

SAFETY EVALUATION REPORT

DOCKET: 70-3103

LICENSE: SNM-2010

LICENSEE: Louisiana Energy Services, LLC

SUBJECT: LOUISIANA ENERGY SERVICES, LLC, – AMENDMENT 105, APPROVAL OF URENCO USA LICENSE AMENDMENT REQUEST TO RAISE THE ENRICHMENT LIMIT TO LESS THAN 10 WEIGHT PERCENT FOR LOW-ENRICHED URANIUM PLUS PRODUCTION SYSTEMS (ENTERPRISE PROJECT IDENTIFIER L-2023-LLA-0168)

1.0 **BACKGROUND**

On November 30, 2023 (Agencywide Documents Access and Management System Accession No. ML23334A122), Louisiana Energy Services, LLC, dba Urenco USA (UUSA), requested the U.S. Nuclear Regulatory Commission (NRC) approval of a license amendment request (LAR) to increase the enrichment limit in special nuclear material (SNM) license SNM-2010, License Condition 6B, from 5.5 weight (wt.) percent uranium-235 (U-235) to less than 10.0 wt. percent U-235 (labeled LAR 23-02). The request focuses on production aspects of the proposed increased enrichment limits and interim controls and excludes the production-related recycling and support systems. The request provided a description and analysis of the proposed change, basis for the change, and safety significance of the proposed change.

The NRC staff issued requests for additional information (RAIs) by letters dated July 12, 2024 (ML24193A213) and September 16, 2024 (ML24248A189), to obtain information needed to conduct a detailed technical review. By letters dated August 1, 2024 (ML24214A300) and October 13, 2024 (ML24288A009), UUSA provided responses to the NRC staff's requests.

The NRC staff conducted its review in accordance with NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Application" (ML15176A258), NUREG/CR-5734, "Recommendations to the NRC on Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Enrichment Facilities" (ML15120A354), and NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology" (ML050250061). The NRC staff also reviewed the request for compliance with that the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," 10 CFR Part 20, "Standards for Protection Against Radiation," 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," and 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material." Where the applicant's design or procedures should be supplemented, the NRC staff has identified license conditions to provide assurance of safe operation.

2.0 TECHNICAL EVALUATION

2.1 Organization and Administration

PURPOSE OF REVIEW

The purpose of the review of UUSA's organization and administration is to ensure that the proposed management hierarchy and policies will provide reasonable assurance that UUSA plans, implements, and controls site activities in a manner that ensures the safety of workers, the public, and the environment. The review also ensures UUSA has identified and provided adequate qualification descriptions for key management positions.

The NRC staff initially reviewed and approved the Organization and Administration chapter for UUSA in 2005, as documented in its Safety Analysis Report (SAR).

REGULATORY REQUIREMENTS

The regulations in 10 CFR 70.22(a)(6), 70.23(a)(2), and 70.62(d) requires a management system and administrative procedures for the effective implementation of health, safety and environment (HS&E) functions concerning the applicant's corporate organization, qualification of the NRC staff, and adequacy of the proposed equipment facilities, and procedures to provide adequate safety for workers, the public and the environment. Specifically, 10 CFR 70.22(a)(6) requires an applicant to include "The technical qualifications, including training and experience of the applicant and members of his staff to engage in the proposed activities in accordance with the regulations in this chapter."

The regulations in 10 CFR Part 70, Section 70.72(c), identifies changes that may be made to license basis documents without prior NRC review and approval. Changes that do not meet the criteria established in Section 70.72(c) require a license amendment request in accordance with Section 70.34.

REGULATORY GUIDANCE

The NRC staff used the guidance in NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications."

REGULATORY ACCEPTANCE CRITERIA

The guidance applicable to the NRC staff's review of the organization and administration section of the LAR is contained in Section 2.4.3 of "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," NUREG-1520, Revision 2.

Section 2.3 of NUREG-1520, Revision 2, "Areas of Review," includes areas of review for both new facility applications and applications for modifications of existing facilities. Because the LAR involves modification to an existing license, the areas of review for existing facilities are applicable. Similarly, Section 2.4.3 of NUREG-1520, Revision 2, "Regulatory Acceptance Criteria," lists acceptance criteria for both new facilities and existing facilities. The regulatory acceptance criteria for existing facilities are applicable to the LAR.

NRC STAFF REVIEW

The NRC staff reviewed the SAR to determine if the organizational structure and associated administrative program proposed by UUSA includes adequate administrative policies, procedures and management policies, and qualifications of key management positions and describe how these will provide reasonable assurance that the HS&E protection functions will be effective.

This section of the Safety Evaluation Report (SER) documents the NRC staff's review and analysis of UUSA SAR Chapter 2, "Organization and Administration," for production of uranium enriched to less than 10.0 wt. percent U-235 (termed Low Enriched Uranium Plus (LEU+) by the fuel cycle industry).

EVALUATION FINDINGS

The NRC staff determined that there are no changes to the UUSA organization and administration for LEU+ production as presented in LAR 23-02. The organization and administration at UUSA remains adequate and acceptable.

2.2 Integrated Safety Analysis

PURPOSE OF REVIEW

The LAR would allow UUSA to produce uranium hexafluoride (UF₆) to support industry demand in using fuel enriched to less than 10.0 wt. percent U-235 (LEU+). The LAR includes changes to License Conditions 6B, 7B, and 8B, as well as for use of a 30B-10 product cylinder among other administrative changes. This LAR focuses on production aspects of the proposed increased enrichment limits and interim controls and excludes the production recycling systems and components for non-LEU material. The changes results in new and/or revised accident sequences, new and/or revised IROFS, Hazard and Operability Studies (HAZOP) and risk determination analyses, and Integrated Safety Analysis (ISA).

The purpose of this review is to determine whether the UUSA ISA program will continue to be in compliance with 10 CFR 70, Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material," should the NRC approve the LAR. The NRC staff also determined if the ISA Summary will continue to provide reasonable assurance that:

- 1) UUSA conducted an ISA of appropriate detail for each applicable process, using methods and qualified staff adequate to achieve the requirements of 10 CFR 70.62, "Safety program and integrated safety analysis;"
- 2) UUSA identified and evaluated in the ISA credible events involving process deviations or other events internal to the facility (e.g., explosions, spills, and fires) and credible external events that could result in facility-induced consequences to workers, the public, or the environment, that could exceed the performance requirements of 10 CFR 70.61, "Performance requirements," and
- 3) UUSA appropriately designated IROFS, evaluated those IROFS for preventing or mitigating the applicable accident sequences and applied its management measures

program to demonstrate compliance with the performance requirements of 10 CFR 70.61.

REGULATORY REQUIREMENTS

The NRC staff evaluated UUSA's ISA program as described in its LAR and ISA Summary to determine whether UUSA meets the following requirements:

- a) The regulations in 10 CFR 70.61 require that the ISA evaluate compliance with performance requirements. Those requirements specify that the risk of each credible high-consequence event must be limited such that the likelihood of occurrence is highly unlikely, and the risk of each credible intermediate-consequence event must be limited such that the likelihood of occurrence is unlikely.
- b) The regulations in 10 CFR 70.62 require the licensee to establish and maintain a safety program, including process safety information, the performance of an ISA that demonstrates compliance with the performance requirements of 10 CFR 70.61 and management measures. The ISA must identify radiological hazards, chemical hazards, facility hazards that could affect the safety of licensed materials and thus present an increased radiological risk, potential accident sequences, the consequence and likelihood of occurrence of each potential accident sequence, and each IROFS.
- c) The regulations in 10 CFR 70.65, "Additional content of application," require the licensee to submit an ISA Summary with the amendment that contains specific information to demonstrate compliance with 10 CFR 70.61.

REGULATORY GUIDANCE

The NRC staff used the guidance in NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications."

REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of UUSA's ISA are outlined in Sections 3.4.3.1 and 3.4.3.2 of NUREG-1520, Revision 2. The acceptance criteria in Section 3.4.3.1 pertain to the performance of an ISA, while the criteria in Section 3.4.3.2 cover the content of the ISA Summary.

NRC STAFF REVIEW AND ANALYSIS

To support the requested change in enrichment, Enclosure 2 of the submittal provides a detail description of the proposed changes for increased enrichment production. The LAR describes the changes to the various systems and processes, as well as new or revised accident sequences. The LAR further describes new or revised IROFS the licensee has determined are needed to demonstrate that the performance requirements of 10 CFR 70.61 remain satisfied. Given the proposed enrichment limit change and modification to IROFS, the NRC staff determined that it should review UUSA's ISA program.

The NRC staff evaluated the LAR, current licensing basis documents, (i.e., SAR, ISA Summary and license), and UUSA's responses to the NRC staff's requests for additional

information (RAI) dated October 13, 2024 (ML24288A009). The LAR included proposed changes to Sections 1.0, 3.0, 5.0, and 6.0 of the SAR, as well as changes to multiple sections of the ISA Summary. The following sections summarize the NRC staff's review and analysis of the UUSA ISA program and the ISA Summary.

INTEGRATED SAFETY ANALYSIS

Section 3.4 and 3.6 of the SAR, were modified to include/edit information associated to the LAR changes. The NRC staff reviewed the proposed SAR changes and found them to be consistent with the descriptions and supporting information provided in the LAR. Therefore, the NRC staff focused its review on changes to the ISA and on the UUSA demonstration of compliance with 10 CFR 70.61.

The NRC staff reviewed the LAR and the proposed changes to the ISA Summary and the supporting evaluations provided via RAI. UUSA described the evaluations performed to each of the processes impacted by the increase in enrichment and performed evaluations for each of the areas impacted. These evaluations considered HAZOP, new and/or revised accident sequences, new and/or revised IROFS changes to criticality and non-criticality accident sequences.

The NRC staff review process was based on the information provided in Enclosure 2 of the submittal. Therefore, the description of the NRC staff review described below follows the structure of Enclosure 2. A large majority of the changes implemented in this LAR deal with the nuclear criticality. The NRC staff reviewed the entirety of the information provided in Enclosure 2 for completeness and selected a sample of specific accident sequences from each of the process areas impacted by the LAR for detailed review. For each of the selected accident sequences, the NRC staff reviewed the changes made to the ISA as presented in Enclosures 4 and 5 of the LAR, along with detailed calculations and the associated hazard evaluation provided as reference for each accident sequence.

The NRC staff found that the licensee conducted process hazard analyses using acceptable methodologies. The NRC staff also found that UUSA adequately used the results of the ISA to identify process hazards, credible accident scenarios, the consequences and likelihood of those scenarios, and the IROFS needed to meet the performance requirements of 10 CFR 70.61 as a result of the changes implemented in this LAR.

The enrichment process in effect for this LAR comprises four major systems: UF₆ Feed System, Cascade System, Product Take-off System, and Tails Take-off System. Other product related functions include the Product Blending and Liquid Sampling Systems, and Contingency Dump System. Supporting functions include sample analysis, equipment decontamination and rebuild, liquid effluent collection, and solid waste management. The following sections of the SER summarize by major system the specific sample of changes and accident sequences from the LAR, which the NRC staff evaluated.

Cascade System/Contingency Dump System

One of the listed changes in Enclosure 2 includes revised requirements for the periodicity of IROFSC22 because of the increase in the enrichment to less than 10 wt. percent. IROFSC22 is a sole administrative IROFS to perform a cascade process mass balance on a periodic basis to ensure subcriticality. Supporting calculation NCS-CSA-116, provides the basis of the periodicity (how frequently to perform the check) of the mass balance check.

IROFSC22 changes to periodicity were evaluated by the NRC staff and found to be acceptable. Due to the risk reduction and the safety significance of this control, the NRC staff reviewed the assumptions used for both the uncontrolled and controlled accident sequence as documented in accident identifier EC3-1 from Enclosure 5.

In response to the NRC staff RAI (ML24288A009), UUSA clarified that no changes to the uncontrolled and controlled accident sequence EC3-1 were made. And UUSA noted in its response that the NRC staff previously reviewed and approved changes to the IROFS control to prevent EC3-1, in a 2010 SER (ML101530562). Additionally, UUSA provided: (1) clarifications to the cause of the upset documented in accident identifier EC3-1; (2) additional information on the failure frequency of the initiating event; (3) the failure probability index of (-3) for IROFSC22 as well as; (4) information discussing the independence between IROFSC22 and the accident sequence initiating event. The NRC staff reviewed these changes, the additional clarifications provided by the RAI and confirms there are no impacts to the system that undermines the NRC staff's basis for prior approval.

A series of new accident sequences and IROFS were identified by UUSA in this system and added to the ISA Summary to replace previously characterized safe-by-design components to IROFS. Safe-by-design components are defined by UUSA in Section 3.1.1.5.2 of the ISA Summary, as those components that by their physical size or arrangement have been shown to have an effective neutron multiplication factor, $k_{eff} < 0.95$, via MONK analysis for components and systems with an enrichment less than or equal to 6.0 wt. percent. As a result of the proposed increase to less than 10 wt. percent, some components would no longer meet the criteria in Section 3.1.1.5.2 of the ISA Summary. For example, the criteria for safe-by-volume, safe-by-diameter, or safe-by-slab thickness would not be met. All the new accident sequences and new safe-by-design IROFS address criticality and UUSA provided detailed HAZOP analyses and nuclear criticality safety (NCS) calculations to support its conclusions.

With regards to the implementation of the ISA methodology, the HAZOP analyses evaluate each of the different systems (i.e., Cascade System) and specific "nodes" or areas contained within the system for the increase of enrichment. The HAZOP identifies the hazards, potential accident sequences, consequences and likelihoods, IROFS, and risk index determinations. The NCS calculations demonstrate how each of the individual components (e.g., cascade valve frame) meets the double contingency principle (DCP). Additionally, the NCS calculations identify the different parameters and acceptance criteria that are controlled and designated as IROFS.

In response to the NRC staff RAI (ML24288A009), UUSA clarified the basis for the initiating event frequency and probability index numbers used for the risk index scoring of the new or revised IROFS identified mainly by replacing safe-by-design passive components to IROFS. Although no specific quantitative evidence or failure data was used to justify the initiating event frequency or probability index numbers, UUSA relied on engineering judgment to qualitatively justify the initiating event frequency of (-2) based on: (1) the operating experience of similarly designed enrichment plants in the world and, (2) the 14 years of experience at the facility to column two of the "-2" frequency index row per Table 3.1-9 of the ISA Summary. For the failure probability index number of (-3) used, UUSA used Table 3.1-10 of the ISA Summary for a single Passive Engineered IROFS.

UUSA further identified in each of the new accident sequence descriptions and in their analyses the conservatism (i.e., failures assumed to occur to result in a nuclear criticality

analyses) or safety margin in their calculations. The NRC staff's review of UUSA's systematic approach of analyzing the hazards, its conclusions on meeting the DCP, as well as the safety margin identified by the licensee, finds the risk index scoring for the new or revised IROFS (previously safe-by-design) is adequately protective.

Product System

The NRC staff evaluated the new accident sequences and IROFS proposed to replace safe-by-design. The specific accident sequence sample from changes in this area included accident identifier PT1-100. The NRC staff reviewed NCS-CSA-118 which evaluates the process gas pipework containing gaseous UF₆ during normal operations. Abnormal conditions are bounded by modeling the pipework as filled full of moderated uranyl fluoride (UO₂F₂•xH₂O). Bounding enrichments for each piping size are evaluated. The NCS calculations identified IROFS105, which is controlled by the dimensions and spacing of the various pipes to control geometry and interaction. The NRC staff reviewed UUSA results and finds the risk index scoring for the new IROFS to be acceptable.

Tails System

The NRC staff evaluated the new accident sequences and IROFS proposed to replace safe-by-design. The specific accident sequence sample from changes in this area included accident identifier TT1-102 for IROFS117. The NRC staff reviewed NCS-CSA-120 which evaluates the tails roots pumps with respect to criticality safety.

The NCS calculations identified new IROFS117, which is volume control as defined by liters of an assumed cylinder, as a bounding modeling characteristic of a pump. Based on these results, the NRC staff finds the risk index scoring for the new IROFS to be acceptable.

Movement and Storage of LEU+ Material

The NRC staff evaluated the new accident sequences and IROFS proposed for this area. The increased in enrichment impacts prior methods of movement and storage to account for differences in spacing, mass, or array types. For this reason, UUSA provided analyses of storage locations for rigs or components. These rigs or components will be removed from their operational location after exposure to LEU+ material and placed into areas to await further handling. The storage of rigs or components does modify activities in the Ventilated Room, Decontamination Workshop, Liquid Effluent Collection and Transfer System, and Solid Waste Collection Rooms. However, the current LAR and this SER does not address the activities of handling the rigs or components, which will be evaluated in a future LAR.

The specific accident sequence sample from changes in this area included accident identifier SA1-101 for IROFS125. The NRC staff reviewed NCS-CSA-110 that analyzed sample cylinder storage cabinets to determine criticality safety, and neutronic interaction with other systems or components that may contain fissile material. Plant modifications needed to implement IROFS125 include modifying the sample bottle storage cabinets to allow only a checkerboard loading pattern. IROFS125 establishes design parameters to maintain geometry by depth, width, and height, among other characteristics of the cabinet. The NRC staff reviewed the information in the LAR and finds the risk index scoring for the new IROFS to be acceptable.

Based on its review of the documentation provided by UUSA in the LAR, the NRC staff finds that UUSA has met the acceptance criteria for the performance of an ISA as outlined in Section 3.4.3.1 of NUREG-1520, Revision 2.

The NRC staff finds proposed revision to the ISA Summary, which describes the ISA methodology and processes that would be affected by changes in enrichment, is acceptable and finds that the projected enrichment increase is reflected in the proposed revision to the ISA Summary. The NRC staff also finds the ISA Summary continues to demonstrate that UUSA has established an ISA methodology with the necessary elements to designate IROFS, evaluate those IROFS for preventing or mitigating the applicable accident sequences, and apply management measures to provide reasonable assurance that the performance requirements of 10 CFR 70.61 are met. The NRC staff also reviewed non-criticality accident sequences to determine if a change in enrichment may affect the associated IROFS. The NRC staff did not identify non-criticality IROFS that an increase in enrichment would affect. Furthermore, the NRC staff finds that the ISA Summary demonstrates that UUSA consistently identified and evaluated credible non-criticality accident sequences involving process deviations or other events internal to the facility (e.g., explosions, spills, and fires).

Based on its review of the documentation in the LAR, the NRC staff finds that the licensee meets the acceptance criteria of Section 3.4.3.2 of NUREG-1520, Revision 2.

EVALUATION FINDINGS

The NRC staff finds reasonable assurance that UUSA has established an ISA program that will continue to be in compliance with 10 CFR Part 70, Subpart H. In addition, the NRC staff finds reasonable assurance that the ISA Summary demonstrates compliance with the performance requirements of 10 CFR 70.61. Specifically, the NRC staff finds reasonable assurance that:

- 1) UUSA has conducted an ISA of appropriate detail for each applicable process, using methods adequate to achieve the requirements of 10 CFR 70.62;
- 2) UUSA has identified and evaluated in the ISA credible events involving process deviations or other events internal to the facility (e.g., explosions, spills, and fires) and credible external events that could result in facility-induced consequences to workers, the public, or the environment, that could exceed the performance requirements of 10 CFR 70.61; and
- 3) UUSA has designated IROFS, evaluated those IROFS for preventing or mitigating the applicable accident sequences, and applied its management measures program to demonstrate compliance with the performance requirements of 10 CFR 70.61.

2.2.1 Integrated Safety Analysis – Natural Phenomena Hazards

PURPOSE OF REVIEW

The purpose of this review is to evaluate whether UUSA meets the applicable requirements for the systems, structures, and components (SSCs) for the proposed changes to authorize the production, handling and storage of enriched UF₆ to less than 10 wt. percent U-235.

REGULATORY REQUIREMENTS

The NRC staff reviewed how the information in the application addressed the following regulations:

- 10 CFR 70.61(e) requires, in part, that each engineered or administrative control or control system that is needed to comply with 10 CFR 70.61 (b), (c) or (d) be designated as an IROFS and requires that the safety program ensuring that each IROFS will be available and reliable to perform its intended function when needed.
- 10 CFR 70.62(c)(iv) requires, in part, that each licensee conduct and maintain an ISA that identifies potential accident sequences caused by credible external events, including natural phenomena.
- 10 CFR 70.64 requires, in part, that the design of new facility and/or new processes incorporate baseline design criteria and defense-in-depth practices and provide adequate protection against natural phenomena hazards (NPH).

Structural Design Bases and Design Criteria

UUSA is required to evaluate NPH in accordance with 10 CFR 70.64 "Requirements for new facilities or new processes at existing facilities." Specifically, 10 CFR 70.64(a)(2) states in part, that the design must provide for adequate protection against natural phenomena with consideration of the most severe documented historical events for the site.

The NRC staff previously reviewed the UUSA original license application (ML040020256), including natural phenomena, and documented its findings in NUREG-1827, "Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico" (ML051780290). Subsequently, in response to the NRC Generic Letter (GL) 2015-01, "Treatment of Natural Phenomena Hazards (NPH) in Fuel Cycle Facilities," UUSA provided a response describing the NPH for its facility located in Eunice, New Mexico (ML15265A047). The NRC staff's review of the licensee's response is documented in an NRC staff evaluation report (ML16256A072), which evaluated the UUSA response to GL 2015-01 and was verified by the NRC staff in Inspection Report No. 70-3103/2017-006 (ML17128A111). Based on the review of the information provided, the NRC staff was able to verify that the licensee adequately addressed the consequences and likelihood of each accident sequence for NPH events for the existing processes at the facility.

Based on the review of the information provided in this LAR, the NRC staff finds that the licensee does not alter or proposes any changes to the structural design basis and design criteria for the site previously reviewed by the NRC staff.

Scope of Review for LAR 23-02

UUSA plans to submit the request for regulatory authorization for increasing the enrichment production and possession of LEU+ in two separate LARs involving various systems, structures and components (SSCs) in each. UUSA proposed in this LAR increased enrichment limit and necessary interim controls, without inclusion of the production recycling systems and components for non-LEU+ material. UUSA noted that there are no physical modifications to the existing facility that require new construction. However, there are modifications necessary for the production handling, storage or

interim controls needed for segregation of removed components that have been exposed to LEU+ material. These modifications are limited to addition of Criticality Accident Alarm System (CAAS) horns, addition of Spacing devices for movement and storage of Type A chemical traps and UF₆ pumps, replacement of a 12-liter storage container with an 11-liter container and a spacing device, removal of aluminum oxide oil adsorption traps on specific mobile rigs, and establishment of a checkerboard pattern for available slots in sample storage cabinets.

As there are no changes to the building facilities structures, and no replacement of major equipment under this amendment, the scope of the NRC staff's reviews for this amendment primarily focused on evaluation of the information the licensee provided for the affected SSCs in the LAR, the revised ISA, and the ISA Summary to ensure appropriate identification and evaluation of controls (i.e. IROFS) for the LEU+ changes for NPH previously identified for the site.

NRC STAFF REVIEW AND ANALYSIS

In reviewing the LAR, the NRC staff noted that the changes to the affected systems and components at the facility need to be addressed appropriately, consistent with the requirements for new processes in 10 CFR 70.64 and the identification of controls relied on to meet the 10 CFR 70.61 performance requirements as IROFS, including for NPH.

Based on the analyses and evaluations for the LEU+ operations, UUSA determined that there were no new types of accidents associated with this LAR. However, the NRC staff finds there were new or revised accident sequences that were evaluated within the Safety Program. The new or revised accident sequences resulted in new or revised IROFS, mainly from replacing the loss of safe-by-design accident sequences. Some IROFS are passive engineered IROFS, and some are administrative IROFS.

The NRC staff notes that the new passive engineered controls identified in the ISA are associated with criticality type accidents. The NRC staff also notes that the new or revised criticality evaluations have accounted for loss of geometry control (during NPH events like earthquakes or tornados) and have shown analyses results to be subcritical. Addressing one of the major changes, UUSA prepared document ISA-IAD-0103, Revision 0, Risk of Criticality Induced by Seismic Event Affecting UUSA (LEU+). The NRC staff's review of ISA-IAD-0103 determined that additional seismic qualification of the plant is not required for LEU+ operations to prevent a criticality event during or following a seismic event. Thus, the NRC staff finds that the revised ISA and ISA Summary have not identified any need for a new or modified controls (i.e. IROFS) for the LEU+ changes for NPH.

EVALUATION FINDINGS

The NRC staff finds that UUSA appropriately conducted an ISA that evaluated changes to the facility to address NPH accidents and the structural performance of SSCs and therefore satisfies the requirements of 10 CFR 70.62(c)(iv) for NPH and structural safety.

The NRC staff finds that established baseline design criteria for the facility protection against NPH remain unaffected by changes in this amendment and therefore satisfies the requirements of 10 CFR 70.64(a)(2) for NPH and structural safety.

2.2.2 Integrated Safety Analysis - Human Factors

REGULATORY REQUIREMENTS

The requirement in 10 CFR) 70.61(e) states that applicants shall establish a safety program to ensure that each item(s) IROFS will be available and reliable to perform its intended function when needed.

The requirement in 10 CFR 70.62(d) states, in part, that each applicant or licensee shall establish management measures to ensure compliance with the performance requirements of 10 CFR 70.61, that the measures applied to a particular administrative control may be graded commensurate with the reduction of the risk attributable to that control, and that management measures shall ensure that administrative IROFS required by 70.61(e) are designed, implemented, and maintained as necessary to ensure they are available and reliable to perform their function when needed.

The requirement in 10 CFR 70.65(b)(4) states, in part, the ISA Summary must include a description of the management measures to be applied IROFS, as well as information necessary to demonstrate compliance with the performance requirements of 10 CFR 70.61.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications," provides guidance to the NRC staff reviewers who perform safety and environmental impact reviews of applications to construct or modify and operate nuclear fuel cycle facilities. Section 3.4.3.1, "Safety Program and Integrated Safety Analysis Commitments," states, in part, that human factors engineering (HFE) should generally be part of the safety program. Human factors practices should be incorporated into the applicant's safety program sufficiently to ensure that IROFS and management measures perform their functions in meeting the requirements of 10 CFR Part 70.

Chapter 11, "Management Measures," provides guidance for compliance with 10 CFR 70.61 is met with reasonable assurance. Specifically, management measures are activities performed by a licensee, generally on a continuing basis, that are applied to IROFS to provide reasonable assurance that the IROFS will perform their intended safety function when needed to prevent accidents or mitigate the consequences of accidents to an acceptable level. As defined in 10 CFR 70.4, "Definitions," management measures include configuration management, maintenance, training and qualification, procedures, audits and assessments, incident investigations, records management, and other quality assurance elements.

Appendix E, "Human Factors Engineering for Personnel Activities," provides guidance to ensure HFE is applied to personnel activities identified as safety significant, consistent with the findings of the ISA, and the determination of whether an IROFS has special or unique safety significance. A graded approach commensurate with the complexity and integration and operation of the control systems is appropriate.

TECHNICAL EVALUATION

In Section 4.1, "Integrated Safety Analysis," of Enclosure 2, "Description of the Proposed Changes for Increased Enrichment Production (LAR 23-02)," UUSA stated that the ISA

Summary analyses and evaluations for LEU+ were performed in accordance with the approved ISA process and Quality Program. As such, there are no new technologies or control systems necessary for LEU+ production. Additionally, there are no changes to safety program commitments (Process Safety Information, ISA and Management Measures). However, there were new or revised accident sequences that were evaluated within the safety program. These new or revised accident sequences did not result in any severity level or accident consequence category changes; however, they did result in new or revised IROFS.

The NRC staff reviewed both the new or revised IROFS associated with the new or revised accident sequences and identified several proposed administrative and enhanced administrative IROFS. UUSA defines administrative IROFS as “a procedural human action that is prohibited or required to maintain safe process conditions.” NUREG-1520, Revision 2, defines the IROFS boundary for “simple” and enhanced administrative IROFS. The IROFS boundary includes everything necessary for the IROFS to perform its intended safety function.

In Section 5, “Implementation,” of Enclosure 2, UUSA stated that “UUSA will implement the necessary changes to operating documents prior to increasing enrichment levels. Changes required include operating procedure revisions, Operating Requirements Manuals revisions, IROFS Boundary Definition Document revisions and change management actions to supporting documents to incorporate this LAR [23-02].” Because there are no changes to the safety program commitments and as defined in the latest Safety Analysis Report, Revision 50d, UUSA will continue to apply an HFE review of the Human-system interfaces for those IROFS requiring operator actions using appropriate NRC guidance. Additionally, the NRC staff reviewed the UUSA process that meets the intent of complying with IROFS requiring operator actions. Moreover, the licensee will also continue to apply management measures to IROFS such that personnel will be trained and qualified to administratively controlled IROFS procedures, and there is adequate procedure development process.

EVALUATION FINDINGS

The NRC staff finds the request to be acceptable because UUSA will continue to apply HFE practices and management measures to the proposed new and revised IROFS requiring operator actions such that the IROFS will be designed, implemented, and maintained as necessary to ensure they are available and reliable to perform their function when needed. Therefore, the NRC staff finds reasonable assurance that the proposed new and revised IROFS are in compliance with 10 CFR 70.61(e) and 70.62(d).

2.3 Radiation Protection

PURPOSE OF REVIEW

The purpose of this review is to determine whether UUSA’s radiation-protection program is adequate to protect the radiological health and safety of workers and to comply with the regulatory requirements.

REGULATORY REQUIREMENTS

The NRC reviewed the radiation protection program described in the UUSA LAR to determine whether the radiological health and safety of workers is adequately protected, as

required by the regulations at 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," 10 CFR Part 20, "Standards for Protection Against Radiation," and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of radiation protection are outlined in Section 4.4.3.3, "Regulatory Acceptance Criteria," of NUREG-1520, Revision 2.

STAFF REVIEW AND ANALYSIS

The proposed inventory of U-235 will be subject to the radiation protection provisions in the current licensed inventory (ML23334A121). The NRC staff finds the current license satisfies: (1) worker qualification requirements; (2) written radiation protection procedures; (3) the radiation work permit program; (4) necessary training requirements for all personnel who have access to radiologically restricted areas; and (5) provides a program to ensure that worker and public doses are as low as is reasonably achievable.

EVALUATION FINDINGS

The NRC staff concluded the current radiation survey and monitoring program is adequate to protect workers and members of the public who may potentially be exposed to radiation in "Safety and Safeguards Evaluation Report for the Renewal of SNM-2010 – Louisiana Energy Services," issued in 2005 (ML051780290). The requested amendment does not change Louisiana Energy Services radiation protection program. Therefore, the NRC staff finds reasonable assurance that the current radiation protection program, as described in the current license, is adequate for the proposed less than 10.0 wt. percent U-235 enrichment.

2.4 Nuclear Criticality Safety

PURPOSE OF REVIEW

The primary purpose of the review is to determine, with reasonable assurance, whether with the proposed changes in the LAR, UUSA will provide adequate protection against criticality hazards related to the storage, handling, and processing of licensed materials, as required by 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material." UUSA must adequately protect the health and safety of workers and the public from the risk of accidental criticality during both normal and credible abnormal conditions.

REGULATORY REQUIREMENTS

The NRC staff conducted its review of the licensee's request to ensure that the proposed changes are consistent with the requirements of 10 CFR Part 70, including:

- 10 CFR 70.24, "Criticality accident requirements;"
- 10 CFR 70.50, "Reporting requirements;"
- 10 CFR 70.52 "Reports of accidental criticality;"
- 10 CFR 70.61, "Performance requirements;"
- 10 CFR 70.62, "Safety program and integrated safety analysis;"

- 10 CFR 70.64, “Requirements for new facilities or new processes at existing facilities;” and
- Appendix A to Part 70, “Reportable Safety Events.”

REGULATORY GUIDANCE

The NRC staff’s review was performed in accordance with NUREG-1520, Revision 2, and portions of NUREG/CR-6698, “Guide for Validation of Nuclear Criticality Safety Computational Methodology” (ML050250061). UUSA’s request did not involve any significant changes to the NCS program, NCS methodology, or ISA methodology; however, the request included new activities involving the production of SNM in excess of its current less than or equal to 5.5 wt. percent U-235 license limit and other factors that necessitate the review of certain aspects of the UUSA NCS program, methodologies, and technical practices. The NRC staff’s review consisted of the following:

- UUSA’s NCS program to ensure its continued effectiveness for enrichments up to less than 10 wt. percent U-235;
- an evaluation of the UUSA minimum margin of subcriticality (MMS) to ensure its continued validity up to less than 10 wt. percent U-235;
- CAAS and changes to SNM-2010 License Condition 33;
- the assurance of subcriticality under normal and credible abnormal conditions for enrichments up to less than 10 wt. percent U-235, including a sample of new or revised NCS evaluations and analyses, NCS-related changes to the ISA and ISA summary, and overall compliance with 10 CFR 70.61 as it relates to criticality hazards;
- changes to Chapter 5.0 of the UUSA SAR; and
- changes to possession limits and SNM-2010 License Conditions 6B, 7B, and 8B.

REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC’s review of nuclear criticality safety are outlined in Section 5.4.3, “Regulatory Acceptance Criteria,” of NUREG-1520, Revision 2 (ML15176A258).

STAFF REVIEW AND ANALYSIS

Chapter 5.0 of the UUSA SAR contains UUSA’s programmatic commitments for management of its nuclear criticality safety (NCS) program. The LAR included administrative changes and several proposed technical changes to Chapter 5.0. However, the most significant change of the LAR was to increase enrichment possession limits. Materials License SNM-2010 currently authorizes UUSA to produce and possess uranium enriched to less than or equal to 5.5 wt. percent U-235. The LAR would authorize UUSA to produce and possess uranium enriched to less than 10 wt. percent U-235.

Nuclear Criticality Safety Program

Section 5.3.B.1 of NUREG-1520, Revision 2, states that reviews should include those portions of the license application (i.e., SAR) affected by the change and should evaluate whether the effectiveness of any license commitments is reduced, or that the licensee has provided an adequate justification that there is still adequate protection against the risk of

accidental criticality. The requested amendment relies on the existing UUSA NCS program and does not involve changes to the management, organization, or administration of the NCS program; NCS training, NCS staff training, and NCS qualifications; management measures applied to the NCS program including characterization and handling of NCS nonconformances, use of procedures, audits, and assessments; use of industry standards; or technical practices such as the performance and documentation of NCS evaluations, treatment of NCS parameters, validation and verification of computational methods, and commitments related to the assurance of subcriticality and the double contingency principle. These elements of the NCS program were previously evaluated and found to be acceptable by NRC staff as documented in NUREG-1827, "Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico," (ML051780290).

In NUREG-1827, the NRC staff concluded with reasonable assurance that UUSA (1) has a staff of managers, supervisors, engineers, process operators, and other support personnel who are qualified to develop implement, and maintain the NCS program in accordance with the facility organization and administration; (2) UUSA's conduct of operations is based on NCS methodologies and technical practices which will ensure that fissionable material will be possessed, stored, and used safely according to the requirements in 10 CFR Part 70; (3) UUSA has developed, implemented, and will maintain a CAAS in accordance with the requirements in 10 CFR 70.24 and the facility emergency management program; and (4) UUSA has an NCS program which is in accordance with the subcriticality of operations and margin of subcriticality for safety requirements in 10 CFR 70.61(d) and baseline design criteria requirements in 10 CFR 70.64(a).

Although the current amendment request necessitates the revision of existing criticality safety evaluations (CSEs) and criticality safety analyses (CSAs), modification of certain limits on controlled parameters, and modification of limits associated with certain IROFS, the licensee's methodology for conducting and documenting CSEs and CSAs, establishing limits on controlled parameters, and designation of IROFS remains unchanged. Furthermore, UUSA's commitments related to NCS technical practices, the assurance of subcriticality under normal and all credible abnormal conditions, and the double contingency principle likewise remain unchanged. The NRC staff noted that while an increase in enrichment can have an impact on safety margin, subcritical margin, and risk, the acceptance criteria contained in Chapter 5 of NUREG-1520, Revision 2, does not explicitly rely on the material enrichment of the facility (the acceptance criteria for fuel facilities that process low-enriched uranium is the same for fuel facilities that process high-enriched uranium) and rather focuses on whether the licensee's NCS program is sufficient to identify credible criticality hazards, limit the risk of credible criticality hazards such that the likelihood of inadvertent criticality is highly unlikely, and assure subcriticality under normal and all credible abnormal conditions. An increase in enrichment does not necessarily increase criticality hazards or increase the likelihood of a criticality accident if the hazards are appropriately controlled via the identification of credible hazards and the limiting of their likelihood. Given the NRC staff's previous conclusions documented in NUREG-1827 that the licensee's NCS program was acceptable, UUSA's overarching commitments to the assurance of subcriticality under normal and credible abnormal conditions and the double contingency principle, and the requirements of 10 CFR 70.61(b) and 10 CFR 70.61(d), the NRC staff determined that UUSA's commitments related to the NCS program were sufficient to provide reasonable assurance of subcriticality under normal and all credible abnormal conditions, provide reasonable assurance of adequate protection against the risk of criticality accidents, and otherwise satisfy the applicable requirements of 10 CFR Part 70 under the conditions of increased enrichment to less than 10 wt. percent U-235.

Minimum Margin of Subcriticality

The NRC staff reviewed the UUSA MCNP6 Validation Report, “Urenco USA (UUSA) MCNP6 Validation” (ML22074A022) and NRC Safety Evaluation Report (SER) for LAR 21-03, “Safety Evaluation Report for License Amendment Request for Revision for Urenco USA – UUSA MCNP6 Validation Report” (hereafter referred to as “SER for LAR 21-03,” ML22129A125). The NRC staff determined that no changes to the licensee’s validation, validation methodology, or MMS were requested as part of LAR 23-02 and that the licensee’s MMS was established for an area of applicability that spanned from depleted to 50 wt. percent U-235 for the parameter of enrichment. Therefore, the NRC staff determined that UUSA’s MMS was appropriate for operations up to less than 10 wt. percent U-235. Proposed changes that could potentially impact the MMS are discussed and evaluated in sections “Chapter 5.0 of the UUSA SAR” and “Changes to SNM-2010 License Conditions 6B, 7B, and 8B” of this report.

Criticality Accident Alarm System/Changes to License Condition 33

The requested amendment does not involve any changes to UUSA’s CAAS coverage or commitments other than to add additional horns and expand the immediate evacuation zone (IEZ); however, License Condition 33 currently authorizes an exemption from the requirement of 10 CFR 70.24(a) to maintain CAAS monitoring for Outdoor 30B Cylinder Storage Areas. The changes to License Condition 33 would prohibit UUSA from storing filled 30B product cylinders containing greater than 5 wt. percent U-235 in the Outdoor Cylinder Storage Areas.

While UUSA will possess 30B cylinders containing greater than 5 wt. percent U-235 when the LAR is approved, the NRC staff considers the proposed change to License Condition 33 necessary to ensure that LEU+ product cylinders will not be stored in the Outdoor Cylinder Storage Areas. Therefore, the NRC staff determined that the requested changes to License Condition 33 are acceptable.

Assurance of Subcriticality - Nuclear Criticality Safety Evaluations

Section 5.3.B.2 of NUREG-1520, Revision 2, states that NRC staff reviews should include, in part, any new or changed assumptions, controlled parameters, safety limits, controls, or safety margin, as well as new or changed criticality accident sequences. Section 5.3.B.5 of NUREG-1520, Revision 2, states that NRC staff reviews should also include the justification for requested changes, including revised criticality safety basis documents (process hazards analyses, criticality safety evaluations, calculations, and other supporting technical documents) that are needed to demonstrate adequate protection against the risk of accidental criticality.

The NRC staff reviewed a sample of CSEs, CSAs, and other NCS documents to verify that the NCS program was being implemented safely and consistent with the commitments in the UUSA SAR and determined that the analyses contained therein were consistent with the NCS technical practices and commitments described in the UUSA SAR. The NRC staff reviewed the following NCS analyses and NCS basis documents:

- NCS-CSA-116, Revision 0, “NCSA of IROFSC22 Periodicity with Normal Cascades at 10 wt.% (LEU+),”

- ISA-IAD-0103, Revision 0, “Risk of Criticality Induced by a Seismic Event Affecting UUSA (LEU+),”
- NCS-CSA-105, “Determination of Critical and Safe Parameters for Uranyl Fluoride Systems (LEU+),”
- NCS-CSE-101, Revision 0, “NCSE of IMU 200/2000 Online Mass Spectrometer (LEU+),”
- NCS-CSE-100, Revision 0, “[NCSE] of Facility Rigs (LEU+),”
- NCS-CSA-117, Revision 0, “[NCSA] of [Gaseous Effluent Vent Systems (GEVS)] Units in the [Separations Building Module (SBM)] (LEU+),”
- CALC-S-00176, Revision 0, “(U) IROFS 53a and IROFS53b Acceptance Criteria at 10 % Production Limit (LEU+),” and
- NCS-CSA-114, Revision 0, “NCSA of Cascade and Assay Unit Evacuation to a Single Tails Cylinder (LEU+).”

The NRC staff observed in the sample of CSEs, CSAs, and other NCS documents that analyses were performed in accordance with the commitments in the UUSA SAR, including adherence to the double contingency principle, assurance of subcriticality under normal and credible abnormal conditions, treatment and control of NCS parameters, identification of credible upset conditions, and ISA methodology.

Assurance of Subcriticality – Integrated Safety Analysis

Section 5.3.B.2 of NUREG-1520, Revision 2, states that NRC staff reviews should include, in part, any new or changed assumptions, controlled parameters, safety limits, controls, or safety margin, as well as new or changed criticality accident sequences.

The NRC staff reviewed a sample of new and revised accident sequences from the licensee’s ISA to verify that credible criticality accident sequences are being identified and their likelihoods controlled consistent with UUSA’s ISA methodology described in Chapter 3.0 of the UUSA SAR and the requirements of 10 CFR 70.61. The NRC staff reviewed the following accident sequences:

LW 1-103	Liquid waste containing LEU+ transferred to Liquid Effluent Collection and Transfer System (LECTS) slab tanks before LECTS is approved for LEU+ operations
PT3-101	Failure to control geometry of product cold trap
PT3-101	Failure to control geometry/volume or neutron absorption of the Product Vent Pump and Chemical Trap Set (PVPTS)
RD1-100	Human error resulting in placement of 30B/30B-10 product cylinder in non-safe criticality interaction arrangement
SA1-109	Loss of interaction control within a linear array for chemical traps due to insufficient spacing
SA1-110	Loss of enrichment control when moving or storing containers or components with enriched uranic material from LEU+ systems

Chapter 5.0 of the UUSA SAR

Section 5.3.B.1 of NUREG-1520, Revision 2, states that NRC staff reviews should include portions of the license application (i.e., SAR) affected by the requested changes to ensure that the effectiveness of any license commitments is not reduced or that the licensee has provided an adequate justification that there is still adequate protection against the risk of an accidental criticality. The NRC staff reviewed the requested changes to Chapter 5.0 of the UUSA SAR and determined that certain changes were either administrative or otherwise did not represent any significant technical changes to, or dilution of, existing commitments; however, there were technical changes to Section 5.1.1. The NRC staff's evaluation of the requested technical changes to Section 5.1.1 of the UUSA SAR is discussed below.

Section 5.1.1 - 1.5 wt. Percent U-235 Enrichment Assumption. Section 5.1.1 of the UUSA SAR currently states that NCS analyses performed for the Contingency Dump System equipment and piping on the second floor of the Process Services Area and the Tails Take-Off System will be performed assuming an enrichment of 1.5 wt. percent U-235. Proposed changes to this section would revise the analytical assumption for these systems from 1.5 wt. percent U-235 to "various bounding enrichment levels for the specific system or component with the system." In response to the NRC staff's RAI, by letter dated October 13, 2024 (ML24288A010) UUSA stated that the enrichment assumption for the Contingency Dump System is based on the average enrichment of UF₆ gas evacuated from a cascade under normal conditions (less than [] wt. percent U-235), but that the Contingency Dump System is analyzed at [] wt. percent U-235 to bound credible upset conditions. With respect to the piping on the second floor of the Process Services Corridor, UUSA stated that the Contingency Dump Buffer Volume and Tails Secondary Header piping are analyzed at [] wt. percent U-235 ([] wt. percent higher than the maximum average cascade enrichment of [] wt. percent U-235) and the Product Primary and Secondary Headers are analyzed at 11 wt. percent U-235. For the Tails Take-Off System, UUSA stated that the assumed enrichment under upset conditions is [] to [] wt. percent U-235, depending on how many cascades are operating. The NRC staff determined that the proposed change is necessary to ensure the safe operation of the facility as the continued use of a 1.5 wt. percent U-235 enrichment assumption would not be bounding to the normal and credible abnormal conditions of facility operations. Therefore, the NRC staff determined that the proposed change is acceptable.

Section 5.1.1 – 6.0 wt. Percent U-235 Enrichment Assumption. Section 5.1.1 of the UUSA SAR states that most NCS analyses for enriched material are performed assuming an enrichment of 6.0 wt. percent U-235. Proposed changes to this section would revise this to state that NCS analyses for enriched material are performed assuming a U-235 enrichment of 6.0 wt. percent for non-LEU+ activities and 11.0 wt. percent for LEU+ activities. The NRC staff reviewed the UUSA MCNP6 Validation Report, "Urenco USA (UUSA) MCNP6 Validation" (ML22074A022) and NRC SER for LAR 21-03 (ML22129A125). The NRC staff noted that the NRC staff's conclusions in SER for LAR 21-03 relied, in part, on UUSA's commitment to assuming 1 wt. percent higher than the operational enrichment for the purposes of conducting NCS analyses for systems greater than 6 wt. percent. The NRC staff determined for most cases involving LEU+ that the proposed change is consistent with this commitment and does not represent any degradation to subcritical margin or the conditions upon which the MMS is based as 11 wt. percent is 1 wt. percent higher than the requested less than 10 wt. percent enrichment limit. However, the NRC staff determined that the proposed changes to License Conditions 6B, 7B, and 8B may present cases that are inconsistent with the commitment to assume 1 wt. percent U-235 higher than the operational

enrichment. These cases are discussed and evaluated in section “Changes to SNM-2010 License Conditions 6B, 7B, and 8B” of this report.

Section 5.1.1 – Piece Count. Proposed changes to this section add piece count as a control parameter. The NRC staff determined that the UUSA SAR already allows the use of mass and volume as NCS control parameters. Given piece count is effectively limiting the number of components with a known mass or volume, the NRC staff determined that piece count is essentially a mass or volume control. Therefore, the NRC staff determined that the proposed change is acceptable.

Section 5.1.1 – Separation Plant Components. Section 5.1.1 states that all Separation Plant components that handle UF₆, other than Type 30B cylinders and contingency dump chemical traps, are safe by geometry. Proposed changes to this section revise this to state that all Separation Plant components that handle UF₆, including product cylinders and contingency dump chemical traps, are criticality safe based on analysis. The NRC staff reviewed the UUSA SAR and determined that several different NCS parameters are authorized as control parameters. Furthermore, the NRC staff identified that the UUSA SAR contains commitments to the assurance of subcriticality under normal and credible abnormal conditions, as well as commitments to compliance with the double contingency principle. Therefore, the NRC staff determined that the proposed change is acceptable because it does not dilute or modify the underlying and more important commitment to the assurance of subcriticality under normal and credible abnormal conditions.

Changes to SNM-2010 License Conditions 6B, 7B, and 8B

Changes to Possession Limits – License Conditions 6B and 6B.1. Materials License SNM-2010 currently authorizes UUSA to produce and possess uranium enriched up to less than or equal to 5.5 wt. percent U-235. The requested license amendment would authorize UUSA to produce and possess up to 10 kilograms U-235 enriched to 10 wt. percent or more but less than or equal to 10.8 wt. percent U-235. As discussed in sections “Nuclear Criticality Safety Program” and “Assurance of Subcriticality – Nuclear Criticality Safety Evaluations” of this report, the NRC staff evaluated the licensee’s NCS program and determined that UUSA’s NCS program was sufficient to provide reasonable assurance of subcriticality under normal and all credible abnormal conditions, provide reasonable assurance of adequate protection against the risk of criticality accidents, and otherwise satisfy the applicable requirements of 10 CFR Part 70 under the conditions of increased enrichment to less than 10 wt. percent U-235. As discussed in section “Minimum Margin of Subcriticality,” the NRC staff evaluated UUSA’s MMS and determined that the MMS was appropriate for operations up to 10 wt. percent U-235. Given the NRC staff’s conclusions regarding UUSA’s NCS program and MMS, the NRC staff determined that UUSA’s request to increase enrichment limits to less than 10 wt. percent U-235 is acceptable.

However, LAR 23-02 includes a request for operational flexibility that would authorize UUSA to periodically produce and possess material enriched beyond its license limit of less than 10.0 wt. percent U-235 up to 10.8 wt. percent U-235 to accommodate fluctuations in the cascade, potential cascade inefficiencies, and product pressure transducer accuracies. Such conditions would be temporary and impact a particular cascade but not the assay of any product cylinder (which will remain less than 10 wt. percent U-235). Previous versions of Materials License SNM-2010 have provided limited operational flexibility to accommodate fluctuations in the cascade due to performance adjustments, authorizing UUSA to enrich material slightly above the license limit. The NRC granted such limited operational flexibility

in 2013 in response to UUSA's license amendment request LAR 13-02, wherein UUSA was authorized to produce U-235 beyond its license limit of 5.0 wt. percent up to 5.5 wt. percent U-235, as documented in NRC SER, "Safety Evaluation Report for License Amendment Request 13-02," dated October 30, 2013 (ML13290A212). UUSA has requested similar operational flexibility as part of LAR 23-02 via proposed changes to License Conditions 6B, 7B, and 8B as follows:

<p><u>License Condition 6B</u> Uranium enriched in isotope U-235 less than 10 percent by weight (wt. percent) and uranium daughters, subject to the following additional constraints below:</p>	<p><u>License Condition 7B.1</u> Physical: Solid, Liquid, and Gas</p>	<p><u>License Condition 8B</u> [Sensitive Conditions]</p>
<p><u>License Condition 6B.1</u> Grams of U-235 contained in uranium enriched to 10 wt. percent or more but less than or equal to 10.8 wt. percent in the U-235 isotope subject to the following additional constraints below:</p>	<p><u>License Condition 7B.2</u> Chemical: UF₆, UF₄, UO₂F₂, oxides, metal and other compounds</p>	<p><u>License Condition 8B.1</u> Less than or equal to 10,000 U-235 (to be included in License Condition 8B total)</p>
<p><u>Constraints for License Conditions 6B and 6B.1</u> URENCO USA facility (UUSA) shall not input parameters into the plant control system (PCS) to produce material for the assay above 5.0 wt. percent limit until the NRC has completed an operational readiness review (ORR) to verify the necessary changes have been implemented and the facility will be operated safely and in accordance with the requirements of the license. UUSA shall notify the NRC for scheduling the ORR at least 60 days prior to the planned production. UUSA shall not produce product material at or above 10 wt. percent U-235 other than in the course of cascade performance adjustments, thus providing the operational flexibility to generate material to satisfactorily fulfill customer orders up to the less than 10 wt. percent U-235 limit. UUSA shall not at any time input parameters into the PCS to produce material for the assay at or above 10 wt. percent U-235.</p>		

While the requested changes do not involve changes to UUSA's computational methods or validation methodology, the changes potentially impact UUSA's approved MMS, necessitating that its validity be evaluated. Many factors can be considered in the appropriateness of an MMS including validation methodology and rigor, sufficiency of the data used for validation (e.g., number of available benchmarks, cross-section data, etc.), and statistical conservatism in the determination of upper subcritical limits (USLs). However, the appropriateness of UUSA's current MMS was based, in part, on conservative assumptions regarding enrichment. As previously discussed in section "Minimum Margin of Subcriticality" of this report, the NRC staff's conclusions that UUSA's MMS was acceptable as documented in SER for LAR 21-03 relied, in part, on UUSA's commitment to assuming 1 wt. percent U-235 higher than the operational enrichment for the purposes of conducting NCS analyses. This has historically provided a predictable and dependable amount of conservatism corresponding to several percent in k_{eff} . Paired with UUSA's proposed change to Section 5.1.1 of the UUSA SAR to assume 11 wt. percent U-235 for LEU+ applications, fluctuations within the cascade resulting in an operational enrichment of 10.8 wt. percent U-235 would challenge this conservatism as this would represent only 0.2 wt. percent U-235 higher than the operational enrichment. This could potentially represent a degradation to the MMS as an assumption of 1 wt. percent U-235 higher than the operational enrichment

provides a greater degree of indirect, non-linear margin in k_{eff} than an assumption of 0.2 wt. percent U-235 higher than the operational enrichment.

The NRC staff evaluated the requested changes' impact on the MMS to determine whether it continues to provide adequate assurance of subcriticality under normal and all credible abnormal conditions as required by 10 CFR 70.61(d) and reasonable assurance of adequate protection of the public health and safety. The NRC staff performed a series of independent calculations using a SCALE/KENOVI: CSAS6 3D Eigenvalue Monte Carlo application with the continuous energy ENDF/B-VII.1 cross-section library to evaluate the sensitivity to changes in process conditions for 11 wt. percent U-235 relative to 10 wt. percent versus 11 wt. percent U-235 relative to 10.8 wt. percent, considering the following configurations:

- fully-reflected, homogeneous sphere of optimally-moderated uranyl fluoride and water mixture;
- fully-reflected, heterogeneous sphere of uranyl fluoride and water mixture;
- fully-reflected, homogeneous infinite cylinder of optimally-moderated uranyl fluoride and water mixture;
- fully-reflected, heterogeneous infinite cylinder of uranyl fluoride and water mixture;
- fully-reflected, homogeneous infinite slab of optimally-moderated uranyl fluoride and water mixture; and
- fully-reflected, heterogeneous infinite slab of uranyl fluoride and water mixture.

The NRC staff determined that although the requested change represented a reduction in conservatism, the reduction in conservatism did not result in any significant difference in sensitivity to changes in process conditions. Further, the conservatisms applied to other NCS parameters (moderation, geometry, etc.) as described in the UUSA SAR remain unchanged and continue to provide a predictable and dependable amount of conservatism generally corresponding to several percent in k_{eff} . Because changes in enrichment inherently affect the neutron energy spectrum, and because the results of the NRC staff's calculations demonstrated a non-linear response in k_{eff} to changes in enrichment, the NRC staff also performed a sensitivity and uncertainty analysis for each of the above configurations to compare and assess the degree of sensitivity to various nuclear cross-sections. The NRC staff performed the sensitivity and uncertainty analysis using the SCALE/TSUNAMI-K5 3D Sensitivity Analysis application with the v7-238 group cross-section library. Although the NRC staff observed small variances in sensitivity for certain cross-sections amongst the varied enrichments, namely fissile-adjacent hydrogen atoms in heterogeneous systems, no degree of sensitivity to cross-section data capable of challenging the validity of the MMS was identified as the sensitivities were generally small compared to the MMS. The NRC staff also noted that conservative assumptions on enrichment represent only one of many important factors to consider when evaluating the appropriateness of the MMS. As stated above, many other factors can be considered, including validation methodology and rigor, sufficiency of the data used for validation, and statistical conservatism in the determination of USLs – all of which remain unchanged as a result of UUSA's request.

Given the requested change does not result in any significant difference in sensitivity to changes in process conditions, no degree of sensitivities to cross-section data exist that are capable of challenging the validity of the MMS, and other conservatisms inherent in the licensee's validation methodology (e.g., validation rigor, sufficiency of data, statistical

conservatism in the calculation of bias and determination of the USL), the NRC staff determined that the proposed change is acceptable.

LICENSE CONDITIONS

Based on the review discussed in this report, the NRC staff concluded that the licensee's request provides reasonable assurance of subcriticality under normal and all credible abnormal conditions, provides reasonable assurance of adequate protection against the risk of criticality accidents, and otherwise satisfies the applicable requirements of 10 CFR Part 70, including 10 CFR 70.61(b) and 70.61(d). However, given the scope of the licensee's request and its broad impact on licensed activities, the NRC staff requires that an operational readiness review (ORR) be completed to support the NRC staff's conclusions as a condition to the approval of the LAR. As part of LAR 23-02, UUSA effectively requested that a license condition to require an ORR be imposed via constraints on License Conditions 6B and 6B.1 as follows:

“URENCO USA facility (UUSA) shall not input parameters into the plant control system (PCS) to produce material for the assay above 5.0 wt. percent limit until the U.S. Nuclear Regulatory Commission (NRC) has completed an operational readiness review (ORR) to verify the necessary changes have been implemented and the facility will be operated safely and in accordance with the requirements of the license. UUSA shall notify the NRC for scheduling the ORR at least 60 days prior to the planned production.”

The NRC staff also requires that restrictions be placed on UUSA's ability to produce limited quantities of SNM in excess of its less than 10.0 wt. percent U-235 license limit. UUSA effectively requested such restrictions be imposed by proposing the following constraint on License Conditions 6B and 6B.1:

“UUSA shall not produce product material at or above 10 wt. percent U-235 other than in the course of cascade performance adjustments, thus providing the operational flexibility to generate material to satisfactorily fulfill customer orders up to the less than 10 wt. percent U-235 limit.”

Given many of UUSA's recycling systems are not within the scope of the LAR, the NRC staff requires that an additional license condition be imposed to ensure that UUSA segregates LEU+ and components exposed to LEU+ from non-LEU+ and systems and components that have not been exposed to LEU+. The NRC staff imposes the following license condition:

“With the exception of the Gaseous Effluent Vent System, there shall be no processing of, or storage of components exposed to, U-235 enriched from 5.5 wt. percent to less than 10 wt. percent in any installed recycling systems or support systems, including the Ventilated Room, Decontamination Workshop, Liquid Effluent Collection and Transfer System Room, or Solid Waste Collection Room. Components that have been exposed to U-235 enriched from 5.5 wt. percent to less than 10 wt. percent shall be segregated from systems and components that have not been exposed to U-235 enriched from 5.5 wt. percent to less than 10 wt. percent.”

EVALUATION FINDINGS

Based on the review discussed in this SER, the NRC staff concluded that UUSA's request provides reasonable assurance of subcriticality under normal and all credible abnormal conditions, provides reasonable assurance of adequate protection against the risk of criticality accidents, and otherwise satisfies the applicable requirements of 10 CFR Part 70, including 10 CFR 70.61(b) and 70.61(d). In support of the conclusions discussed in this SER, the NRC staff imposes license conditions to ensure that UUSA will segregate components exposed to LEU+ from systems and components that have not been exposed to LEU+, there are constraints placed on the production of SNM in excess of 10.0 wt. percent U-235, and that an ORR will be completed as a condition to the approval of the LAR.

2.5 Chemical Process Safety

PURPOSE OF REVIEW

The purpose of this chemical process safety review is to determine if the UUSA chemical safety program commitments and proposed controls identified in the LAR for the first phase of its LEU+ production operations (LAR-23-02, ML23334A122) provide reasonable assurance of adequate protection of workers, the public, and the environment from chemical hazards that are under the NRC's regulatory jurisdiction. This review is specifically for the production of LEU+ material and does not cover the introduction of LEU+ material into the existing recycling and support systems which are currently authorized to accommodate material enriched up to 5.5 wt. percent. LAR-23-02 states that there will be a future LAR that addresses higher enrichment material in the recycling and support systems.

REGULATORY REQUIREMENTS

This review evaluated the LAR for compliance with the requirements of 10 CFR 70.22 and 70.65 which identify the general and additional contents of the application. The review also evaluated the LAR against the requirements of 10 CFR 70.23 and 70.66 which identify the requirements for approval of applications. In particular, the chemical process safety review determined there is reasonable assurance that the UUSA commitments and controls related to chemical safety for LEU+ production and presented in LAR 23-02 provide reasonable assurance that the proposed LEU+ production operations will comply with the chemical safety requirements contained in 10 CFR 70.61, 70.62, and 70.64.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of chemical process safety are presented in Section 6.4.3 of NUREG-1520, Revision 2 (ML15176A258).

STAFF REVIEW AND ANALYSIS

The chemical safety review focused on (1) any proposed changes to the existing, approved UUSA chemical safety program and (2) any changes to chemical safety-related controls related to the production of material that is enriched up to 10.8 percent.

Review of Chemical Safety Program

Enclosure 2 of LAR 23-02, (ML23334A124) states in section 4.4 that UUSA has determined there is no need to change the Chemical Process Safety program described in chapter 6 of the SAR to accommodate the production of LEU+ material. This section also documents UUSA's position that chemical hazards in the enrichment process do not change with enrichment levels.

The current UUSA chemical safety program was reviewed and approved by the NRC staff as part of the process for issuing the existing license. This chemical safety review was documented in chapter 6 of the 2005 SER that supported issuance of the current license (NUREG-1827, ML051780290).

The NRC staff's review confirms that chemical hazards in the enrichment process do not change with level of enrichment. The NRC staff finds that the existing chemical safety program is acceptable for LEU+ production.

Review of chemical safety related controls for producing LEU+

Enclosure 2 of LAR 23-02, (ML23334A124) also states in section 4.4 that UUSA has determined there are no changes to acute chemical exposure accident sequences or IROFS for the proposed license amendment. This UUSA position is based on the recognition that the chemical processing hazards associated with the production of 5.5 wt. percent enriched material are not modified by the production of LEU+ material.

Recycling and support systems that have been approved for 5.5 wt. percent enriched material will not be modified to accommodate higher enriched material under the LAR-23-02. UUSA is instituting interim controls that limit operations of these recycling and support systems to those already approved for enrichment up to 5.5 wt. percent. These interim controls are discussed in section 4.6 of the Enclosure 2 of LAR 23-02 (ML23334A124).

The NRC chemical safety review confirms that there are no changes to acute chemical exposure accident sequences or IROFS for the LEU+ production operations because there are no changes in the chemical process for the operations for the production of LEU+.

EVALUATION FINDINGS

The NRC staff finds that continued compliance with the approved chemical safety program will continue to provide reasonable assurance of adequate protection of health and minimization of danger to life and property from chemical hazards that are under NRC's regulatory jurisdiction. Continued compliance will also provide reasonable assurance that the performance requirements of 70.61 related to acute chemical exposure will be met.

UUSA's updating of the ISA Summary and SAR for LEU+ production demonstrate compliance with the existing license commitments. After reviewing and evaluating the information and analyses in the updated ISA Summary and the updated SAR, the NRC staff finds reasonable assurance that the proposed LEU+ production operations will comply with the chemical safety performance requirements of 10 CFR 70.61.

The NRC staff finds that there are no new acute chemical exposure accident sequences and no need for additional IROFS for the proposed production of LEU+ material.

2.6 Fire Safety

PURPOSE OF REVIEW

The primary purpose of this fire safety review is to determine if UUSA's planned facility modifications and operational changes to raise enriched UF₆ levels from 5.5 wt. percent to less than 10.0 wt. percent U-235 as described in the LAR 23-02, will provide reasonable assurance of adequate fire protection of workers, the public, and the environment from fire hazards that are under the NRC's regulatory jurisdiction.

REGULATORY REQUIREMENTS

The regulatory basis for the fire safety review is found in 10 CFR 70.22 and 70.65 which require general and additional contents of the application. The review also considers compliance with the requirements of 10 CFR 70.23 and 70.66 which identify the requirements for approval of applications. The fire safety review determines if there is reasonable assurance of compliance with the fire safety requirements of 10 CFR 70.61, 70.62, and 70.64.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of fire safety are outlined in Section 7.4.3, "Regulatory Acceptance Criteria," of NUREG-1520, Revision 2 (ML15176A258). The National Fire Protection Association "National Fire Codes" are also used, as appropriate, to evaluate a reasonable assurance of fire safety.

STAFF REVIEW AND EVALUATION

The application was submitted with Description of Proposed Changes for Increased Enrichment Production (LAR 23-02 Enclosure 2), Mark-up Pages to the Safety Analysis Report (LAR 23-02 Enclosure 3), Mark-up Pages to the ISA Summary (LAR 23-02, Enclosure 4), and ISA Summary with Changes Incorporated (LAR 23-02, Enclosure 5) for the proposed changes that would be implemented if the amendment were approved.

The NRC staff's fire safety review has focused on (1) facility modifications for increased enrichment to 10.0 wt. percent U-235, (2) adequacy of the commitments that support fire safety (e.g., identification and management of fire hazards that are under the NRC's regulatory jurisdiction) and (3) implementation of the fire safety-related commitments to support processing of 10.0 wt. percent U-235 fuel.

Facility Modifications

UUSA stated, in section 4.5, "Facility Modifications," of the LAR 23-02, Enclosure 2, that (1) there are modifications necessary for the production, handling, storage or interim controls needed for the increased enrichment, and (2) there are no physical modifications to the existing facility that require any new construction. UUSA listed the facility modifications in section 4.5 of the LAR 23-02, Enclosure 2, and stated that the modifications, related to increased enrichment as mentioned in item (1) above, are small and limited and will not introduce new fire hazards or the response to fire hazards.

The NRC staff reviewed the facility modifications described in section 4.5 of the LAR 23-02, Enclosure 2 and finds that the scope of the facility modifications is small and limited to raising the enrichment licensed limit. The NRC staff confirmed that the facility modifications have no negative impact to fire safety.

Changed/New Accident Sequences

UUSA presented, in Appendix A of the LAR 23-02 Enclosure 2, the changed/new accident sequences, including FF6-1 for Cylinder Receipt and Dispatch Building (CRDB) General Areas (external fire), FF45-1 for Separation Building Module (SBM) Interconnecting Corridor (external fire), and FF45-2 for SBM Interconnecting Corridor (internal fire). The application noted that the changes to the accident sequence description of FF45-1 and FF45-2 were to change only the type of product cylinder designation.

The NRC staff reviewed the fire accident sequences of FF6-1, FF45-1, and FF45-2 described in the LAR 23-02 Enclosure 4 and Enclosure 5, and finds that the revised FF6-1 is related to external fire propagating into the CRDB General Areas from other areas that could result in a release of the UF₆ inventory, and the revised FF45-1 and FF45-2 were to change only the type of product cylinder designation. The NRC staff finds that there are no negative impacts to fire accident sequences or the fire protection IROFS associated with the proposed increase in enrichment.

Fire Hazards Analysis, Fire Safety Program, and Management Measures

UUSA stated, in section 4.7, "Fire Safety," of the LAR 23-02, Enclosure 2, that there are no changes to the Fire Safety Program as described in Chapter 7 of the Safety Analysis Report and there are no changes to the Fire Hazards Analysis, Fire Safety Program, Management Measures or commitments needed to implement this LAR.

The NRC staff finds that the enrichment increase to less than 10.0 wt. percent U-235 will not result in modifications to the fire safety organization, fire hazard analysis, and management measures, and the applicant will continue to maintain the fire safety program and cooperation with the local fire department for response to plant fires that escalate beyond the incipient level.

EVALUATION FINDINGS

Based on this review, the NRC staff has determined that UUSA will continue to maintain an adequate level of fire protection for fabrication of the less than 10.0 wt. percent U-235 fuel at the facility. The fire protection program (1) will continue to meet the acceptance criteria in Chapter 7 of NUREG 1520 Revision 2 and (2) is adequate to protect against fires and explosions that could affect the safety of licensed materials. Therefore, the NRC staff finds that LAR 23-02 provides a reasonable level of assurance that adequate fire protection will be provided to meet the fire safety performance requirements of 10 CFR 70.23, 10 CFR 70.61, and 10 CFR 70.66.

2.7 Emergency Management

PURPOSE OF REVIEW

The purpose of reviewing UUSA's emergency management plan is to determine if UUSA has established adequate emergency management facilities and procedures to protect workers, the public, and the environment if approved to enrich to less than 10 wt. percent U-235.

REGULATORY REQUIREMENTS

The regulations in 10 CFR 70.22(i) state in part "Each application to possess enriched uranium or plutonium for which a criticality accident alarm system is required, UF₆ in excess of 50 kilograms in a single container or 1000 kilograms total, or in excess of 2 curies of plutonium in unsealed form or on foils or plated sources, must contain either:

- (i) An evaluation showing that the maximum dose to a member of the public offsite due to a release of radioactive materials would not exceed 1 rem effective dose equivalent or an intake of 2 milligrams of soluble uranium, or
- (ii) An emergency plan for responding to the radiological hazards of an accidental release of special nuclear material and to any associated chemical hazards directly incident thereto."

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

Regulatory Guide (RG) 3.67, "*Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities*" (ML103360487), provides guidance acceptable to the NRC staff on the information to be included in emergency plans and establishes a format for presenting the information. UUSA states that the emergency plan conforms to the RG 3.67.

STAFF REVIEW AND ANALYSIS

In its letter, UUSA requested a change to allow an increase of the enrichment limit in Materials License SNM-2010 from 5.5 wt. percent U-235. to less than 10.0 wt. percent U-235. UUSA stated there are modifications necessary for the production handling, storage or interim controls needed for segregation of removed components that have been exposed to LEU+ material. However, there are no physical modifications to the existing facility that require any new construction. UUSA states that the increase in authorized enrichment proposed by this application will result in an indirect impact to Emergency Planning. The onsite IEZ will be expanded with additional Criticality Accident Alarm System coverage. However, there will be no changes to the emergency response actions or alarm response, as personnel will still evacuate the area where the alarms sound. Implementing procedures will be updated to reflect new IEZ and actions to be taken during an alarm.

Additionally, UUSA stated in Enclosure 2, "Description of Proposed Changes for Increased Enrichment Production," to the application that increasing the uranium enrichment to less than 10.0 wt. percent U-235 results in no changes in the emergency classifications for any event scenario considered. It also does not alter the chemical effects of hydrogen fluoride (HF) from a release event. Increasing the uranium enrichment does not impact the quantity of uranium deposited or inhaled. However, the increase in U-235 enrichment does result in

an increase to the internal dose due to the increased concentration of uranium-234 in accident releases but continues to not be the limiting factor for accidents. UUSA states that although new accident sequences have been identified, the credible accident types have not changed, nor have the severity levels and consequences to the workers, the public, and the environment from these proposed revisions.

The NRC staff did not request any additional information related to emergency planning and reviewed Enclosure 2 and Enclosure 7, "Mark-up Pages to the Emergency Plan," of the application. The NRC staff reviewed the licensee's evaluation of impacts to the emergency plan and proposed changes to the emergency plan found in Enclosure 7. The proposed changes in Enclosure 7 were reviewed by the NRC staff to be administrative in nature. The NRC staff reviewed the changes as specified in Enclosure 2 and determined that the actions required for the expanded IEZ remain the same, no changes were required for the emergency action levels, and the severity levels for offsite consequences remains the same. Therefore, the NRC staff finds no changes were necessary to the emergency plan even with the potential for an increase in internal dose. The NRC staff finds these changes acceptable.

EVALUATION FINDINGS

The NRC staff reviewed the requested changes to the emergency plan. For the reasons set forth in this SER, the NRC staff finds that the revisions described in the application meet the relevant requirements of 10 CFR 70.22(i). Therefore, the NRC staff finds the proposed change to the UUSA Emergency Plan acceptable.

2.8 Environmental Protection

PURPOSE OF REVIEW

The purpose of this review is to determine whether UUSA's proposed environmental-protection measures are adequate to protect the environment and public health and safety and to comply with the regulatory requirements.

REGULATORY REQUIREMENTS

The activities proposed under LAR 23-02 must comply with NRC regulations and conditions specified in the UUSA license, including 10 CFR 20, Subpart B, "Radiation Protection Programs," Subpart D, "Radiation Dose Limits for Individual Members of the Public," Subpart F, "Surveys and Monitoring," Subpart K, "Waste Disposal," Subpart L, "Records," and Subpart M, "Reports." Additionally, the activities must comply with 10 CFR 70.22(a)(7), that the proposed facility and equipment are adequate to protect the environment and public health and safety, and 10 CFR 70.59, "Effluent Monitoring Reporting Requirements,"

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The regulatory guidance and acceptance criteria for the NRC's review of environmental protection are outlined in Section 9.4.2, "Regulatory Guidance and Section 9.4.3, "Regulatory Acceptance Criteria," of NUREG-1520, Revision 2.

STAFF REVIEW AND ANALYSIS

Materials License SNM-2010 issued by the NRC to UUSA, authorizes UUSA to receive, acquire, possess, and transfer byproduct, source, and special nuclear material as designated. Under the current license, UUSA is authorized to produce enriched uranium up to 5.0 wt. percent U-235 and possess enriched uranium up to 5.5 wt. percent U-235.

The effects on the environment from facility operations were assessed in the facility expansion environmental assessment (ML15072A016). The NRC staff reported that the potential radiological impacts of gaseous releases for the expanded UUSA facility (operating at 10 million separative work units) would be only a small fraction of the NRC's public dose limit of 1 millisievert per year (mSv/yr) (100 millirem per year (mrem/yr)) as stated in 10 CFR 20.1301(a)(1). The gaseous annual release of uranium was conservatively estimated in the 2015 environmental assessment to be 800 microcurie per year ($\mu\text{Ci/yr}$) (29.7 megabecquerel per year (MBq/yr)). Moreover, the estimated gaseous dose at the site boundary is a small fraction of the dose from direct exposure. The increase in enrichment to from 5.5 weight (wt.) percent uranium-235 (U-235) to less than 10.0 wt. percent U-235 are not expected to significantly higher than emissions analyzed in the 2015 environmental assessment. The annual release of uranium at the UUSA facility is estimated to be approximately 260 $\mu\text{Ci/yr}$ (9.62 MBq/yr), which falls below the conservative estimate reported in the facility expansion environmental assessment.

The current 25,000-cylinder limit for the storage of enriched uranium 30B product cylinders on the UBC Storage Pad is unchanged by the LAR. The estimated annual dose at the nearest site boundary from direct exposure was estimated to be 9.4 mrem/yr (0.094 mSv/yr), which is well below the 100 mrem/yr (1 mSv/yr) Total Effective Dose Equivalent (TEDE) limit established by 10 CFR 20.1301, "Dose limits for individual members of the public", and below the 25 mrem/yr (0.25 mSv/yr) dose equivalent to the whole body and any organ limit established by 40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations" (ML051750801). The NRC staff does not anticipate changes in potential dose impacts and will not require mitigation measures because contents of cylinders and the number of cylinders on the UBC Storage Pad or in Outdoor Cylinder Storage Areas are unchanged.

UUSA monitors the occupational workers for internal exposure from intake of uranium as well as doses from external exposure. Its exposure control program maintains exposures as low as reasonably achievable (ALARA) using radiation monitoring systems, personnel dosimetry and mitigation systems to reduce environmental concentrations of uranium. The most significant contributor to occupational radiation exposure from an increase to enrichment less than 10 wt. percent U-235 remains the direct radiation from the stored cylinders on the UBC Storage Pad.

Dose records for occupational workers from the time the facility expansion was authorized in 2015 through 2022 indicate the average TEDE to workers is 67.9 mrem, which is only a fraction of the occupational dose limit in 10 CFR 20.1201 of 5 rem. The potential direct public exposure from the UBC Storage Pad presented in the environmental assessment for facility expansion is not expected to change under the current license amendment and therefore remains bounding.

The NRC does not expect significant radiological or non-radiological impacts from approval of the proposed action, and impacts will remain bounded by the impacts assessed in the

NRC's 2015 expansion EA. Occupational dose estimates associated with the proposed action will continue to be ALARA and fall within the limits identified in 10 CFR 20.1201. Approval of the proposed action is not expected to result in measurable radiation exposure to a member of the public. For these reasons, the NRC staff finds (1) the incremental change in occupational exposure will remain a small fraction of NRC's dose limits, (2) the potential cumulative impact to public and occupational health is not significant and, (3) no mitigation is required.

The UUSA facility Semi-Annual Radiological Effluent Release Reports between March 2015 and June 2023 shows the gross uranium activities in gaseous effluents were below the Minimum Detectable Activity or were less than 10 percent of values listed in 10 CFR 20, Appendix B, Table 2, "Effluent Concentrations," Column 1, Class D, for U-234, U-235, and U-238. The NRC staff finds increasing the enrichment level to less than 10 wt. percent U-235 is not anticipated to significantly impact the effluent releases given the existing low levels of gross uranium activities.

EVALUATION FINDINGS

The NRC staff finds the license amendment request to increase UF₆ enriched to less than 10 wt. percent U-235 does not warrant a change to the radiation protection program in Materials License SNM-2010. UUSA's current practices and processes are adequate to ensure uranium exposures to personnel and the environment are maintained ALARA. UUSA has committed to adequate environmental-protection measures, including: (1) environmental and effluent monitoring; and (2) effluent controls to maintain public doses as low as is reasonably achievable (ALARA) as part of the radiation protection program. The NRC staff verified that the requested amendment changes do not require changes to the environmental and effluent monitoring and radiation protection programs. Therefore, the NRC staff finds the existing environmental and effluent monitoring and radiation protection programs as acceptable.

The NRC staff also finds the potential impacts of increasing the enrichment level to less than 10 wt. percent U-235 do not necessitate changes to the existing environmental protection program. The LAR meets the relevant requirements of 10 CFR Part 20 and Part 70 by continuing to provide adequate controls and processes to achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA).. Therefore, the NRC staff finds that the request to increase UF₆ enriched to less than 10 wt. percent U-235 the enrichment will not cause a significant change in the plant effluents. The NRC staff also finds the environmental monitoring and effluent controls would continue to ensure compliance with relevant requirements for public health and safety and environmental protection of 10 CFR Part 20 and 10 CFR Part 70.

2.9 Financial Assessment (Decommissioning)

PURPOSE OF REVIEW

The purpose of the review of UUSA's decommissioning plans is to determine with reasonable assurance that UUSA will be able to decommission the facility safely and in accordance with the requirements of the NRC if approved to enrich to less than 10 wt. percent U-235.

REGULATORY REQUIREMENTS

Nuclear facilities licensed under 10 CFR, Part 70, are required to provide adequate financial assurance for decommissioning, decontamination and reclamation pursuant to 10 CFR 70.25, "Financial assurance and recordkeeping for decommissioning." UUSA is a holder of Materials License SNM-2010. Pursuant to 10 CFR Paragraph 70.25(e)(2), UUSA is required to submit a decommissioning cost estimate (DCE) and financial assurance for NRC review and approval. UUSA submitted the updated DCE with LAR-23-02. After resolution of any NRC comments on the estimate, the licensee will submit, as necessary, revised financial instruments reflecting an amount sufficient to cover the approved cost estimate. UUSA remains liable for any decommissioning costs not covered by the financial instrument. UUSA also remains responsible for the current status and future decommissioning of the licensed site and facility and will continue to abide by all commitments and representations previously made to the NRC. In addition, UUSA will continue to abide by all constraints, conditions, requirements, representations, and commitments identified in the license.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of UUSA's decommissioning plan are outlined in Section 10.4.2 of NUREG-1520, Revision 2.

STAFF EVALUATION

When updating the DFP, the Decommissioning Planning Rule requires licensees to consider the effect of eight factors, outlined in 10 CFR 70.25(e)(2), on their DCEs. In the 2023 submittal, UUSA addressed these factors:

Spills of radioactive material

The 2023 DFP provides affirmation that there has not been any change in spills of radioactive material.

Waste inventory

The 2023 DFP provides affirmation that there has not been any change in waste inventory.

Waste disposal costs

The 2023 DFP provides affirmation that there has not been any change to waste disposal cost.

Facility modifications

The 2023 DFP provides affirmation that there has not been any change to facility modifications.

Changes in authorized possession limits

The 2023 DFP provides affirmation that there has not been any change in authorized possession limits.

Actual remediation costs that exceed the previous cost estimate

The 2023 DFP provides affirmation that there has not been any change in actual remediation.

Onsite disposal

The 2023 DFP provides affirmation that there has not been any change in onsite disposal.

Use of a settling pond.

The 2023 DFP provides affirmation that there has not been any change in use of a settling pond.

EVALUATION FINDINGS

Based on the review of the Decommissioning Plan submitted by UUSA as part of the LAR, the NRC staff finds that there is no change to the decommissioning funding requirements as a result of the LAR.

2.10 Management Measures

PURPOSE OF REVIEW

The purpose of this review is to verify whether the applicant provided conclusive information to ensure that the management measures applied to IROFS, as documented in the "ISA Summary," provide assurance that the IROFS will be available and reliable, consistent with the performance requirements of 10 CFR 70.61. If a graded approach is used, the review should also determine whether the measures are applied to the IROFS in a manner commensurate with the IROFS' importance to safety.

REGULATORY REQUIREMENTS

The requirements for fuel cycle facility management measures are specified in 10 CFR 70.22, "Contents of Applications," and 10 CFR 70.65, "Additional Contents of Applications," of 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

1. 10 CFR 70.4 states that management measures include: configuration management (CM); maintenance; training and qualifications; procedures; audits and assessments; incident investigations; records management; and other quality assurance (QA) elements.
2. 10 CFR 70.62(a)(3) states that records must be kept for all IROFS failures; describes required data to be reported; and sets time requirements for updating the records.

3. 10 CFR 70.62(d) requires an applicant to establish management measures, for application to engineered and administrative controls and control systems that are identified as IROFS, pursuant to 10 CFR 70.61(e), to ensure they are available and reliable.
4. 10 CFR 19.12 states requirements for workers instructions that are applicable to personnel training and qualifications.
5. 10 CFR 70.22(a)(8) states requirements for license applications to address proposed procedures to protect health and minimize danger to life and property.
6. 10 CFR 70.72 requires a licensee to establish a CM program to evaluate, implement, and track changes to the facility; structures, systems and components (SSCs); processes; and activities of personnel.
7. 10 CFR 70.74(a) and (b) state requirements for incident investigation and reporting.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications," provides guidance to the NRC staff reviewers who perform safety and environmental impact reviews of applications to construct or modify and operate nuclear fuel cycle facilities.

The acceptance criteria for the NRC's review of the applicant's management measures program are outlined in Section 11.4.3 of NUREG-1520, Revision 2. Chapter 11, "Management Measures," provides guidance for compliance with 10 CFR 70.61 is met with reasonable assurance. Specifically, management measures are activities performed by a licensee, generally on a continuing basis, that are applied to IROFS to provide reasonable assurance that the IROFS will perform their intended safety function when needed to prevent accidents or mitigate the consequences of accidents to an acceptable level. As defined in 10 CFR 70.4, "Definitions," management measures include configuration management, maintenance, training and qualification, procedures, audits and assessments, incident investigations, records management, and other quality assurance elements.

NRC STAFF REVIEW

Section 3.1.3, "Management Measures," outlines the management measures that apply to all IROFS that provide high quality assurance that these IROFS will be maintained as necessary to ensure they are available and reliable to perform their function when needed. UUSA did not propose any changes in LAR 23-02 for LEU+ production.

In Section 4.1, "Integrated Safety Analysis," of Enclosure 2, "Description of the Proposed Changes for Increased Enrichment Production (LAR 23-02)," UUSA stated that the ISA Summary analyses and evaluations for LEU+ were performed in accordance with the approved ISA process and Quality Program. As such, there are no new technologies or control systems necessary for LEU+ production. Additionally, there are no changes to Safety Program commitments (Process Safety Information, Integrated Safety Analysis and Management Measures). However, there were new or revised accident sequences that were evaluated within the Safety Program. These new or revised accident sequences did

not result in any severity level or accident consequence category changes; however, they did result in new or revised IROFS.

The NRC staff reviewed both the new or revised IROFS associated with the new or revised accident sequences and identified several proposed administrative and enhanced administrative IROFS. UUSA defines administrative IROFS as “a procedural human action that is prohibited or required to maintain safe process conditions.” NUREG-1520, Revision 2, defines the IROFS boundary for “simple” and enhanced administrative IROFS. The IROFS boundary includes everything necessary for the IROFS to perform its intended safety function.

In Section 5, “Implementation,” of Enclosure 2, UUSA stated that “UUSA will implement the necessary changes to operating documents prior to increasing enrichment levels. Changes required include Operating procedure revisions, Operating Requirements Manuals revisions, IROFS Boundary Definition Document revisions and change management actions to supporting documents to incorporate this LAR [23-02].” Moreover, UUSA will also continue to apply management measures to IROFS such that personnel will be trained and qualified to administratively controlled IROFS procedures, and there is adequate procedure development process.

EVALUATION FINDINGS

The NRC staff finds UUSA’s request to be acceptable because UUSA will continue to apply management measures to the proposed new and revised IROFS such that the IROFS will be designed, implemented, and maintained as necessary to ensure they are available and reliable to perform their function when needed. Based on its review of the SAR, the NRC staff finds that UUSA has adequately described the application of management measures, other QA elements and other safety-related items. The NRC staff also finds UUSA provides adequate assurance that personnel performing quality-related activities will perform work according to approved procedures and will demonstrate suitable proficiency in their assessment tasks. Additionally, the NRC staff finds that UUSA established and documented an organization structure responsible for developing, implementing, and assessing the management measures for providing assurance of safe facility operations, consistent with the acceptance criteria in Section 11.4 of NUREG-1520, Revision 2.

2.11 Material Control and Accounting

PURPOSE OF REVIEW

The purpose of this review is to determine whether the proposed LAR to increase the enrichment limit to less than 10 wt. percent U-235 for production systems, as referenced in the submittal, will result in significant impacts on the UUSA material control and accounting (MC&A) program’s ability to adequately detect and protect against loss, theft, or diversion of SNM.

REGULATORY REQUIREMENTS

As specified in 10 CFR 70.22(b), each licensee authorized to possess and use SNM in a quantity exceeding one effective kilogram must provide a full description of its program for material control and accounting (MC&A) of such SNM to show how compliance with applicable requirements of 10 CFR Part 74, “Material Control and Accounting of Special

Nuclear Material,” will be accomplished. Regulations in 10 CFR Part 74 Subpart B, “General Reporting and Recordkeeping Requirements,” and in 10 CFR 74.33, “Nuclear Material Control and Accounting for Uranium Enrichment Facilities Authorized to Produce Special Nuclear Material of Low Strategic Significance,” apply to the establishment of an MC&A program for Category III enrichment facilities. The requirements in 10 CFR 74.33 cover the specific MC&A program capabilities needed to establish an acceptable MC&A program. 10 CFR 74.33(b) requires that Category III enrichment facilities submit a FNMC plan describing how the performance objectives in 10 CFR 74.33(a), the system features and capabilities of 10 CFR 74.33(c), and the recordkeeping requirements of 10 CFR 74.33(d) will be met. Additionally, the NRC makes a determination that the proposed MC&A controls related to the LAR are adequate and meet subparagraph (a)(6) of 10 CFR 70.23, “Requirements for the approval of applications.”

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The NRC regulatory guidance for an acceptable MC&A program applicable to Category III enrichment facilities is NUREG/CR-5734, “Recommendations to the NRC on Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Enrichment Facilities.” The NUREG is divided into separate chapters for each of the program areas listed with associated commitments and acceptance criteria for each program area.

NRC STAFF REVIEW

The NRC staff reviewed the LAR for information regarding specific MC&A impacts of the proposed increase in the enrichment level up to 10 wt. percent U-235 for the LEU+ production systems. In the submittal letter, UUSA indicated that the LAR is limited to the elements necessary for production, handling, and storage of LEU+ at the UUSA site and the associated interim controls for LEU+ material removed from production processes without the use of the existing recycling and support systems for LEU+ material. In Enclosure 2, UUSA provided the descriptions and supporting information regarding the proposed changes for the production systems and storage of LEU+, the basis for change, the safety significance of the proposed changes, and the minor administrative changes to the Material License. Additionally, in Enclosure 2, UUSA provided the interim controls to be implemented to ensure segregation of the LEU+ components and systems from the recycling and support systems that are not included in this LAR.

Specifically, in Section 4.2.2, “Background and Safety Significance of License Conditions 6B.2 and 8B.2,” of Enclosure 2, UUSA provided an overview of the Unauthorized Enrichment Prevention (UEP) program, as described in chapter 9, “Unauthorized Enrichment Prevention Program,” of their fundamental nuclear material control plan (FNMCP), including descriptions of the various activities performed by both the MC&A staff and the operations personnel. UUSA concluded that the current FNMCP and the UEP as written ensures any unauthorized production with enrichment in the range of [] to [] wt. percent U-235 is detected before the quantity of U-235 contained in such LEU amounts to [] kilograms. In Section 4.10, “Fundamental Nuclear Material Control and Accounting,” of Enclosure 2, UUSA states that the proposed increase in the enrichment limit would not change the category of SNM possessed by UUSA, as less than 10 wt. percent U-235 is considered SNM of low strategic significance in accordance with 10 CFR 74.4, “Definitions.” UUSA further states that there would be no changes to the material balance areas or item control areas, and administrative changes to implement the LAR are the following: perform

an uncertainty measurement for the 30B-10 cylinders, revise MC&A procedures to include 30B-10 cylinders, and revise and submit the Design Information Questionnaire. In Enclosure 6, UUSA provided page markups for associated license basis documents, including the FNMCP. The proposed FNMCP changes that UUSA provided in the enclosure are the 8 pages where references of “30B” were revised to “product.”

The NRC staff reviewed the currently approved FNMCP, Revision 28b, dated December 20, 2023, which is required by 10 CFR 70.22(b). The FNMCP describes the licensee’s MC&A program and demonstrates how UUSA complies with applicable general recordkeeping and reporting requirements of 10 CFR Part 74, Subpart B and of 10 CFR 74.33 with respect to the possession and use of SNM of low strategic significance at enrichment facilities.

NRC STAFF EVALUATION

The NRC staff determined additional information was needed to complete its review. On July 12, 2024, the NRC staff sent a RAI to UUSA. By cover letter dated August 1, 2024, UUSA provided a response to the RAI. In the response, UUSA clarified the impacts of the proposed increased enrichment on the dynamic inventory process and how the quantity of the material in the cascades is determined. UUSA provided information regarding the evaluation of the U-235 levels inside an operational cascade when the enrichment is raised to 10 wt. percent. Consequently, UUSA affirmed that section 2.1.4.2, “Material in Enrichment System Piping and Equipment,” of the FNMCP, would be revised to update the information on the inventory of the enrichment system cascades. Additionally, in the RAI response, UUSA provided clarification regarding the use of calibration standards and standard cylinders that are utilized for the cylinder measurement systems. UUSA confirmed that the calibration standards and calibration limits currently utilized for the cylinder measurement systems at the site will cover the weight ranges for the new 30B-10 product cylinders and no new standards are needed.

EVALUATION FINDINGS

Based on the review of the submittal, UUSA’s current FNMCP, and the RAI response, the NRC staff finds that the proposed license amendment to increase the enrichment limit in Materials License SNM-2010 to less than 10.0 wt. percent U-235 will not result in any significant impacts on the UUSA material control and accounting (MC&A) program’s ability to adequately detect and protect against loss, theft, or diversion of SNM. The NRC staff determined that the information UUSA provided regarding the revision to section 2.1.4.2 of the FNMCP meets the requirement in 10 CFR 70.32(c)(1)(iii). 10 CFR 70.32(c)(1)(iii) allows changes that do not decrease the effectiveness of the MC&A program without prior NRC approval. UUSA’s MC&A program described in the FNMCP will continue to provide reasonable assurance that loss, theft, or diversion of SNM will be detected and protected against. The NRC staff also finds that UUSA (1) continues to meet the applicable MC&A requirements in 10 CFR Part 74, and (2) the 10 CFR 70.23(a)(6) requirement for approving applications has been met. The NRC staff finds reasonable assurance that UUSA’s commitment to implement the FNMCP changes as described in the RAI response and to submit the change in accordance with 10 CFR 70.32(c)(2)(ii) ensure NRC’s regulatory requirements will be met.

3.0 ENVIRONMENTAL REVIEW

The NRC staff reviewed the proposed action in accordance with the requirements of 10 CFR Part 51. The NRC staff concludes that approval of UUSA's proposed action to produce, store, and handle enriched UF₆ at enrichment of less than 10 wt. percent U-235 at the UUSA enrichment facility would not significantly affect the quality of the human environment. As described in Section 3 of the environmental assessment (ML24331A260), approval of the proposed action will not result in changes to land use, no construction or soil disturbance will take place, no visible changes to the facility or the viewshed will occur, and no staffing changes are anticipated that would affect socioeconomic indicators. UUSA would store LEU+-exposed, reusable materials and cascade components inside in a designated, approved storage area until further disposition. The NRC does not expect significant radiological or non-radiological impacts from approval of the proposed action, and impacts will remain bounded by the impacts assessed in the NRC's 2015 expansion environmental assessment. Occupational dose estimates associated with the proposed action will continue to be ALARA and fall within the limits identified in 10 CFR 20.1201. Approval of the proposed action is not expected to result in measurable radiation exposure to a member of the public. Therefore, the NRC staff has determined that, pursuant to 10 CFR 51.31, preparation of an environmental impact statement is not required for this proposed action, and pursuant to 10 CFR 51.32, a finding of no significant impact is appropriate.

4.0 CONCLUSION

The NRC staff reviewed UUSA's LAR together with supporting analyses and responses to NRC staff RAIs. Based on its review discussed in this report, the NRC staff finds reasonable assurance that UUSA's ISA program, radiation program, nuclear criticality program, chemical safety program, fire safety program, MC&A program, and environmental protection program satisfy the applicable requirements of 10 CFR Parts 19, 20, 51, 70, and 74, as stated in this report. Additionally, UUSA's decommission cost estimates provide adequate financial assurance that funds will be available for the decommissioning, decontamination and reclamation of the facility pursuant to 10 CFR 70.25.

Therefore, the NRC staff approves the LAR to increase the enrichment limit in Materials License SNM-2010 from 5.5 wt. percent U-235 to less than 10.0 wt. percent U-235. In support of the conclusions of this SER, the NRC staff imposes license conditions and requires that an ORR be completed as a condition to the approval of the LAR, as delineated in this SER.

5.0 PRINCIPAL CONTRIBUTORS

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