and the containment vessel shall be inerted with argon of high purity ( $> 99\%$ ) and with low moisture ( $< 5$  ppm moisture). SARP Package Operations for HEU material are applicable for DU.
- Section 5(e), Added (1): *ES-3100 Depleted Uranium Usage*, RP 801580-0032 000 01, December 2021.

## Conclusion

Based on the statements and representations in the supplemental safety evaluation, DOE PCP staff concludes that the Model No. ES-3100 package design has been adequately described and evaluated and has reasonable assurance that requirements of 10 CFR Part 71 have been met, subject to the conditions above.

## Reference

- [1] *Request for an Amendment to the Department of Energy Certificate of Compliance Number 9315 to Add Depleted Uranium as Approved Content*, Memorandum, Robbins to Shuler, June 9, 2022
- [2] *ES-3100 Depleted Uranium Usage*, RP 801580-0032 000 00, October 2021.
- [3] *ES-3100 Depleted Uranium Usage*, RP 801580-0032 000 01, December 2021.
- [4] *Safety Analysis Report for Packaging, Y-12 National Security Complex, Model ES-3100 Package with Bulk HEU Contents*, SP-PKG-801940-A001 000 03 (Rev. 3), January 21, 2021.