Global Nuclear Fuel

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July 1, 2022

Thomas H. Boyce, Acting Chief
Fuel Facility Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission

Attn: Document Control Desk

Subject: GNF-A Response to NRC Request for Additional Information

References: 1) NRC License SNM-1097, Docket 70-1113
2) GNF-A Request to Approve 20 wt. % Safety Analytic Methods, 1/20/22
3) Letter, T. H. Boyce (NRC) to D. Nay (GNF-A), "Request for Additional Information to Support Review of Safety Analytic Methods, 6/8/22 (Enterprise Project Identification Number L-2022-LLA-0012)

Dear Mr. Boyce:

Attached is Global Nuclear Fuel – Americas, LLC (GNF-A) response with the additional information that you requested on June 8, 2022 (Reference 3).

If you have any questions concerning this information, please call me at (910) 819-5950.

Sincerely,

Scott Murray, Manager
Facility Licensing

Attachment(s): 1) GNF-A Response to NRC Request for Additional Information

Cc: J. Rowley, NRC/NMSS/DFM/FFLB
J. Munson, NRC/NMSS/DFM/NARAB
SPM 22-025

REQUEST FOR ADDITIONAL INFORMATION – GNF-A RESPONSE

MINIMUM MARGIN OF SUBCRITICALITY FOR USE UP TO 20 WT.% U-235
GLOBAL NUCLEAR FUEL – AMERICAS, LLC
DOCKET NO. 70-1113
MATERIALS LICENSE SNM-1097

By letter dated January 20, 2022 (ADAMS Accession No. ML22020A129, Reference 1), Global Nuclear Fuel – Americas, LLC (GNF-A) requested NRC approval to use its current nuclear criticality safety analytic methods, validation techniques, and minimum margin of subcriticality (MMS) described in NRC license SNM-1097, Chapter 5, "Nuclear Criticality Safety," for applications involving enrichments less than or equal to (≤) 20 weight percent (wt.%) uranium-235 (U-235) in support of planned operations involving high assay low-enriched uranium (HALEU).

The following request for additional information is necessary to determine whether the licensee's proposed MMS is acceptable and to facilitate the NRC staff's review performed in accordance with NUREG-1520, "Standard Review Plan for Fuel Cycle Facilities License Applications," and NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology."

RAI NCS-1

Title 10 of the *Code of Federal Regulations* (10 CFR) 70.61(d) requires, in part, that the risk of nuclear criticality accidents be limited by assuring that under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety (i.e., the MMS).

Section 5.3.B.4 of NUREG-1520, "Standard Review Plan for Fuel Cycle Facilities License Applications," Revision 2, states that NRC staff reviews should include any relevant portions of the licensee's criticality code validation report(s), as appropriate, in evaluating whether the licensee's proposed MMS is acceptable. Section 5.3.B.4 also states that the reviewer should verify that calculations pertaining to changed operations are still within the licensee's validated area(s) of applicability (AOAs), or that AOA(s) have been appropriately extended, and that the licensee's proposed MMS remains valid.

In evaluating whether the licensee's MMS remains valid, Appendix B to NUREG-1520 states that the reviewer should consider several aspects of criticality code validation before making a qualitative determination of the adequacy of the MMS, including: (1) the similarity of benchmark experiments to actual applications; (2) sufficiency of the data (including the quantity and quality of benchmark experiments); (3) adequacy of the validation methodology; and (4) conservatism in the calculation of bias and bias uncertainty.

Tables 5-2 and 5-6 of the SCALE 6.2.4 Validation Report, "Validation of SCALE 6.2.4/KENO-VI with the Continuous-Energy ENDF/B-VII.1 Cross Section Library for HALEU Systems," provides a range of enrichments of ≤ 37.76 weight percent (wt.%) and ≤ 20.91 wt.% uranium-235 (U-235) for the HALEU Homogeneous Systems and HALEU Heterogeneous Systems areas of applicability (AOAs), respectively. However, a validated version of SCALE, SCALE 6.1/KENO-VI, already covers enrichments up to 8 wt.% in its AOAs.

a. State whether the SCALE 6.2.4 Validation Report is intended to replace, or simply supplement, the SCALE 6.1/KENO-VI Validation Report. Clarify which version of SCALE will be used for applications involving enrichments up to 8 wt.% U-235.

GNF-A Response:

SCALE 6.1.3/KENO-VI validation report (ref. ADAMS Accession No. ML20175A206) utilizing the ENDF/B-VII continuous energy cross section library is used to support the existing LWR fuel forms for material enrichments up to 8.0 wt.% U235 (a.k.a., “LEU+”).

SCALE 6.2.4/KENO-VI validation report (ref. ADAMS Accession No. ML22020A129) utilizing the ENDF/B-VII.1 continuous energy cross section library will be used to replace SCALE 6.1.3 validation report to support advanced reactor fuel forms for planned future HALEU process applications (including TRISO and/or metallic uranium Natrium fuel fabrication) for enrichments up to 20.0 wt.% U235.

Any GNF-A licensing action supporting a process application above 8.0 wt.% will utilize SCALE 6.2.4/KENO-VI.

b. Section 5.4.5.2 of the SNM-1097 License Application describes several analytical methods to perform nuclear criticality safety analyses (e.g., GEMER, GEKENO, MCNP, etc.). State the ranges of use for each analytical method described in Section 5.4.5.2 of the SNM-1097 License Application. Clarify which analytical methods will be used for applications involving enrichments greater than 5 wt.% U-235.

GNF-A Response:

LEU+ (up to 8.0 wt.% U235 enrichment) and HALEU (up to 20.0 wt.% U235 enrichment) process applications at GNF-A utilize the SCALE/KENO-VI code using continuous energy cross sections as described in response (a).

GEMER/GEKENO methods described in the current Chapter 5 (rev. 5) are no longer actively used; the former will be retained in Chapter 5 (rev. 6) for legacy purposes.

MCNP5 (or later) is used to support the Criticality Accident Alarm System detector placement analysis to determine adequacy of detector placement in the existing GNF-A fuel manufacturing and support complex.