Global Nuclear Fuel

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Global Nuclear Fuel

Security-Related and Proprietary Information Notice
This letter forwards security-related and proprietary information requested to be withheld from public disclosure in accordance with 10 CFR 2.390. Upon removal of Attachment 2, Page 1.8, and Attachment 7 the balance of this letter can be made public.

M220086

June 24, 2022

Director, Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attn: Document Control Desk

Subject: GNF-A License Amendment Request for 8 wt. % U 235 (LEU+)

References:
1) NRC License SNM-1097, Docket 70-1113
2) GNF-A/NRC License Amendment Request Pre-Application Meeting, 7/24/19
3) NRC Review of the GNF-A Minimum Margin of Subcriticality for Up to 8 Weight Percent Uranium Enrichment and Amendment 16, 8/13/20
4) GNF-A/NRC License Amendment Request Pre-Application Meeting, 5/3/22

Dear Sir or Madam:

The Global Nuclear Fuel – Americas L.L.C. (GNF-A) facility in Wilmington, North Carolina hereby submits a license amendment request to our approved SNM license and renewal application (Reference 1).

General Information

As we discussed on July 24, 2019 and May 3, 2022 (References 2 and 4), pursuant to 10 CFR 70.34, GNF-A is requesting a license amendment to permit nuclear fuel fabrication at material enrichments up to 8.0 wt.% U 235 which is also referred to as LEU+.. This includes receipt, handling, and storage of Model 30B UF_6 cylinders. On demand, the 30B UF_6 cylinders are transported onsite by Fuel Support personnel to the Dry Conversion Process (DCP) vaporization autoclave process and the UF_6 is vaporized; the UF_6 gas is fed to the DCP conversion reactor-kiln and converted to UO_2 powder where it is discharged to powder outlet cooling hoppers; and after cooling the powder is discharged to powder containers and placed into storage. The downstream powder preparation processes include standard homogenization, blend, precompact, granulate, and tumble operations. Once the powder is ready, it is then transferred to press feed and green pellets are discharged from the rotary presses. The green pellets are stored in pellet boats and then converted to ceramic grade UO_2 pellets in the sintering furnaces. The sintered UO_2 pellet is then subjected to grind, rod load, and bundle assembly to fabricate a nuclear fuel bundle.

For this license amendment request, the GNF-A nuclear fuel conversion and fuel fabrication facility will be impacted. Fuel support activities such as 30B cylinder receipt, pad storage, incineration, decontamination facilities, liquid radwaste effluent treatment systems will likewise be impacted by the change to permit 8.0 wt.% U 235 enriched uranium to be processed. There are no plans for segmentation of the fuel fabrication facility based on enrichment. The entire fuel fabrication facility will be approved and controlled to safely process material enrichments up to 8.0 wt.% U 235.

There are no changes required to the current license possession limits.

Integrated Safety Analysis

SNM-1097 program commitments to document criticality safety analyses (CSAs), conduct process hazards analysis (PHA), document quantitative risk assessments (QRA), and maintain an Integrated Safety Analysis Summary (ISAS) remain unchanged as a result of this license amendment request. GNF-A has re-evaluated and documented CSAs using the current methodologies and minimum margin of subcriticality for existing operations at the requested enrichment limit of 8.0 wt.% U 235.

Based on completed safety analysis work, the enrichment increase does not create new types of accident sequences and there are no plans to use new processes, technologies, or control systems in which GNF-A has no prior experience. In addition, there are currently no “sole” IROFS identified in the ISAS that could be altered. Controls necessary to meet 10 CFR 70.61 performance requirements were systematically evaluated and changes to Items Relied on for Safety (IROFS) have been identified. GNF-A is not requesting any changes to the existing ISA program commitments in SNM-1097.

As stated in our pre-application meetings, the ISAS will be updated after NRC approval in accordance with internal procedures using the ISA program described in Chapter 3 of SNM-1097. The ISAS will be revised through the Change Management program described in Chapter 3 and 11 of SNM-1097.

A copy of an updated draft ISAS pursuant to 10 CFR 70.65(b) is provided as Attachment 7 to this letter.

Facility Modifications

Several facility changes are underway to support processing of uranium enriched up to 8.0 wt.% U 235. As described in Section 3.5.1 of SNM-1097, evaluations have been performed of each change to determine if it requires prior approval by the NRC. Section 1.3.1.2 of SNM-1097 provides criteria for changes that do not require prior approval by the NRC, which are based on the criteria in § 70.72(c). No facility changes have been identified that require prior NRC approval.

Criticality Safety

The criticality safety function has evaluated the proposed amendment and has concluded the request to increase the enrichment to 8 wt.% U 235 will result in modifications to select nuclear criticality safety controls as documented in supporting Criticality Safety Analyses (CSAs) prepared in accord with Chapter 5 of SNM-1097. Current program commitments and practices were followed to assure the system remains subcritical under both normal and credible abnormal operating conditions. Changes to SNM-1097 license chapters are shown in attached; changes to controls elevated to IROFS necessary to meet 10CFR70.61 performance requirements are described in the attached ISAS.

Radiation Safety

The radiation safety function has evaluated the proposed amendment and has concluded the request to increase the enrichment to 8 wt.% U 235 will not result in modifications to the radiation protection program described in Chapter 4 of SNM-1097. Current practices and processes are sufficient to contain the uranium and ensure exposures to personnel and the environment are maintained ALARA.

Radiological accident sequences identified in the ISA did not change as a result of this license amendment request. Increasing the enrichment limit increases the maximum specific activity of uranium that could be involved in radiological accident sequences identified in the ISA, which in turn reduces the Material-at-Risk (MAR) threshold masses required to reach intermediate or high threshold consequence severities established in 10 CFR 70.61.Calculations supporting the ISA consequence severities have been updated to address changes in specific activity and MAR thresholds. The reduced MAR thresholds do not result in any increases to the consequence severities of events identified in the ISA.

Chemical Safety

The chemical and physical forms of the uranium throughout the GNF-A nuclear fuel fabrication and support processes remain unchanged. The uranium chemistry in the UF_6 to UO_2 conversion process is not affected by the enrichment change. The uranium compounds and hydrocarbon additives now used in the powder preparation process remain unchanged. The sintered UO_2 pellet and product powder material uranium chemical and physical characteristics are likewise unchanged by a change in enrichment. There are no unforeseen chemical or physical forms in the SNM processes involving uranium enriched to 8 wt.% U 235. As a result, the license amendment will not result in modifications to the chemical safety program described in Chapter 6 of SNM-1097; nor are there anticipated changes to the existing acute chemical exposure accident sequences and IROFS that prevent or mitigate these accident sequences currently identified in the current GNF-A ISA Summary.

Fire Safety

The license amendment will not result in modifications to the fire safety organization, management, or program elements described in Chapter 7 of SNM-1097. There are no anticipated changes to the existing fire accident sequences or the associated fire safety controls described in fire hazard analysis. In addition, there are no changes to fire safety commitments regarding facility design, process fire safety, or fire protection systems described in Section 7.4 through 7.10 of SNM-1097. Any changes made to implement the amendment request that could affect fire safety will be evaluated under the existing configuration management program. If changes to existing fire protection systems, fire hazard analyses, pre-fire plans or any other fire safety related document are identified, they will be addressed appropriately.

Emergency Planning

The current Radiological Contingency and Emergency Plan (RC&EP) does not specify source terms, IROFS, or estimated exposures thus no changes are required. The RC&EP generally discusses the types of accidents that could occur at GNF-A based on the accident sequences identified in the ISA Summary. The severities of exposures to the public for significant events that could potentially result in high or intermediate consequences to the public are evaluated in the ISA based on the source term, release parameters, and atmospheric dispersion. Information on these types of evaluations is included in ISA documentation as required by procedures. Where necessary the ISA also specifies the preventive or mitigative IROFS required to make high consequence events highly unlikely, or intermediate consequence events unlikely. This detailed information is not reiterated in the RC&EP.

The impact of increasing the maximum enrichment from 5% to 8% is that the maximum specific activity of uranium that could be involved in an event would increase by approximately the same ratio. Radiological exposures to the public from a given event could therefore be slightly higher. However, the events with the highest potential consequences involve UF_6 releases and the chemical consequences from exposure to HF or soluble uranium produced from a UF_6 release outweigh the radiological consequences. The chemical consequence severities will not be affected by the change in enrichment and will remain the dominant exposure consequence. Calculations supporting the ISA consequence severities have been updated to address the change in maximum specific activity due to the increase in the maximum enrichment limit.

The incremental increase in potential exposures will not increase the public consequence severities levels of events identified in the ISA.

No new events that could result in public radiological exposures are anticipated as a result of this amendment request. In addition, no changes to facility features or IROFS that prevent or mitigate exposures to the public are anticipated. There are no changes of significance to the process or physical locations where accidents could occur.

Based on the above discussion, the license amendment is not anticipated to have an affect the RC&EP.

Environmental Protection

Pursuant to 10 CFR 51.60(b)(2), the license amendment will not require an environmental report because it will not result in:

- A significant expansion of the site or construction impact
- A significant change in the types of effluents
- A significant increase in the amounts of effluents
- A significant increase in individual or cumulative occupational radiation exposure
- A significant increase in the potential for or consequences from radiological accidents
- A significant increase in spent fuel storage capacity

The licensing action will not individually or collectively have a significant effect on the human environment and meets the 10 CFR 51.22(c)(11) criterion for categorical exclusion. The license amendment does not significantly alter the previously evaluated environmental impacts associated with the licensed operation and does not affect the scope or nature of the licensed activity.

Decommissioning

There are no changes to the types, amounts, and discharge points of waste materials in solid, liquid, and gaseous forms that are considered in the current decommissioning cost estimate and funding plan. The increase in enrichment does not change waste disposal costs.

In addition, 10 CFR 70.25(e)(2) lists eight events to be considered during a DFP update. Of these, there will be minor facility modifications. For example, the planned enrichment increase will require favorable geometry liquid radwaste process tank dimensions now used at 5% enrichment to be replaced with new favorable geometry tank dimensions to process 8% enriched liquid waste. These modifications will not affect the current decommissioning cost estimate.

There are no changes required to the decommissioning cost estimate for the other seven events (waste inventory, disposal cost increases, spills of radioactive material producing additional residual radioactivity, changes in authorized possession limits, actual remediation costs that exceeded previous cost estimate, onsite disposal and use of a settling pond).

Material Control and Accounting

The Material Control and Accountability (MC&A) function has evaluated the proposed amendment and commits that changes to the policies, procedures, and controls to support the proposed amendment will be implemented consistent with the existing MC&A program. The Fundamental Nuclear Material Control Plan (FNMCP) currently in place for GNF-A will continue to satisfy the requirements of 10 CFR 74.31. The information in the Plan demonstrates the adequacy of the compliance program for fulfilling the requirements of 10 CFR 74.31 with regard to the licensing to possess and use special nuclear material of low strategic significance referenced as low enriched uranium (less than 10 wt. percent U235).

SNM-1097 Chapter Revisions

A description and reason for the change in each affected renewal application chapter is provided in Attachment 1 to this letter to aid NRC Staff review.

Attachments 2, 4, 5 and 6 provide updates to Chapter 1, "General Information", Chapter 5, "Nuclear Criticality Safety", Chapter 8, "Radiological Contingency and Emergency Plan" and Chapter 10, "Decommissioning". The revised sections are identified with a vertical line in the right-hand margin on each revised page.

Schedule

GNF-A requests NRC review and approval of the amendment within 12 months of this request.

Please contact me on (910) 819-5950 if you have any questions or would like to discuss the request.

Sincerely,

Scott P. Murray, Manager
Facility Licensing

Attachments:
1) SNM-1097 Change Table Summary
2) SNM-1097 Chapter 1-Contains Security Related Information
3) SNM-1097 Chapter 1, Page 1.8 (Public)
4) SNM-1097 Chapter 5
5) SNM-1097 Chapter 8
6) SNM-1097 Chapter 10
7) GNF-A Integrated Safety Analysis Summary (Draft), Revision 25A, June 2022 (Contains Security Related Information)

cc: J. Rowley, USNRC NMSS/DFM/FFLB
J. Rivera, USNRC RII
SPM 22-023

M220086
US NRC
6/24/22

GNF-A License Amendment Request for 8 wt % U 235

Attachment 1

SNM-1097 Change Table Summary

SNM-1097 License Application Change Table 06/24/2022		
Section	**Description of Change**	**Reason for Change**
Chapter 1 -GENERAL INFORMATION		
Section 1.1 – Facility and Process Description	Second sentence changed enrichment limit value from 5.0 to 8.0 weight percent U-235.	Enrichment limit change
Figures 1.2, 1.3	Updated to reflect I-140 and ATC-2, respectively	Update map and facility configuration to reflect current.
Section 1.1.4 – Process Description	First sentence changed enrichment limit value from 5.0 to 8.0 weight percent U-235.	Enrichment limit change
Section 1.2.2 – Type, Quantity, and Form of Licensed Material	Sub-bullets 1) and 2) change enrichment limit value from 5.0% to 8.0%	Enrichment limit change
Section 1.3.3.1 – Transfer of Hydrofluoric Acid (HF) for Testing	Second paragraph changed enrichment limit value from 5.0% to 8.0% U-235.	Enrichment limit change
Section 1.3.3.2 – Transfer of Hydrofluoric Acid (HF) as Product	First paragraph changed enrichment limit value from 5.0 to 8.0 weight percent U-235.	Enrichment limit change
Section 1.3.3.3 – Transfer of Nitrate- Bearing Liquids	First paragraph, changed enrichment limit value from 5.0 weight percent U-235 to 8.0 weight percent U-235.	Enrichment limit change
Chapter 5 -NUCLEAR CRITICALITY SAFETY		
Section 5.1.1 a) – Criticality Safety Design Philosophy	NCS program commitments statement a) remove the words “an inadvertent” from sentence.	Text clarification; words unnecessary
Section 5.1.2.1	Second sentence, change… in accord… to …in accordance.	Text reformatting; correct grammar.

Section 5.1.2.2 Role of the Criticality Safety Function	Second sentence changed "… commensurate with the risk involved" to "…. commensurate with risk".	Text clarification; words unnecessary
Section 5.3.2.5	Change first sentence word "uniform" to "installed" ….	Improve clarity.
Section 5.4.2.3 – Administrative Controls	First paragraph describing augmented administrative controls and administrative controls are split into two separate bullets.	Text reformatting
Section 5.4.3 – Specific Parameter Limits	First paragraph, last sentence removes percentage basis statement for Table 5.1 favorable geometry values and replaces with new basis statement. Acceptable safety margins for units listed in this table are documented in accord with Section 5.4.5 analysis methods (keff + 3σ ≤ USL).	Historical percentages of published literature critical diameter, slab thickness, and sphere volume are now derived explicitly.
	Second paragraph, last sentence changed to acknowledge subcritical limits in accord with Section 5.4.5.	Text clarification.
	Third paragraph, last sentence changed to acknowledge mass limits are based on enrichment (not U235 mass limits).	Text clarification; uranium enrichment is basis of mass limits.
	First bullet in section; second sentence changed to removed "over the range of 1.1% to 5%" as this enrichment range is no longer valid.	Text clarification; words unnecessary
	Table 5.1 Favorable Geometry Values – reported values have been replaced with calculated results for homogeneous UO_2 and water, homogeneous aqueous uranyl nitrate and water, and heterogeneous UO_2 and water mixtures over the enrichment range from 5.0 to 8.0 weight percent U-235 as noted above. Theoretical densities used are specified and based on SCALE6.1 standard composition library.	Historical percentages of published literature critical diameter, slab thickness, and sphere volume are now derived explicitly from SCALE/KENO-VI calculated minimum critical masses using ce_endf_v7 cross section library.

5.4.3 Specific Parameter Limits	Second paragraph, second sentence reworded.	Text clarification; words unnecessary.
	Table 5.2 Safe Batch Values for UO_2 and Water – reported values have been replaced with calculated safe batch results for homogeneous UO_2 powder and water and heterogeneous UO_2 pellets and water mixtures over the enrichment range from 5.0 to 8.0 weight percent U-235.	Table 5.2 lists safe batch limits as a function of enrichment from 5.0 to 8.0 weight percent U-235. Text update.
	First paragraph, first sentence; removed reference to Solid Angle methods (SAC code) and Monte Carlo code GEKENO, added MCNP. Removed previous third paragraph GEKENO summary description paragraph.	Historical methods using Solid Angle methods or GEKENO 16-energy group Knight Modified Hansen Roach cross section data set are no longer used in production applications. MCNP is added as it may also be used in support of production applications.
	Second paragraph (new) added to more fully describe the SCALE/KENO-VI Monte Carlo code used solve eigenvalue solution to the neutron transport equation in 3-dimensional space.	Provide summary description of SCALE/KENO-VI transport code now used in support of production applications.
	Fourth paragraph (new) added to more fully describe the MCNP Monte Carlo neutron particle transport code used solve eigenvalues for fissile medium systems.	Provide summary description of MCNP transport code now used in support of production applications.
5.4.4.6 – Spacing (or Unit Interaction)	Remove second paragraph, first sentence as Solid Angle interaction analysis is no longer used.	Text clarification; words unnecessary- as Solid Angle methods no longer used.
5.4.4.8 Reflection	Change second sentence to acknowledge 1-inch water reflection (minimum).	Clarification of current practices consistent with NUREG-1520.
5.4.5.3- Validation Techniques		

	First and sixth paragraphs; replace ANSI/ANS-8.1-1998 reference with current ANSI/ANS-8.1-2014 (R2018).	Text update to current standard.
	Replace last bullet with clarified and corrected statement: “Statistical methods may be used to ensure that the extrapolation is not large. The SCALE/TSUNAMI code may be used to compare the application system to the benchmark experiments for similarity and USL penalty determination.	Text clarification; and acknowledgement of TSUNAMI code to quantify AOA_m.
5.4.5.4 - Computer Software & Hardware Configuration Control	Second paragraph; update verification of software to acknowledge results may be identical or within statistical uncertainty.	Acknowledge statistical uncertainty permitted in verification case set results.
	Change third paragraph to read, “Modifications to software and nuclear data that may affect the calculational results that fall outside statistical uncertainty require re-validation of the software.	Text clarification; additional words unnecessary.
5.4.5.5- Criticality Safety Analysis	Sixth bullet: Specifications and Requirements for Safety; removed out of place / incomplete sentence containing “interface considerations….”	Text correction; interface considerations for the process being analyzed is previously addressed in the general process description section of the documented nuclear criticality safety evaluation.
Chapter 8- RADIOLOGICAL CONTINGENCY AND EMERGENCY PLAN	Changed third paragraph plan update reporting location	Align with revised 10 CFR 70.32 (i)
Chapter 10- DECOMMISSIONING	Changed first sentence decommissioning funding plan date Changed third sentence to remove “parent company guarantee” reference	Text updates