U.S. DEPARTMENT *of* ENERGY

Office of Environmental Management

DOE Packaging Certification Program

SAFETY EVALUATION REPORT
Amendment and Renewal of Certificate of Compliance No. 9979 for the Model 9979 Package

Docket Nos. 25-19-9979 and 25-28-9979

Prepared by: CHRISTOPHER CABLE Digitally signed by CHRISTOPHER CABLE Date: 2025.09.03 15:18:35 -04'00'

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Docket 25-19-9979 Evaluation

By email [1] dated February 27, 2025, the Savannah River Operations Office (SR) submitted a request to amend US Department of Energy (DOE) Certificate of Compliance (CoC) Number 9979, for Package Identification No. USA/9979/AF-96 (DOE). The review of this request (Docket 25-19-9979) by DOE Packaging Certification Program (PCP) staff was delayed pending issuance of DOE CoC 9979 Revision 19 (for Docket 21-16-9979), July 22, 2025. This amendment request is supported by the safety basis document and supplements listed in the CoC.

The application [2] was prepared for SR, by the Savannah River National Laboratory (SRNL), to amend, for clarification, the content descriptions in CoC Table 1, *Radioactive Content Description*, and Table 2, *Content Envelope Limits for HEU, TRISO Fuel and Process Materials*, in three places.

DOE PCP staff reviewed the requested changes to the CoC 9979 Rev. 19 to confirm the changes were consistent with the existing CoC safety basis document [Safety Analysis Report for Packaging (SARP) Rev. 7] and supplements listed in CoC Section 5(e).

Uranium Oxide

The applicant requested a change to expand the general description from "UO_4" to "uranium oxides" in CoC Table 1, the *Material Forms*, *Solid Compounds and Metal.* The justification for this change is the previously approved nuclear criticality safety assessment (NCSA) in SARP Rev. 7, Section 6.10, Reference 3 (N-NCS-G-00174, Revision 1), which included uranium oxides.

DOE PCP staff confirmed by document review that the NCSA included UO_2 and U_3O_8 in the scope of that assessment for TRISO fuel and process materials, which was authorized beginning with CoC 9979, Rev. 10. In addition, the staff notes that the nuclear criticality safety evaluation (NCSE) supporting SARP Chapter 6, *Criticality Evaluation*, assumes all U-235 is in metal form, that is, 350-grams of U-235 as 100 wt.% metal with a density of 19.05 g/cc, per SARP Rev. 7, Section 6.10, Reference 4 (N-NCS-A-00019, Revision 2). Lower densities of U-235 metal or U-235 in oxide forms were not analyzed because the maximum theoretical density of uranium metal (19.05 g/cc), provides the bounding results. Therefore, the staff concludes that the change to CoC Table 1 description from "UO_4" to "uranium oxides" does not require a change to CoC Table 2 fissile mass limits and is bounded by the existing NCSE.

DOE PCP staff notes that the applicant's shielding evaluation in SARP Rev. 7, Appendix 5.1 (N-CLC-G-00132, Revision 1) considered only uranium metal for the upper-limit case of 350-grams of U-235, whereas, for the shielding evaluation in SARP Rev.7, Supplement for Docket 23-11-9979, Section 5.6, Reference 13 (N-CLC-A-00108, Revision 1) for lower-limit case of 15-grams of U-235 considered both uranium metal and oxide (UO_2) but no other uranium oxides, such as, U_3O_8 and UO_4. According to the shielding analysis results in N-CLC-A-00108, for some radioisotopes in CoC Table 2, for example, Co-60 and Cs-137, 15-grams of U-235 in oxide form would lead to lower mass limits for these two radioisotopes than 15-grams U-235 of metal, in order to meet the dose rate requirements specified in § 71.47(a). However, the calculated differences in the mass limits are small, and compliance with § 71.47(a) is determined by

measurement prior to shipment, rather than estimated by calculation. Therefore, the staff concludes there are no changes required to the CoC Table 2, *Radiation* column, for uranium oxide, as these calculated limits are for estimating purposes.

Boron Carbide

The applicant requested a new footnote to CoC Table 2, to clarify that the mass limits for Graphite/Cabon do not apply to boron-carbide compounds. The justification for this change is that this note is already included as a footnote in SARP, Rev 7, Table 6.1, as supported by the previously approved nuclear criticality safety evaluation (NCSE) in SARP Rev. 7, Section 6.10, Reference 4 (N-NCS-A-00019, Revision 2).

DOE PCP staff confirmed by document review that the NCSE shows adding boron in the form of boron-carbide acts as a neutron poison which significantly reduces k_{eff}; therefore, adding this footnote to CoC Table 2 is consistent with the existing CoC safety basis document and supplements.

Graphite/Carbon & Beryllium

The applicant requested a new footnote to CoC Table 2, to clarify that the 1.0E+03 grams mass limit for the sum of Graphite/Carbon and Beryllium impurities is an absolute mass limit for the package payload based on the fissile material mass limits, and not as a percentage fissile mass or total payload mass (90 kg). The justification for this change is SARP Rev.7, Supplement for Docket 21-03-9979, Chapters 5 and 6, based on bounding analysis.

DOE PCP staff notes that the waste acceptance criteria (WAC) [3] for packages disposed of at the Nevada National Security Sites (NNSS) include a requirement in WAC Section 3.1.5.1 that graphite and beryllium shall not exceed 1% by mass of the waste, but the waste generator has the option to submit a waste-specific NCSE with their waste profile for waste that does not meet that requirement. Consequently, this proposed change would require shippers to provide an NCSE with their waste profile if they cannot meet this WAC requirement.

The NCSE in SARP Rev. 7, Section 6.10, Reference 4 (N-NCS-A-00019, Revision 2) evaluates 1.0E+03 grams of beryllium as the bounding mass for the combined graphite/carbon and beryllium for HEU content, since beryllium is more reactive. DOE PCP staff confirmed by document review this limit is independent of the mass of the waste. NCSE, Section 6.8, *Model Conservatisms* states "Only fissile material, moderator, and reflectors were modeled inside the inner drum. This is conservative as these packages will likely contain other waste which would provide separation and/or a poisoning effect." The staff also notes in SARP Rev. 7, Appendix 5.1 (N-CLC-G-00132, Revision 1) and SARP Rev.7, Supplement for Docket 23-11-9979, Section 5.6, Reference 13 (N-CLC-A-00108, Revision 1), that beryllium was also used by the applicant as the bounding impurity in their shielding model, since it maximizes the dose rate due to alpha-neutron (α,n) reactions, verses carbon. Other waste materials in the 30-gallon drum would provide distance and marginal shielding and are thus omitted from the shielding model; therefore, the shielding evaluation is not dependent on the waste mass. Nevertheless, compliance with § 71.47(a) is determined by measurement prior to shipment, rather than estimated by calculation.

DOE PCP staff concludes this clarification to CoC Table 2, to add a note that the maximum mass limit of graphite/carbon and beryllium are absolute limits and not a percentage (1%) of the mass of the waste, is consistent with the existing CoC safety basis document and supplements.

Based on the statements and representations in the amendment request and SARP Rev. 7, as supplemented, and DOE PCP staff review as summarized in this SER, the staff finds that the requested amendment to the CoC acceptable, and will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met, subject to the conditions of approval below in this SER.

Docket 25-28-9979 Evaluation

By email [4] dated July 1, 2025, SR submitted a request to renew the CoC for 5-years. CoC 9979 is scheduled to expire September 30, 2025, and is currently under timely renewal per DOE Order 460.1D,

SR did not request any changes to either the package design or authorized contents since CoC Revision 19, was issued on July 22, 2025. CoC Rev 19 is based on *Safety Analysis Report for Packagings Model 9979 Type AF Shipping Package*, S-SARP-G-00006, Revision 7, December 2020 and the following supplements listed in Section 5(e) of the certificate:

(1) *Safety Analysis Report for Packaging Model 9979 Type AF Shipping Package*, S-SARP-G-00006, Revision 7 (Supplement for Docket 21-03-9979), July 2023.
(2) *Safety Analysis Report for Packaging Model 9979 Type AF Shipping Package*, S-SARP-G-00006, Revision 7 (Supplement for Docket 23-11-9979, Rev 1), January 10, 2024.
(3) *Safety Analysis Report for Packaging Model 9979 Type AF Shipping Package*, S-SARP-G-00006, Revision 7 (Supplement for Docket 21-16-9979, Rev 1), January 2025.
(4) *9979 TYPE A FISSILE PACKAGING COMPACT AUGMENTED PERMEATION SYSTEM (CAPS)*, Technical Requirements Datasheet, M-DS-G-00124, Revision 0, June 4, 2025.

DOE PCP staff confirmed SARP Rev. 7, and supplements listed above were available and complete.

Condition 6 of CoC Rev.18 will be added to CoC Rev. 20 to authorize previously fabricated packages prior to Rev.19.

Based on the statements and representations in the renewal request and SARP Rev. 7, as supplemented, and the conditions specified below in this SER for inclusion in the CoC, DOE PCP staff concludes that the package continues to meet the requirements of 10 CFR Part 71.

Conditions of Approval

The following changes to CoC Revision 19 are required for amendment and renewal.

- Section 5(a)(2), *Description*, 2nd para: Revise to "… The 30-gallon inner drum, fabricated from 18-gauge …" (correction to change 16 to 18-gauge).
- Section 6b, *Expiration Date*: Revise to "September 30, 2030" (Docket 25-28-9979)
- Section 5(b)(1), Table 1, *Radioactive Content Description*, row for *Solid Compounds and Metal*: Revise "UO_4" to "uranium oxide." (Docket 25-19-9979)
- Section 5(b)(2), Table 2, *Content Envelope Limits for HEU, TRISO Fuel and Process Materials*: Add footnote "e" superscript to table rows "Graphite/Carbon" and "Beryllium" (Docket 25-19-9979)
- Section 5(b)(2), Table 2, Notes for Table 2, item "e": Add "…The corresponding 1.0E+03-gram mass limit for the sum of Graphite/Carbon and Beryllium impurities is an absolute mass limit for the package payload based on the Fissile Material (U-235 equivalent) limits, and not as a percentage fissile mass or total payload mass (90 kg). In addition, the impurity mass limits for Graphite/Carbon do not include or apply to the mass of boron-carbide compounds (neutron poison)." (Docket 25-19-9979)
- Section 5(d) *Conditions:*
  - Revise (10) to "Revision 18 of this certificate may be used until September 30, 2025. Revision 19 of this certificate may be used until December 30, 2025" (grace period to allow users to implement/reference the latest certificate).
  - Add (14) to authorize use of previously fabricated packaging:

    Packaging without the modifications authorized in Revision 19 of this certificate to the 30 Gallon Drum Assembly (Drawing R-R1-G-00028, Rev. 8, Items 8 and 9) and to the 55 Gallon Drum Sub-Assembly and Weldment (Drawing R-R2-G-00057, Rev. 12, Item 13) may continue to be used subject to following, which was previously Condition 6 of Revision 18 of this certificate:

    The shipping period and minimum package void volume in the 30-gallon drum apply for each content Table as follows (Note – Shipping period begins when the 30-gallon drum is closed):

    - Tables 2 and 4 – shipping period is 180 days, with a minimum void volume of 8.9% for Table 2 contents and 4.6% for Table 4 contents.
    - Tables 3, 5a, and 5b – shipping period is unlimited and with no minimum void volume.

    The shipping period for packages loaded with Tables 2 and 4 contents may be reset to 180 days by:

    - Diffusion or purging methods described in the operations procedures in Section 7.4.3 of the SARP, as supplemented. For the purging method, use of the 100 μm sintered metal filter of 0.092 inch thickness is required for contamination control.
    - The detection or sampling methods described in the operations procedures in Section 7.4.4 of the SARP, as supplemented.

- Section 5(e) *Supplements*: Add

  (5) *DOE-SR / SRNL Request for docket and review of 9979 CoC Amendment,* email Luke Sobus to Christopher Cable, February 27, 2025.

  (6) *DOE-SR 9979 CoC Renewal Request*, email from Luke Sobus to Christopher Cable, July 1, 2025.

Conclusion

Based on the statements and representations in the amendment and renewal requests and SARP Rev 7, as supplemented, and the conditions of approval specified in this SER for inclusion in the CoC, DOE PCP staff concludes that the package continues to meet the requirements of 10 CFR Part 71.

References

[1] DOE-SR / SRNL Request for docket and review of 9979 COC Amendment, email, Sobus, L to Cable, C, February 27, 2025.

[2] *Request for Amendment to the CoC for Model 9979 for Table 1 and Table 2 Contents*, SRNL-2230000-2025-0000, Rev. 0, February 20, 2025.

[3] *Nevada National Security Sites Waste Acceptance Criteria*, DOE/NV--325-24-00, February 2024.

[4] *DOE-SR 9979 CoC Renewal Request*, email, Sobus, L. to Cable, C., July 1, 2025.