

SAFETY EVALUATION REPORT

DOCKET NO.: 70-1257

LICENSE NO.: SNM-1227

LICENSEE: Framatome, Inc.

SUBJECT: APPROVAL OF LICENSE AMENDMENT REQUEST FOR FRAMATOME, INC.'S SUBMITTAL TO AUTHORIZE TRISO FUEL FABRICATION AND TO INCREASE ENRICHMENT FROM 6.5 WEIGHT % TO UP TO 10.0 WEIGHT % U-235 IN THE SPECIALTY FUELS BUILDING AT THE FRAMATOME FUEL FABRICATION FACILITY IN RICHLAND, WA – ENTERPRISE PROJECT IDENTIFIER NUMBER L-2024-LLA-0130

1.0 BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC) staff has received your submittal dated September 20, 2024 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML24264A171), transmitting your request to authorize Tri-structural Isotropic (TRISO) fuel fabrication in the Specialty Fuels (SF) Building at the Framatome Fuel Fabrication Facility in Richland, WA. The process will be conservatively designed to support less than 20.0 weight percent (wt.%) Uranium-235 (U-235) enrichment even though the enrichment for the new process will be less than 10.0 wt.% U-235.

The NRC staff issued a Request for Supplemental Information (RSI) letter dated January 6, 2025 (ML24348A193) and a follow-up request on March 24, 2025 (ML25188A192) and March 28, 2025 (ML25188A203). Framatome responded by email on February 5, 2025 (ML25097A221) and further supplemented with additional information related to the electrical/instrumentation and control (I&C) and structural reviews on June 27, 2025 (ML25178B380) and July 1, 2025 (ML25182A223). The NRC completed the acceptance review of the License Amendment Request (LAR) on July 7, 2025 (ML25181A802).

The NRC staff issued a request for additional information (RAI) by email dated September 10, 2025 (ML26113A319) to obtain information needed to conduct a detailed technical review in the areas of chemical safety, fire safety, criticality, electrical and I&C, integrated safety analysis (ISA) Summary, structural safety, and human factors. The RAIs for these areas were the main topics of discussion for the Horizontal Vertical Slice Audit on September 24 and 25, 2025.

As the result of issues in the areas of ISA Summary, electrical and digital I&C, and structural safety, separate RAIs were needed and these areas were separated from the original RAI set prepared and provided on September 10, 2025.

By email dated September 30, 2025 (ML26050A216), Framatome provided draft responses to the areas of chemical safety, fire safety, criticality, electrical and I&C, ISA Summary, structural safety, and human factors to the NRC staff's September 10 requests. Framatome provided a formal response by letter dated May 29, 2026 (ML26149A379) that addressed all issues

raised in the areas of chemical safety, fire safety, criticality, electrical and I&C, ISA Summary, structural safety, and human factors that were discussed during the Horizontal Vertical Slice Audit.

The NRC staff issued a separate RAI by letter dated February 11, 2026 (ML26026A170), to obtain information needed to conduct a detailed technical review in the areas of ISA Summary, and electrical and I&C.

By letter dated May 12, 2026 (ML26132A301) and May 29, 2026 (ML26149A379), Framatome provided responses to the NRC staff's February 11 requests for information for the areas of ISA Summary, and electrical and I&C.

The NRC staff issued an additional separate RAI by email dated March 26, 2026 (ML26097A386), to obtain information needed in the area of structural safety.

By letter dated May 29, 2026 (ML26149A379), Framatome provided responses to the NRC staff's March 26 request for structural safety information.

The NRC staff conducted a Horizontal Vertical Slice Audit on September 24 and 25, 2025 (ML26061A030) to obtain information needed related to the areas of chemical safety, fire safety, criticality, electrical and I&C, ISA Summary, structural safety, and human factors of the review. As a result of the Audit the technical reviewers in the focus areas of the Audit were able to obtain the information they needed to develop their safety evaluation reports and Framatome was able to develop their formal response to the RAIs which was provided on May 29, 2026.

The NRC staff conducted a Virtual Electrical Audit on January 21 and 22, 2026 (ML26135A022) and an on-site Electrical and Digital I&C Audit on April 14 to April 16, 2026 (ML26117A074) to obtain information needed related to the electrical and digital I&Cs sections of the review. As a result of the Electrical and Digital I&C Audit, the technical reviewers were able obtain the information they needed to develop their safety evaluation report and Framatome was able to develop their formal response to the RAIs which was provided on May 29, 2026.

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 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.

Framatome was able to adequately respond to all requests for information with their formal response dated May 29, 2026, with their response to the ISA Summary RAIs dated May 12, 2026, with their response to the electrical digital and I&C RAIs dated May 29, 2026, and with their response to the structural safety RAIs dated May 29, 2026.

2.0 TECHNICAL EVALUATION

2.1 Organization and Administration

PURPOSE OF REVIEW

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

The NRC staff reviewed Framatome's LAR and determined that it did not propose any changes related to Chapter 2, Organization and Administration, which has been previously reviewed and approved as part of its 2009 license renewal process (ML090760702).

REGULATORY REQUIREMENTS

10 CFR 70.22(a)(6), 70.23(a)(2), and 70.62(d) require 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 "[t]he 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."

10 CFR 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 LAR in accordance with Section 70.34.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

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

The guidance applicable to the NRC staff's review of the organization and administration section of the LAR is contained in NUREG-1520, Revision 2, Section 2.4.3, "Regulatory Acceptance Criteria."

NUREG-1520, Revision 2, Section 2.3, "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, NUREG-1520, Revision 2, Section 2.4.3, lists acceptance criteria for both new facilities and existing facilities. The regulatory acceptance criteria for existing facilities are applicable to the LAR.

STAFF REVIEW AND ANALYSIS

The NRC staff reviewed the LAR to determine whether the organizational structure and associated administrative program proposed by Framatome include adequate administrative policies, procedures and management policies; the qualifications of key management positions; and whether the LAR describes 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 Framatome SER Chapter 2, "Organization and Administration," for the proposed changes to authorize TRISO particle-based reactor fuel production and for the increase on enrichment from 6.5 weight (wt.) percent to up to 10.0 wt. percent U-235 for the area comprising the SF Building.

EVALUATION FINDINGS

The NRC staff determined that there are no changes to the Framatome organization and administration for production of TRISO fuel fabrication in the SF Building as presented in the September 20, 2024, license application submittal. The organization and administration at Framatome remain adequate and acceptable.

2.2 Integrated Safety Analysis

PURPOSE OF REVIEW

The purpose of the review of Framatome's ISA and ISA Summary is to attain reasonable assurance that Framatome has established an ISA program that is, and will continue to be, in compliance with Title 10 of the *Code of Federal Regulations* Part 70, Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material."

REGULATORY REQUIREMENTS

The NRC staff reviewed the LAR to ensure that the requested changes were consistent with the requirements in 10 CFR Part 70, including:

- 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;"
- 10 CFR 70.65, "Additional content of applications;"

REGULATORY ACCEPTANCE CRITERIA

The NRC staff used the guidance in NUREG-1520, Revision 2, “Standard Review Plan for Fuel Cycle Facilities License Applications,” Chapter 3, “Integrated Safety Analysis and Integrated Safety Analysis Summary.” The acceptance criteria for the NRC’s review of Framatome’s ISA are outlined in NUREG-1520, Revision 2, Section 3.4.3.1, “Safety Program and Integrated Safety Analysis Commitments,” and Section 3.4.3.2, “Integrated Safety Analysis Summary and Documentation.” 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.

STAFF REVIEW AND ANALYSIS

Framatome stated in the LAR Section 2, “Proposed Change,” (ML24264A171) that the TRISO fuel fabrication project is broken into ten nodes, including systems 690-699 and that systems 690-694 are processes with which Framatome has extensive experience and creates no new hazards nor uses new technologies that would require NRC prior approval. The processes in systems 695-699 include: Solution Gelation, Kernel Conversion, TRISO Coating, CVI, Scrap Recovery, Upgrading, Shell Filling, Inspection, He Leak Testing, Block Loading and Ancillary Support Systems. The LAR identifies the changes in the license application and the ISA Summary to support the amendment request. The bulk of the ISA changes are in the ISA Summary Part 2 – Chapter 11 – SF Building (E15-01-2.11), for the Specialty Fuels Building.

The NRC staff reviewed the LAR including the revised ISA Summary to ensure compliance with the applicable regulatory requirements. The NRC issued a request for additional information (RAI) by letter dated February 11, 2026 (ML26026A170), to obtain information needed to conduct a detailed technical review. Relevant to the ISA, RAI-11 through RAI-13 requested additional information on the adequacy of likelihood definitions for the new processes, Process Hazards Analyses for the Solution Gelation, Kernel Conversion and CVI Densification processes, further justification for the scoring of items relied on for safety (IROFS), and a number of sequence-specific questions. By letter dated May 12, 2026 (ML26132A301), Framatome provided responses to the NRC staff’s requests.

In RAI-11, the NRC noted that guidance in NUREG-1520 proposes quantitative likelihood definitions of 10^{-5} per event, per year for “highly unlikely” and a range of 10^{-4} to 10^{-5} per event, per year for “unlikely” and that these definitions were developed to be reasonably consistent with other NRC guidance. The RAI further notes that a footnote to the Risk Matrix in Table 4-5 in the Framatome ISA summary notes:

“The NRC has indicated a willingness to accept only a small number of high consequence accident sequences with a CEI=-4. To Meet company objectives process systems with accident sequences in this risk category will only be operated only with concurrence from the site manager.

As discussed in NUREG-1718, Section 5.4.3.2(B)(vii)(c), "Acceptance Criteria for Quantitative Definitions of Likelihood," the highly unlikely guideline is based on the goal of not having inadvertent criticalities in the fuel cycle industry. Limiting the total risk of having a high consequence event at each facility to 10^{-3} per year is reasonably consistent with this goal. Understanding facilities are likely to have approximately 100 high consequence sequences, a per sequence limit of 10^{-5} accomplishes this goal ($10^{-5} \times 100 = 10^{-3}$).

In response to RAI-11, Framatome stated that receiving site manager approval to operate at a controlled event index (CEI) of 4 for high consequence events is not a common occurrence and Framatome eliminated the last accident high consequence sequence that had a CEI=-4 in 2008. They further state that Framatome has not used the Justification for Continued Operation process to authorize restarting the operation of a process with a CEI of 4 without additional compensatory measures within the last ten years. In response to RAI-11, Framatome stated that the ISA summary will be updated to include a footnote stating: "The NRC has indicated a willingness to accept only a small number of high consequence accident sequenced with a CEI=-4. To meet company objectives, process systems with accident sequences in this category will only be operated with the concurrence from the site manager and such conditions will be infrequent and temporary."

While the regulations in 10 CFR 70.61 are written to control intermediate and high consequence events on a per event basis, the NRC staff agrees that small, "infrequent and temporary" deviations from the highly unlikely definitions proposed in NUREG-1520 will not significantly affect the overall goal facility risk. The NRC staff finds that Framatome's approach commits to controlling high consequence events to the likelihood definitions suggested in NUREG-1520 with only "infrequent and temporary" exceptions is consistent with the guidance in NUREG-1520 and satisfies the requirements for 10 CFR 70.61.

In RAI-13, the NRC staff noted that the index numbers used for scoring IROFS in the ISA summary tend toward the lower (non-conservative) range of the tables describing Framatome's ISA methodology, and the basis for the enhanced scoring was unclear. In its response, Framatome stated that its likelihood determination, as described in ISA Summary Part 1 – Chapter 1-8 – Richland Facility ISA Program (E15-01-1), Section 4.2.4, "Likelihood Determination," allows additional credit to be given to administrative IROFS when repeat administrative failures must occur before the IROFS no longer provides its safety function, consistent with the practices of NUREG/CR-1278, "Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications." The NRC staff reviewed several sequences and verified that the IROFS receiving additional credit appeared to require multiple human failures that are sufficiently independent to justify additional credit. Accordingly, the NRC staff finds this approach acceptable in meeting the performance requirements of 10 CFR 70.61 and the requirements for safety program in 10 CFR 70.62.

EVALUATION FINDINGS

The NRC staff finds that Framatome has established an ISA program that will continue to maintain compliance with 10 CFR 70.62. Specifically, the NRC staff finds:

- 1) Framatome has conducted an ISA of appropriate detail for each applicable process, using methods adequate to achieve the requirements of 10 CFR 70.62;

- 2) Framatome 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;
- 3) Framatome has documented the ISA in accordance with the requirements of 10 CFR 70.65.

The NRC staff finds that the ISA Summary demonstrates compliance with the requirements of 10 CFR Part 70 Subpart H.

2.2.1 - Integrated Safety Analysis - Natural Phenomena Hazards

PURPOSE OF REVIEW

The purpose of this review is to evaluate whether Framatome meets the applicable requirements for the systems, structures, and components (SSCs) for the proposed changes to authorize TRISO particle-based reactor fuel production and for the increase on enrichment from 6.5 weight (wt.) percent to up to 10.0 wt. percent U-235 for the area comprising the SF Building.

REGULATORY REQUIREMENTS

10 CFR 70.61(e) require, 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 that the safety program ensures that each IROFS will be available and reliable to perform its intended function when needed.

10 CFR 70.62(c)(iv) require, 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, "Requirements for new facilities or new processes at existing facilities," require, in part, that the design of a new facility and/or new processes incorporate baseline design criteria and defense-in-depth practices and provide adequate protection against natural phenomena hazards (NPH).

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The NRC staff review follows the guidance in Sections 3.4.3.1, "Safety Program and Integrated Safety Analysis Commitments," 3.4.3.2, "Integrated Safety Analysis Summary and Documentation," and Appendix D, "Natural Phenomena Hazards," of NUREG-1520, Revision 2. This review also follows the guidance in Interim Staff Guidance FCSE-ISG-15, "Natural Phenomena Hazards in Fuel Cycle Facilities" (ML15121A044).

STAFF REVIEW AND ANALYSIS

Framatome proposed new TRISO particle-based reactor fuel production into the existing SF Building and to increase the enrichment limit from 6.5 weight (wt.) percent to up to 10 wt. percent U-235 for the area comprising most of the SF building (SFB), (A structure built in 1970 as a Mixed Oxide Facility), and the adjoining south and west yard area (also known as “SF Ten Percent Island”). This introduces the new systems and processes for TRISO fuel production and requires modifications to the SSCs primarily within the existing SF Building.

In reviewing the LAR, the NRC staff notes that the changes to the affected SSCs 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.

The ISA summary for Framatome Richland site is presented in two parts. ISA Summary Part 1 – Chapter 1-8 – Richland Facility ISA Program (E15-01-1) (ML24264A179) includes Chapters 1-8 and describes the Richland Facility ISA Program at the site level. This includes Chapter 7, which addresses hazards such as natural phenomena and man-made events that apply on a sitewide basis or are evaluated through bounding scenarios. ISA Summary Part 2 – Chapter 11 – SF Building (E15-01-2.11) (ML2426A180) includes Chapters 2.11, which provides the ISA Summary that is specific to the SF Building and the proposed new processes. Framatome has revised both Part 1 and Part 2 ISA Summaries to incorporate the proposed TRISO fuel production activities and the associated expanded enrichment scope. These revisions are documented in E15-01-1FS, Version 32.0, and E15-01-2.11, Version 23.0, and as further modified by Framatome in the RSI and RAI responses. The NRC staff used the guidance in NUREG-1520, Rev. 2, FCSS Interim Staff Guidance-04, “Clarification of Baseline Design Criteria” (ML051520313) and Interim Staff Guidance FCSE-ISG-15, “Natural Phenomena Hazards in Fuel Cycle Facilities” (ML15121A044), in its review. The NRC staff reviewed Framatome’s design bases and design criteria for SSCs against NPH, the methods for evaluating and designing the SSCs, and the incorporation of the NPH assessments into the ISA Summaries, including the identification of NPH related IROFS and demonstration of compliance with the performance requirements in 10 CFR 70.61.

The NRC staff noted that previous staff evaluations of Framatome’s ISAs for NPH are documented in an NRC technical evaluation report and inspection report (ML16223A703 and ML16274A172, respectively) in response to Generic Letter 2015-01, “Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities.” The purpose of those evaluations and inspections was to document the staff’s review and determine whether additional actions were necessary to address the potential consequences of NPH events in the ISA for the existing processes at the Richland facility. Similarly, the previous NRC staff review of the ISA Summary is documented in the ISA summary technical evaluation report (ML072280248), which was credited in SER for the SNM license renewal application. For this LAR, the NRC staff reviewed the revised ISA Summaries to confirm safety and regulatory compliance, considering the existing evaluations for NPH and other external events wherever previous staff conclusions remain applicable and unaffected by the changes proposed under this LAR.

Baseline Design Criteria for Natural Phenomena Hazards

The NRC staff reviewed the baseline design criteria established for the proposed new TRISO fuel fabrication process in the SF Building, as described in ISA Summary Part 2 – Chapter 11 – SF Building (E15-01-2.11), Section 11.3.5, “Baseline Design Criteria,” and further supplemented in the applicant’s response (ML24264A170) to the NRC staff’s RSI 4-2. Based on this review, the NRC staff concludes that the applicant has appropriately identified and addressed the baseline design criteria requirements for NPH in 10 CFR 70.64(a), “Baseline Design Criteria.”

High Winds

ISA Summary Part 1, Section 7.1.1, “Potentially Hazardous Natural Phenomena,” identifies high-wind as a credible external event for the Richland site and states that the 100-year peak gust at 50 feet is 86 mph, corresponding to a fastest-mile wind speed of approximately 66 to 78 mph. The response to RSI 4-3 includes additional information confirming that no sustained winds since 2005 have exceeded the historical wind speeds previously reviewed by NRC staff. As stated in the RSI 4-2 response, the Main SF Building was designed to wind loads of 15 pounds/ft² (PSF) (up to 20 feet elevation) and 20 PSF (between 20 to 49 feet elevation) in accordance with Uniform Building Code (UBC) 1967, with 15 PSF corresponding to a fastest-mile design wind speed of roughly 76-mph. The SF Building Extension (i.e., Furnace Addition Building identified as Room 180 of the SF Building) was designed in accordance with UBC 1991 for a fastest-mile wind speed of 70 mph with an importance factor of 1.15 (approximately 75 mph). Overall, both the original SF Building and the extension were designed for wind loads consistent with the building codes in effect at the time of their design.

The NRC staff reviewed historical National Oceanic and Atmospheric Administration National Centers for Environmental Information (NOAA NCEI) data and determined that the highest recorded wind speed near the Richland facility was 96 mph during a 2011 thunderstorm event. Using American Society of Civil Engineering (ASCE) 7-16 Table C26.5-7, “Basic Wind Speeds,” the NRC staff compared the ASCE 7-16 design wind speed (proposed for major structural modifications and new installations) with the legacy design-basis wind speeds for both the Main SF Building and the SF Building Extension. A fastest-mile wind speed of 76 mph, using an allowable stress design (ASD) basis, corresponds to a 90 mph 3-second gust for an ASD or a 114 mph 3-second gust for an ultimate strength design (USD) in accordance with ASCE 7-16. However, because the legacy UBC provisions allowed a one-third increase in allowable stress for wind loading, the existing SF Building’s lateral force-resisting system would not be expected to meet the full 114 mph ultimate-level wind speed, assuming no additional design margin (i.e., between actual and allowable stress). Under this conservative assumption, and considering the USD methodology, the NRC staff estimates that the existing SF Building could withstand an ultimate-level wind 3-second gust wind speed of approximately 100 mph, which remains consistent with the historical maximum recorded wind speeds for the site.

Based on these considerations, the NRC staff concludes that the existing building design-basis, together with the proposed baseline design criteria, provides a design that appropriately accounts for the most severe historically reported high-wind event for the site

and surrounding regions. Accordingly, the NRC staff finds that the baseline design criteria for high-wind events meet the requirements of 10 CFR 70.64(a), "Baseline Design Criteria," for NPH.

Tornado and Tornado-Generated Missiles

ISA Summary, Part 1, Section 7.1.1, "Potentially Hazardous Natural Phenomena," states that no tornadoes were sighted in Benton County since 1956, and nine tornadoes of F0 and F1 rating on Fujita scale were recorded in southeastern Washington between 1980 and 2005. However, none of these nine tornadoes were observed near the site. The ISA Summary further states that the NUREG/CR-4461, Revision 1, Table 5-1, "Calculated Tornado Model Parameters," estimates the 95 percent upper-limit probability of a tornado striking a facility (finite structure) in the western United States as 6.88×10^{-6} per year. The nearby Columbia Nuclear Generating Station final safety analysis report similarly cites a probability of about six in a million per year for the nearby Exxon (now Framatome Richland) site, equivalent to roughly one in four thousand over a 40-year plant life. The Columbia Nuclear Generating Station final safety analysis report further states that these two independent estimates are in close agreement.

The NRC staff considered historical NOAA NCEI data in its review and identified six EF0 and two EF1 tornadoes events within 60 km of the Richland facility. In reviewing Framatome's tornado strike likelihood assessment and guidance in NUREG/CR-4461, Revision 2, "Tornado Climatology of the Contiguous United States," the NRC staff determined that Framatome's reference to the 95 percent upper-limit probability from Table 5-1 corresponds to a wind exceeding a specified speed if a tornado does strike. As previously assessed for high-wind events, the SF Building structures is expected to withstand approximately 100 mph ultimate 3-sec gust straight-line wind speed. According to NUREG/CR-4461, the expected tornado wind speed for an annual exceedance probability of 10^{-5} is approximately 78 mph near the Richland site area, and the suggested regional tornado design wind speed is 100 mph. Considering that the building structures are designed for comparable straight-line wind speed, and based on review of the NUREG/CR-4461, Appendix A, B, and C data for the Richland site, the NRC staff concludes that the design against high-wind events provides for a reasonable design-basis against historical tornado events, and tornado-generated missiles need not be considered for baseline design criteria.

Earthquake

ISA Summary, Part 1, Section 7.1, "External Hazards," identifies earthquakes as a credible external event for the Richland site. As stated in the application, new SSCs will be designed in accordance with the latest applicable seismic codes and standards, while existing SSCs will retain their original design requirements. Accordingly, the existing SF Building and the structural modifications and design of new process systems within the SF Building are reviewed as follows.

For the existing SFB, ISA Summary Part 1, Section 7.1.1 and the response to the NRC staff's RSIs describe the Main SF Building as designed to an operational basis earthquake peak ground acceleration (PGA) of 0.125 g and a design-basis earthquake or safe shutdown earthquake (SSE) PGA of 0.25 g. Framatome compared this earthquake design criteria to data from the nearby United States Department of Energy Hanford Reservation and Columbia Nuclear Generating Station and noted that the PGAs and annual probabilities of occurrence from Hanford data and the Final Safety Analysis Report for Columbia Generating Station are comparable for the Richland Facility. Framatome also identified and

provided the structural seismic calculations performed for the Main SF Building (ML26127A195 and ML26127A204). Based on the review of the calculations, the NRC staff notes that the structural responses were determined using seismic accelerations derived at each floor level using dynamic analysis method. These calculations were consistent with the codes of record used for the design and construction of each structure.

As described in the response to RSI 4-2, the SF Building Addition at the south end was designed to withstand an earthquake with a PGA of 0.2 g in accordance with the UBC 1991 design criteria. Framatome also identified and provided the structural calculation package (ML26127A200) prepared for this addition to the main building. The NRC staff finds that the seismic design calculations were performed using the equivalent static force method in UBC 1991. These calculations are consistent with the codes of record used for the design and construction of the added structure.

As described in Framatome's responses to the NRC staff's RSIs, the structural design for process systems were established in accordance with the International Building Code (IBC) 2021, the International Existing Building Code (IEBC) 2021, and American Society of Civil Engineering (ASCE) 7-16. Framatome also stated that no equipment or structures containing SNM are located outside the SF Building in the 10 wt. percent island area, except for waste drums/boxes, UF6 cylinders, and product shipping packages.

In response to RSI 4-2, Framatome identified the baseline design criteria for any major modification to the building structure. These criteria include mapped spectral response accelerations of 0.406 g for short periods and 0.161 g for 1-second periods. In accordance with ASCE 7-16, Section 11.6, "Seismic Design Category," Framatome determined the Seismic Design Category (SDC) to be SDC D based on the structure's Risk Category and the site-specific design spectral response accelerations. These criteria will apply to the proposed design of modifications to the existing building structure unless an exception under Section 805 of the IEBC is applicable. Considering the structural modifications identified by Framatome in response to the RSI 4-1, the NRC staff finds that these modifications qualify as excepted modifications under IEBC Section 805.

Regarding the structural design bases for new equipment and internal structures within the SF Building, Framatome stated in its response to RSI 4-2 that internal SSCs will be evaluated for seismic loads consistent with IBC 2021 and ASCE 7-16. For nonstructural components, Framatome will apply SDC D, an importance factor of 1.5 for critical components in accordance with ASCE 7-16, Section 13.1.3, "Component Importance Factor," and applicable component amplification factors and response modification factors based on the component type.

As stated in ISA Summary, Part 2, Section 11.3.5.2, "Natural Phenomena Hazards," Framatome will evaluate the effects of seismic design loads on the IROFS SSCs in the new SF Building configuration, including potential interactions with non-safety SSCs and equipment. This analysis will be performed once the TRISO fuel fabrication process design is finalized and equipment and anchorage details become available. The design will comply

with the applicable codes and standards referenced in the response to RSI 4-2 for new equipment and internal SF Building structures. The resulting evaluation will be available for NRC on-site review during the operational readiness review. The NRC staff notes that the structural analyses and designs for these SSCs will be verified to be consistent with the specified design codes and standards during an operational readiness review, as discussed in new condition S-11 that is being added to materials license SNM-1227 – see Section 4.0 of this SER.

As described in the response to RSI 4-3 and the Framatome Supplement to the Environmental Report, Section 3.3.2, “Seismology,” (ML24264A187), Framatome identified the 1872 Eastern Washington earthquake as the strongest historical event for the region, with an estimated magnitude of 7.0 and Maximum Modified Mercalli Intensity (MMI) of IX. The epicenter is estimated to be between Wenatchee and British Columbia, though its exact location is unclear. According to the Seismological Society of America Bulletin, Vol. 92, No. 8 (2002), the highest recorded MMI was VIII near Lake Chelan; closer to Richland, it was VI. The Environmental Report Supplement lists major Columbia Plateau earthquakes (1850-2000), noting a 1936 Oregon event of magnitude 6.0 and MMI VII. The NRC staff reviewed historical data and found no other significant earthquakes since 2001. The probabilistic seismic hazard analyses for the nearby Hanford site estimate 0.2 g horizontal acceleration for a 2,500-year recurrence interval matching US Geological Survey (USGS) and ASCE 7-16 standards. Under ASCE 7-16, SDC D corresponds to MMI VIII, indicating new installations exceed historical seismic intensity. Therefore, the NRC staff concludes that the applicant’s baseline design criteria for earthquake events complies with the requirements in 10 CFR 70.64(a)(2).

Intense Precipitations

Snow

ISA Summary, Part 1, Section 7.1.1 identifies snow as a credible external event for the Richland site. The response to RSI 4-3 states that the highest one-day snowfall accumulation in recent history was 14.0 inches, recorded in 1921. As stated in the response to RSI 4-2, the Main SF Building was designed to a roof load of 20 PSF in accordance with UBC 1967. The SF Building Extension (Furnace Addition) roof was designed for 25 PSF snow load, corresponding to a basic ground snow load of 31 PSF, in accordance with UBC 1991. Both the Main SF Building and the subsequent building addition were designed for snow loads using the methodology in the governing building codes applicable at the time of their original design.

The NRC staff reviewed historical snowfall data from the NOAA NCEI database and determined that the most severe documented snowfall event near the Richland site was 19 inches. Using the methodology in Interim Staff Guidance (ISG) DC/COL-ISG-07, “Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures,” specifically Equation 1 for estimating ground snow load from maximum recorded snowfall, the NRC staff calculated that the 19-inch snowfall event corresponds to an approximate ground snow load of 15.3 PSF. The NRC staff also compared the ASCE 7-16 flat roof snow load requirement to design-basis roof loads for both the Main SF Building and the SF Building Extension. The comparison shows that the design-basis roof loads for both structures meet or exceed the ASCE 7-16 requirements for Risk Category IV buildings.

Based on this review, the NRC staff concludes that Framatome's baseline design criterion for snow load properly accounts for the most severe historically documented snowfall event for the site and surrounding area. Therefore, the NRC staff finds that the baseline design criteria for snowstorm events meet the requirements of 10 CFR 70.64(a), "Baseline Design Criteria," for NPH.

Rainfall Intense Precipitation

SNM-1227, Chapter 1, Section 1.3.3, "Meteorology," and ISA Summary Part 1, Section 7.1.1 identify intense precipitation from rainfall as a credible external event for the Richland site. ISA Summary Part 1, Section 7.1.1, stated that based on historical data, the Hanford area can expect two inches of rain in a 24-hour period once every hundred years. The estimated probable maximum precipitation (PMP) for a 5-hour time span is 9.2 inches from an area thunderstorm per the nearby Columbia Generating Station (CGS) FSAR. The roofs of the structures are designed for at least 20 PSF and have adequate capacity drainage system. The design-basis criterion for roof load is 20 PSF (4 inches of water) for the Main SF Building and 25 PSF for the SF Building Extension.

The NRC staff reviewed precipitation data provided by the NOAA National Weather Service for the site and noted that the NOAA Atlas 2, Volume IX, Figure 30 identifies a 100-year, 24-hour precipitation data, that is consistent with the two inches of rainfall in 24 hours cited in the ISA Summary Part 1 for the Hanford area. The ISA Summary also references the nearby CGS PMP event, which yields 9.2 inches of precipitation over a 5-hour period from an area thunderstorm. The NRC staff further reviewed NOAA's Hydrometeorological Report No. 57 (HMR57), which provides general storm PMP estimates for the Pacific Northwest States. HMR57 identifies 24-hour general storm PMP of 8.5 inches for the Richland site, which generally aligns with the 7.9 inches calculated in the CGS FSAR. The NRC staff notes that, by comparison, the thunderstorm PMP is considerably more severe and, therefore, governs the design of the roof structural and drainage system.

Based on the above considerations, the NRC staff concludes that the baseline design criterion for intense precipitation has appropriately considered the most severe historically reported intense precipitation from rainfall for the site and surrounding region. Therefore, the NRC staff finds that Framatome's baseline design criterion for rainfall events meet the requirements of 10 CFR 70.64(a), "Baseline Design Criteria," for NPH.

Ice

The NRC staff noted that the design for ice loading is only applicable to structures where atmospheric icing governs the structural design. Such structures are classified as "ice--sensitive structures" per ASCE 7-16, Section 10.2, "Definitions." The SF building does not meet this definition. Therefore, the NRC staff concludes that ice loading need not be considered for baseline design criteria.

Extreme Temperatures

The Supplement to the Environmental Report, Section 3.4.4.1, "Meteorology and Climatology," (ML24264A187) states that the Pasco Basin in the Columbia Plateau has a semi-arid climate shaped by the Pacific Ocean and surrounding mountain ranges. Average summer and winter temperatures are approximately 23.4 °C (74.2 °F) and 1 °C (33.8 °F),

respectively, with temperatures falling below freezing on roughly 107 days each year. The historical record temperatures are 47.8 °C (118 °F) and -30.6 °C (-23 °F). In response to the RAI St-2, Framatome subsequently identified 120 °F and 29 °F as the record high and low temperatures.

The NRC staff noted that these temperature data were obtained from the Hanford Site Climate Data Summary 2024 report, NOAA Richland Weather Records from 1894 to 2026, and State Climate Extremes Committee Memorandum dated Feb. 3, 2022. These sources provide site-specific climatological information collected at meteorological stations located at the nearby USDOE Hanford site.

The NRC staff finds Framatome's use of these climatological data recorded at nearby representative meteorological stations to be acceptable and finds them to be consistent with NRC guidance provided in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," to establish a design criterion for extreme temperature events at nuclear facilities. Therefore, the NRC staff finds that Framatome's baseline design criterion for NPH meets the requirements of 10 CFR 70.64(a), "Baseline Design Criteria."

Review for Compliance With 10 CFR 70.61

To demonstrate compliance with the performance requirements of 10 CFR 70.61, Framatome intends to demonstrate that the design of the existing SF Building, along with the design of the new process system developed in accordance with the established design criteria, provides adequate protection against credible NPH and/or other man-made external hazards.

Consistent with 10 CFR 70.61(b) and (c), Framatome's design incorporates engineered controls intended to prevent or mitigate the consequences of credible external events. These controls are designed to ensure that the facility maintains compliance with the performance requirements of 10 CFR 70.61, particularly in scenarios where external events could result in consequences exceeding performance requirements in 10 CFR 70.61. The ISA Summary stated that the existing SF Building and subsequent alterations were designed and constructed to comply with the UBC criteria applicable for the year of design and construction. Framatome credited IROFS # 0.24 that requires the Richland facility and associated SSCs to be designed and built to meet the prevailing codes and standards to ensure adequate protection against the credible NPH hazards and other external events.

The NRC staff reviewed the applicant's design-basis for the existing facility structures and design criteria for the proposed modifications and installations of the new process systems containing SNM, using the acceptance criteria in NUREG-1520, Section 3.4.3.2(2)(c), "Integrated Safety Analysis Summary and Documentation." In addition, the NRC staff considered acceptance criteria from NUREG-1520, Sections 3.4.3.2(3) and 3.4.3.2(4), which evaluates the hazards and accident sequences identified to demonstrate compliance with the performance requirements of 10 CFR 70.61. Based on these criteria, the NRC staff evaluated the acceptability of Framatome's design-basis for the existing facility structure and the proposed design criteria for the modified and new process systems and associated controls parameters to determine whether they adequately prevent or mitigate potential hazards from credible external events, as discussed below.

High Winds Evaluation

The Main SF Building and Furnace Addition were designed in accordance with the 1967 and 1991 Editions of the UBC, respectively, to withstand service level wind events of 75 to 76 mph fastest-mile wind speed, that is equivalent to a 3-sec gust, 90 mph service level wind event as described in the “High Winds” Section of this chapter of the SER. This design wind speed exceeds the 3-sec gust wind speed 86 mph corresponding to a 100-year mean recurrence interval (MRI) per ASCE 7-16 for the Richland site. The NRC staff notes that the existing buildings’ 100-MRI wind load design-basis is consistent with NRC guidance in NUREG-0800 for the design at the nuclear facilities. Further, as described in the “High Winds” Section, considering a margin between the increased ASD and USD methods, this building is expected to tolerate loads associated with approximately 100 mph, 3-sec gust, ultimate wind speed that corresponds to 700-year MRI per ASCE 7-16.

Based on these design considerations and comparison with the current codes and standards for the wind loading, the NRC staff concludes that the structural design of the SF Building is adequate to withstand high winds events. The likelihood of structural failure due to such events resulting in the release of radioactive material is considered to be highly unlikely. Therefore, the NRC staff finds that the SF Building meets the performance requirements of 10 CFR 70.61 with respect to high winds event hazards.

Seismic Evaluation

For the existing SF Building, the seismic design of the building structures followed the applicable UBC requirements in effect at the time of construction. The Main SF Building was designed to an SSE PGA of 0.25 g. Framatome compared this design-basis event with seismic hazard information from both the Hanford Reservation and the Columbia Generating Station. These sources report PGAs and annual exceedance probabilities that are consistent with the Richland design inputs. Based on this information, Framatome estimated the probability of earthquake-induced structural or component failure to be on the order of 10^{-4} to 10^{-5} , classifying such events as “highly unlikely” in accordance with its ISA methodology. The NRC staff’s review of the Columbia Generating Station FSAR identified an annual exceedance probability of 1.1×10^{-4} for a 0.25 g PGA, and 2.9×10^{-5} to 9.2×10^{-5} for the SSE response spectrum (0.125 sec–0.4 sec), which is consistent with Framatome’s estimated values.

For the Furnace Addition (Room 180) to the SF Building, Framatome states that the structure is designed to a 0.2 g PGA, corresponding to an annual probability of exceedance 4×10^{-4} . The NRC staff previously reviewed and evaluated the seismic design bases for the process and storage buildings at the Richland site with the same design-basis PGA and exceedance probability (ML16223A703). Based on its review of the SF Building Addition’s seismic design-basis, the changes addressed in this LAR, and the prior NRC staff evaluation, the NRC staff concludes that the previous NRC staff evaluation appropriately bound the seismic hazards for this LAR and remains applicable.

For structural modifications and the design of the new process systems, Framatome proposed using ASCE 7 Risk Category IV for the structural design of SSCs, reflecting the significance of their safety functions. The associated importance factor of 1.5 ensures that the structural performance of the building modifications and support systems within the SF Building will meet or exceed that of the existing building. Consequently, the NRC staff conclude that the likelihood of collapse or loss of structural integrity remains unaffected.

The ISA Summary also states that critical nonstructural components are also designed to meet the same design-basis earthquake event as the primary structures, following the seismic design methodology for nonstructural components outlined in ASCE/SEI 7-16. In accordance with this standard, nonstructural components are designed using an importance factor of 1.5 and the same SDC as the supporting structure. This ensures that these components remain anchored and functional during and after a seismic event. Consequently, the NRC staff concludes that the likelihood of collapse or loss of structural integrity due to seismic events is low and therefore meets the performance requirements of 10 CFR 70.61.

Intense Precipitation (Rain, Snow) Evaluation

The roofs of the SF Building at the Richland facility are designed in accordance with the UBC code edition in effect at the time of design and construction of the original building and subsequent addition to withstand environmental loads associated with intense precipitation events, including rain and snow.

The ISA Summary, Part 2, identifies building roof as a primary barrier (IROFS # 1108 and 1614) to prevent atmospheric precipitation from entering process areas and to ensure moderation control. The SF Building roofs at the Richland facility are designed for a rain load of at least 20 PSF (approximately 4 inches of water) and incorporates a drainage system to prevent rainwater accumulation. The estimated PMP for a 5-hour duration is 9.2 inches from an area thunderstorm, with a peak one-hour accumulation of 5.2 inch. In response to RAI St-1 (ML26149A379), Framatome stated that the building roof water accumulation depth and drain design are based on an analysis that assumes one primary roof drain is blocked and uses the 100-year design-basis rainfall event of 1 inch per hour. The calculated ponding depth during a design-basis event is less than 0.5 inches. Framatome further stated that each roof drain has a capacity that exceeds the flow-rate demand for both the design-basis rainfall event and the PMP event.

Based on a review of the roof and drainage systems design, the NRC staff concludes that it is highly unlikely that either a PMP event or a design-basis rainfall event would result in roof damage capable of causing significant radiological or chemical consequences or nuclear criticality incidents.

Extreme Temperatures Evaluation

In its response to RAI St-2, Framatome indicated that hazards associated with extreme temperatures will not result in consequences of concern for the IROFS inside the SF Building. Passive engineering controls (e.g., IROFS # 0.20, #302) like pipe and vessel

geometry and material integrity ensure criticality safety under the temperature extremes at the site. Fissile liquids are handled in vessels with geometry that ensures criticality safety under any concentration changes from freezing or evaporation. Loss of electricity or other system faults trigger a safe shutdown of process systems. I&Cs are rated for commercial and industrial environmental limits; operations can be suspended if extreme temperatures exceed those limits. For the electrical, digital, I&C IROFS detailed evaluation, refer to Section 2.11 of this SER.

Based on these considerations, the NRC staff concludes that the likelihood of an extreme temperature event leading to the release of radioactive material or a criticality event is highly unlikely. Therefore, the NRC staff finds that the new process within the SF Building meets the performance requirements of 10 CFR 70.61 with respect to extreme temperature hazards.

Flooding

ISA Summary, Part 1, Section 7.1.1 states that historical flood data indicate a 500-year flood would not reach the Richland Facility, regardless of flood control dams on nearby rivers. Therefore, Framatome did not identify flood-related hazards that could cause unacceptable risk.

The NRC staff evaluated the most recent flood hazard information available from the Federal Emergency Management Agency under the National Flood Insurance Program for the Richland site. Based on this review, the NRC staff determined that there have been no changes to the site's flood hazard conditions relative to those previously reviewed by the NRC. Accordingly, the NRC staff concludes that the site remains well outside the 1-percent annual chance (100-year) floodplain and 0.2 percent (500-year) annual chance floodplain. Based on the current data available for the site location pertaining to flooding and the nature of the changes requested in this LAR, the NRC staff finds that the conclusion in the previous NRC evaluation (ML16223A703) remains applicable to this LAR.

Lightning

ISA Summary, Part 1, Section 7.1.1 states that the likelihood of a lightning strike affecting the Richland site is low, based on the regional flash density and the footprint of existing buildings. Therefore, the existing facility structures were not designed to include dedicated lightning-protection features. The ISA Summary states that a lightning strike could result in a loss of normal power and, although unlikely, may initiate a fire. Such fire scenario is bounded by the fire hazard analyses described in ISA Summary, Part 1, Section 7.2.3, "Fire Hazards."

The NRC staff reviewed the proposed building structural modifications described in the response to RSI 4-1 and determined that the changes are minor and do not impact the conclusions of the previous NRC evaluation (ML16223A703) regarding protection of structures against lightning events. For the evaluation of the fire safety due to the addition of new or modified process systems within the SFB, refer to Section 2.6 of this SER. For the evaluation of the new electrical, and digital I&C systems' IROFS equipment and components safety to protect against power surges and a loss of power associated with lightning strike event, refer to Section 2.11 of this SER.

Volcanoes

In ISA Summary, Part 1, Section 7.1.1, Framatome provided historic volcanic activity data and stated that an eruption of volcano only leads to ash accumulation at the Richland Facility. As a result, volcanic eruptions present no significant hazards that would lead to consequences of concern. The eruption of Mount St. Helens in 1980 was identified as a major volcanic event, but its impact to Richland facility was limited to ash deposition. As documented in previous NRC technical evaluations and inspection reports (ML16223A703 and ML16274A172), Framatome has established emergency response procedures for volcanic events, including equipment shutdowns protocols and the evacuation of non-essential personnel. Additionally, based on the NRC staff's review of the NOAA NCEI volcanic activity database, no volcanic eruptions have been reported in Washington state since 1981. Considering the historical volcanic activity data, the existing emergency response procedures, and the changes described in this LAR, the NRC staff finds Framatome's approach acceptable and concludes that the previous NRC evaluation remains applicable to this LAR.

Landslides

In ISA Summary, Part 1, Section 7.1.1, Framatome stated that most landslide zones in Benton County are 500–2,000 years old and stable. The Rattlesnake Hills near Hanford and Kennewick have steep slopes, some over 50 percent, but remain stable. There are no steep or unstable slopes at or near the Richland Facility. Considering the topography of the area in the vicinity of the Richland facility and historic data, the NRC staff finds that the landslide risk is minimal to none and concludes that accident sequences due to a landslide event need not be considered.

Rangeland Fires

According to ISA Summary, Part 1, Section 7.1.1, natural cover fires are frequent in the Columbia Plateau. Dryland agriculture, rangeland, and undeveloped areas account for more than 50% of Benton County's land, which is dry and hot during summer and creates a risk for rangeland fires.

As documented in previous NRC reviews and inspection reports (ML16223A703 and ML16274A172), the risk of wildfire to the facility is low. The NRC staff reviewed existing SF Building designs, construction drawings, and prior reports, and notes that metal and concrete buildings with fire-resistant roofs and minimal surrounding vegetation maintains a lower fire risk, preventing the external hazards in leading to consequences of concern. The NRC staff finds that these earlier findings are still valid for this LAR. Therefore, the NRC staff concludes that the risk of a rangeland fire causing an accident at the facility remains low.

Man-Made External Events

Dam Failure

In ISA Summary Part 1, Section 7.1.2, "External Man-made Hazards", it indicates that flooding from the Columbia River due to the presence of dams and dikes is characterized as highly unlikely. Seven upstream dams were constructed to withstand major events, including

earthquakes. Inundation mapping indicates that only a failure of the Grand Coulee Dam would result in flooding at the Richland Facility. The estimated arrival time of floodwaters from such failure is approximately 23 hours, with cresting expected around 38 hours after the event. Framatome stated that the likelihood of a failure of the Grand Coulee Dam is very low and that the available warning time would allow sufficient time for safe evacuation should a failure occur. Previous NRC evaluations concluded that the release of hazardous material leading to unacceptable consequences under such flooding scenario is highly unlikely.

In the event of a dam failure, the emergency response procedure requires that all open SNM to be secured in closed containers and the immediate evacuation of site personnel. In response to the NRC staff's inquiries regarding this LAR, Framatome confirmed that this emergency response procedure remains applicable to the SF Building facility and the proposed new processes. Framatome also noted contamination control practices limit both the number and location of open containers, resulting in only a small number of containers being open during any given shift. Operators routinely close and store containers as part of standard operating procedure.

Based on the proposed changes in this LAR and the finding of previous NRC reviews, the NRC staff concludes that the prior evaluation remains applicable and that the event continues to be highly unlikely.

Offsite Hazardous Material Spills and Traffic Accidents

In ISA Summary Part 1, Section 7.1.2, Framatome described the risks associated with hazardous material releases, including potential transport accidents involving chemicals within Benton County. Horn Rapids Road and other nearby two-lane roads are located approximately 300 to 2,500 feet off the Richland facility. However, no relevant accidents have been reported in the immediate vicinity. Historical incidents in the region range from minor spills to major transportation accidents, yet safety assessments demonstrate that, when necessary, the facility can be safely evacuated or shut down with no resulting consequences of concern. Most of the facility is protected by a concrete barrier system, except for the front parking lot and office complex, and a 300-foot setback with soft gravel further reduces the risk of vehicle breaches.

Because this LAR does not alter these site characteristics and does not introduce new on-site hazards due to an offsite spill or a traffic accident, the NRC staff concludes that such events would not result in consequences of concern and continues to meet the performance requirements of 10 CFR 70.61.

Airplane Crash

In ISA Summary Part 1, Section 7.1.2, Framatome identified three municipal airports located within the Tri-Cities area. The Richland Airport, approximately 2.5 miles from the facility, experiences light aviation traffic. The other two airports are located roughly 9 miles from the site. Considering the likelihood of a heavy commercial aircraft crash and the likelihood for general aviation aircraft, Framatome calculated the combined likelihood as 2.9×10^{-5} per year, which Framatome characterized as highly unlikely.

The previous NRC evaluation (ML072280248) concluded that these results were acceptable and met the requirement of 10 CFR 70.62(c)(1)(iv). The NRC staff considered the proposed changes in this LAR and prior NRC evaluations and confirms that the previous evaluation

remains applicable to this LAR and continues to support the conclusion that the event is highly unlikely.

EVALUATION FINDINGS

The NRC staff concludes that the SF Building at the Richland facility has been appropriately evaluated and designed to protect against credible external events. Framatome has properly identified and applied the baseline design criteria in accordance with 10 CFR 70.64(a)(2), as applicable to the new processes SSCs within the facility. The LAR defines the relevant design-basis events and associated safety parameter limits for their design, and provides supporting methodologies, data, and available analysis results that demonstrate compliance with these design bases for the SF Building and the critical SSCs within the building.

Based on this evaluation, the NRC staff concludes that the engineered controls established to mitigate the risks associated with credible external events provide reasonable assurance that the consequences of such events are either highly unlikely to occur or do not exceed the performance requirements specified in 10 CFR 70.61.

2.2.2 - Integrated Safety Analysis – Human Factors

PURPOSE OF REVIEW

The purpose of this review is to evaluate whether Framatome meets the applicable requirements for the human factor engineering practices for the proposed changes to authorize the production of TRISO fuel and to authorize the production, handling and storage from 6.5 to up to 10.0 wt.% U-235 in the SF Building.

REGULATORY REQUIREMENTS

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

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 Section 70.61(e) are designed, implemented, and maintained as necessary to ensure they are available and reliable to perform their function when needed.

10 CFR 70.65(b)(4) states, in part, that the ISA Summary must include a description of the management measures to be applied to 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, "Standard Review Plan for Fuel Cycle Facilities License Applications," Revision 2, 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. HFE 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," of NUREG-1520 provides guidance for assessing whether 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," of NUREG-1520 provides guidance to ensure HFE is applied to personnel activities identified as safety significant, is consistent with the findings of the ISA, and supports 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.

STAFF REVIEW AND ANALYSIS

The NRC staff reviewed the LAR and evaluated both Administrative (Admin) and Enhanced Administrative (EA) Control IROFS. Framatome describes Admin IROFS as controls that rely on actions, judgement, and responsible actions of people for their implementation. Their use is limited to situations where passive and active engineered controls are not practical. Assurance is maintained through selected management measures (MM). EA Control IROFS are described as those IROFS that involve human intervention augmented by warning devices or other automated prompts and are preferred over simple procedural requirements for a specific action.

Framatome will utilize its dry conversion process for chemical conversion of UF₆ to uranium dioxide powder for further processing into TRISO fuel. Framatome stated that the process that will be used for TRISO fuel is the same basic design that is currently used at the Fuel Fabrication Facility. Equipment sizes will be modified based on criticality safety requirements and the process will be conservatively designed to support less than 20.0 wt.% U-235 enrichment even though the enrichment for the new process will be less than 10 wt.% U-235.

New IROFS

The NRC staff evaluated the proposed new IROFS that would be created by the new types of accident scenarios introduced by the addition of the TRISO fuel fabrication project to Framatome's existing licensed activities.

The NRC staff evaluated the change and justification of the IROFS in the ISA Chapters including the forms and operator aids which must be issued concurrently with the chapter revision. Framatome stated they will continue to use its graded approach to quality for new IROFS and will continue to comply with Section 11.8, "Quality Assurance for IROFS," of the existing license. Likewise, Framatome's records management process is unchanged by the LAR. All controlled documents created to support the activities in the LAR (i.e., forms and operator aids) will meet the license commitments made in, in part, Chapter 11, "Management Measures."

The NRC staff finds the new IROFS created by the new types of accident scenarios due to the production of TRISO fuel to be acceptable because each IROFS has the appropriate level of risk (i.e., probability of failure on demand (PFOD) value) and application of MMs such that the IROFS are available and reliable to perform their intended safety function. The application provides sufficient information to demonstrate the identification of personnel activities as discussed in NUREG-1520, Appendix E, "Human Factors Engineering for Personnel Activities."

New IROFS That Are Similar to Existing IROFS

The NRC staff evaluated whether the addition of existing IROFS to new accident scenarios would change the IROFS description, PFOD, and/or MM. Specifically, the NRC staff evaluated the proposed new IROFS that stated in their descriptions that they were "similar" to existing IROFS.

The NRC staff reviewed the IROFS descriptions and determined that the changes in the descriptions are considered editorial as they reflect the proposed change of TRISO fuel production in the SF building. Moreover, if for some reason, the LAR for the SF Building/Advanced Reactor Fuel Manufacturing (ARFM) complex is not approved or approved in time, there will be no impact on the portion of the Framatome site not associated with the ARFM complex because the IROFS associated with these containers are not used in that area.

The NRC staff finds the proposed IROFS to be acceptable because they are similar to current IROFS. The changes provide clarity, specificity, and reflect the use of TRISO fuel production. Additionally, the changes did not result in an increase in risk for the IROFS or changes to their respective MM such that the IROFS are available and reliable to perform their intended safety function. The application provides sufficient information to demonstrate the identification of personnel activities as discussed in NUREG-1520, Appendix E.

EVALUATION FINDINGS

The NRC staff finds Framatome's request to begin TRISO fuel production in the SF Building (i.e., ARFM) to be acceptable because Framatome will continue to apply HFE practices and MM to the proposed Admin and EA Controls 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, with reasonable assurance, that the proposed IROFS will remain 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 Framatome'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 staff conducted this review to determine whether the radiation protection program described in the Framatome license application is adequate to protect the radiological health and safety of workers and to comply with the associated regulatory requirements in 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," for up to 10.0 wt.% U-235 enrichment and production of TRISO fuel fabrication in the SF Building license application.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

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

STAFF REVIEW AND ANALYSIS

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

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) the requirement to provide a program to ensure that worker and public doses are as low as is reasonably achievable.

While uranium at enrichments up to 20.0 wt.% can technically be considered a radiation hazard through ingestion, dermal, and ocular routes, the primary concern with this level of enrichment is usually its chemical toxicity rather than its radiation potential, meaning the

health effects from exposure are more likely to be due to its chemical properties than its radioactivity, especially when considering skin contact or ingestion; however, inhalation of soluble uranium compounds at this enrichment level could pose a significant radiation hazard. For most exposure scenarios with uranium enriched up to 20.0 wt.%, the primary health concern is chemical toxicity, particularly kidney damage, which can occur through ingestion or inhalation of soluble uranium compounds.

EVALUATION FINDINGS

The LAR does not change Framatome's radiation protection program. Since there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, and there is no significant increase in individual or cumulative occupational radiation exposure, the NRC staff finds that the radiation protection program is adequate to protect workers and members of the public who may potentially be exposed to radiation as previously concluded the "Safety and Safeguards Evaluation Report for the Renewal of SNM-1227 – Framatome," issued in 2009 (ML090760702).

Therefore, the NRC staff finds, with reasonable assurance, that the current radiation protection program, as described in the current license, is adequate for the proposed 10.0 wt.% 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, Framatome 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." Framatome 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 regulations in 10 CFR 70.61, "Performance requirements," specify the performance requirements for compliance with 10 CFR Part 70, Subpart H. Framatome is required to submit information to demonstrate compliance with the following performance requirements:

- the descriptive commitments required by 10 CFR 70.62, "Safety program and integrated safety analysis,"
- ISA Summaries as required by 10 CFR 70.65, "Additional content of applications,"
- 10 CFR 70.24, "Criticality accident requirements,"
- 10 CFR 70.52, "Reports of accidental criticality,"
- 10 CFR 70.64, "Requirements for new facilities or new processes at existing facilities,"
- 10 CFR 70.72, "Facility changes and change process," and
- 10 CFR Part 70, Appendix A, "Reportable Safety Events."

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The NRC staff's review was conducted in accordance with the applicable acceptance criteria in NUREG-1520, Revision 2, Chapter 5, "Nuclear Criticality Safety," (ML15176A258). This includes the commitment to use NRC Regulatory Guide 3.71, which endorses the use of the American National Standards Institute/American Nuclear Society, Series-8 NCS standards, with some exceptions.

STAFF REVIEW AND ANALYSIS

The LAR relies on the existing nuclear criticality safety (NCS) program and does not propose changes to the organizational structure, NCS program administration, methodologies, or analytical techniques. Elements of the NCS program that are unchanged include MM, Framatome's criticality safety control philosophy, preferences of NCS controls, creating Nuclear Criticality Safety Analyses (NCSAs), Nuclear Criticality Safety Specifications (NCSSs), NCS postings, Operating Procedures, Fissile Content Determination, Reporting off-standard NCS conditions, operational and incident reviews. These elements of the NCS program were previously evaluated and found to be acceptable by NRC staff as documented in the NRC staff SER, "Safety Evaluation Report for the Renewal of SNM-1227 Richland Fuel Fabrication Facility Richland, Washington – Docket No. 70-1257," (ML090760702). Therefore, the NRC staff's review of the LAR focused on the changes in technical practices when evaluating the new process and the assurance of subcriticality under normal and credible abnormal conditions, Criticality Accident Alarm System (CAAS) coverage, and the applicability to the approved minimum margin of subcriticality (MMS).

The NRC staff performed an audit at the Framatome site in Richland, Washington during the review process for the LAR. The NCS part of the audit focused on-site control of NCS material and additional NCSAs to supplement the amendment submittal. The audit is documented within the NRC audit plan (ML25363A158).

Criticality Safety Program Changes – Technical Practices, Normal and Credible Abnormal Conditions

The LAR does not propose any changes to Framatome's commitments to their criticality safety control philosophy or methodologies of calculating k_{eff} . Framatome's criticality safety control philosophy includes a commitment to the double contingency principle and conducting NCSAs that analyze both normal and credible abnormal conditions of each process to be adequately subcritical. These commitments were previously evaluated and found to be acceptable by the NRC staff as documented in the NRC SER, "Safety Evaluation Report for the Renewal of SNM-1227 Richland Fuel Fabrication Facility Richland, Washington – Docket No. 70-1257." Therefore, the NRC staff's review focused on a new technical practice within the NCS program for enrichment controls and a vertical slice review of new processes' NCSAs to show adherence to the previously accepted NCS program.

The NRC staff reviewed the new enrichment control methodology for the Advanced Reactor Fuel Complex with the acceptance criteria outlined in NUREG-1520 Rev. 2, Section 5.4.3.1.7.3, "Evaluation and Implementation of Controlled Parameters." Framatome commits

to the assumption of a maximum 10.0 wt. % U-235 when evaluating NCSEs, unless the criteria of segregating differing enrichments and verification are met. The NRC staff reviewed process NCSAs relating to the SF Building for assurance that Framatome is following their license commitments in EO4-NCSA-695, Version 1.0, "Specialty Fuels – Solution Gelation," (ML26050A506, non-public) and EO4-NCSA-696, Version 1.0, "Specialty Fuels – Kernel Conversion, TRISO Coating, and CVI," (ML26050A500, non-public). Each NCSA reviewed used limiting and conservative enrichment values as described within the license amendment.

The NRC staff also reviewed NCSAs pertaining to the Advanced Reactor Fuel Complex for acceptability of 10 CFR 70.61 requirements pertaining to criticality safety. Each NCSA identified multiple accident sequences that could result in a criticality. The analysis prescribed process limits to meet the double contingency principle for criticality safety and meet the performance requirements of 10 CFR 70.61. The NRC staff's review of the performance requirement methodology is described in Chapter 2.2 of this SER. To prescribe these limits, each process is analyzed for normal and credible abnormal conditions and sensitivity studies are performed to determine the most reactive configurations within each process step. The sensitivity studies include moderator to fuel volume ratio (V_m/V_f), kernel size, process interaction configurations, uranium concentration, UO_2 powder density, and interstitial moderation conditions between discrete objects in arrays. The NRC staff reviewed each NCSA for adherence to the approved NCS program, along with satisfying the criticality requirements of 10 CFR 70.61. The NRC staff found, with reasonable assurance, that Framatome provides adequate protection against all credible criticality-related hazards and satisfies the requirements of 10 CFR 70.61.

Criticality Accident Alarm System

The proposed amendment does not involve any changes to Framatome's commitments related to CAAS coverage. These commitments were previously evaluated and found to be acceptable by NRC staff as documented in the NRC SER, "Safety Evaluation Report for the Renewal of SNM-1227 Richland Fuel Fabrication Facility Richland, Washington – Docket No. 70-1227." The SF Building has previously housed processes that involve an amount of SNM necessitating a CAAS system. As described in the ISA summary for the SF Building, the building will use a CAAS to detect an inadvertent criticality but does not explicitly state the current status of the alarm system within the SF Building. Therefore, NRC staff reviewed the license commitments related to CAAS coverage to ensure that the commitments are sufficient to continue to satisfy the requirements of 10 CFR 70.24.

Framatome continues to commit to a CAAS that meets the requirements of 10 CFR 70.24(a)(1). SNM-1227 – Chapter 5, Nuclear Criticality Safety, Section 5.5, "Criticality Accident Alarm System – CAAS," states that the CAAS system shall be capable of detecting, with at least two detectors, a criticality that meets the requirements of 10 CFR 70.24(a)(1). The NRC staff reviewed a detector coverage map and technical testing information provided in the Richland Facility ISA Program document for assurance of detection capabilities (ML24264A180). An out of service detection system for greater than four hours will cause movement of SNM in the affected areas to cease until compensatory monitoring measures begin. Routine testing and calibration will be performed to guarantee adequate performance. These findings are consistent with the previous staff evaluation for

the renewal of SNM-1227. The NRC staff determined that Framatome's existing commitments related to CAAS coverage are sufficient to continue to satisfy the requirements of 10 CFR 70.24.

Minimum Margin of Subcriticality

The LAR does not propose changing the approved MMS. This margin was reviewed by NRC staff and approved in a previous license amendment (ML22154A439, non-public). NRC staff reviewed the amendment application for adherence to the approved MMS's areas of applicability. The SF Building processes involve enrichments up to 10.0 wt.% U-235 uranium oxide, hydro-carbon moderated systems, homogeneously and heterogeneously moderated systems, with varying fuel to moderator ratios. NRC staff reviewed NCSAs for the Solution Gelation, Kernel Conversion, TRISO Coating, and CVI processes. When determining criticality safety process limits, the calculation configurations were bounded by the areas of applicability. Model configurations were shown to be bound by fuel-to-moderator-ratio, moderator type, enrichment, neutron absorber, and physical form of uranium. Therefore, consistent with the NRC staff's evaluation documented in NRC SER, "Minimum Margin of Subcriticality For Use Up to 20 wt.% U-235", (ML22154A439) the NRC staff determined Framatome's MMS is acceptable.

Operational Readiness Review

Based on its review of the LAR, the NRC staff finds that there is reasonable assurance that subcriticality will be maintained under normal and all credible abnormal conditions, that adequate protection is provided against the risk of criticality accidents, and that Framatome satisfies the applicable requirements of 10 CFR Part 70, including 10 CFR 70.61(b) and 70.61(d). However, the NRC staff is requiring an operational readiness review (ORR) to be completed as a condition to the approval of the LAR because of the higher enrichment of U-235 and its potential impact on licensed activities at the facility. The NRC staff amends Materials License SNM-1227 with license condition S-10:

- S-10. Except for the special nuclear material authorized under Items 1.A, 1.B, 2.A, 2.B, 3.A, and 3.B of Materials License SNM-1227, Framatome shall not receive, possess, handle, store, or process any special nuclear material in excess of 6.5 wt. % U-235 until the NRC completes an ORR that verifies the facility will be operated safely and in accordance with the requirements of Material License SNM-1227. Framatome shall notify the NRC at least 120 days prior to the receipt of special nuclear material in excess of 6.5 wt. % U-235, other than special nuclear material authorized in Items 1.B.

EVALUATION FINDINGS

The NRC staff reviewed the LAR, ISA Summary, NCSA documents, and current SNM-1227 License Application and determined that Framatome demonstrated conformance to their approved NCS Program, which includes adherence to the Double-Contingency Principle, demonstration of subcriticality for normal and credible abnormal conditions, CAAS coverage, and MMS. The NRC staff concludes that the application complies with all applicable criticality-related requirements of 10 CFR Part 70.

2.5 Chemical Process Safety

PURPOSE OF REVIEW

Framatome submitted a LAR to modify the processes in the SF Building to produce TRISO fuel. NRC staff conducted the chemical safety review to determine if the commitments in the Framatome LAR and information in the documents supporting the license application (e.g., the ISA Summary) provide reasonable assurance that Framatome will adequately protect workers, the public, and the environment from chemical hazards that are under NRC's jurisdiction.

REGULATORY REQUIREMENTS

The regulatory basis for this chemical safety review is found in 10 CFR 70.22 and 70.65, which identify general and additional contents of an application. This review also considers compliance with the requirements of 10 CFR 70.23 and 70.66, which identify the requirements for the approval of applications. The chemical safety review determines if there is reasonable assurance of compliance with chemical 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 chemical safety are outlined in NUREG-1520, Revision 2, Section 6.4.3, "Regulatory Acceptance Criteria."

STAFF REVIEW AND ANALYSIS

Framatome submitted a LAR (ML24264A171) to authorize dry conversion of higher enrichment UF6 and production of TRISO fuel in the SF Building at the Richland site. The amendment application identified the Specialty Fuel project as involving the following process nodes:

- Node 690: HALEU UF6 Cylinder Receiving and Storage
- Node 691: HALEU Vaporization
- Node 692: HALEU Powder Production
- Node 693: HALEU Dry Conversion Liquid Effluent and HF Recovery
- Node 694: Transportation and Storage Containers
- Node 695: Solution Gelation
- Node 696: Kernel Conversion, TRISO Coating, and CVI
- Node 697: Scrap Recovery
- Node 698: Upgrading, Shell Filling, Inspection, He Leak Testing, Block Loading
- Node 699: Ancillary Support Operations

The LAR stated that Nodes 690-694 are processes for which Framatome has extensive experience and involve no new hazards or use no new technologies that would require NRC prior approval. There are no new chemical hazards for the enriched UF6 conversion and associated operations (Nodes 690-694).

The operations which are new to Framatome are those which are part of TRISO fuel fabrication operations (Nodes 695, 696, 697, 698 and 699) and these nodes are the focus of this chemical safety review.

The purpose of this chemical safety review is to determine if the commitments in the Framatome LAR and information in the documents supporting the LAR (e.g., the ISA Summaries) provide reasonable assurance that Framatome will adequately protect workers, the public, and the environment from chemical hazards that are under NRC's regulatory jurisdiction.

As documented in the 2009 Framatome License Renewal Safety Evaluation Report (ML090760702), Framatome (formerly AREVA NP, Inc.) has a chemical safety program which has been determined to meet the requirements of 10 CFR Part 70, Subpart H.

Major elements of the Framatome chemical process safety management that were reviewed as part of the 2009 license renewal process (2009 Framatome License Renewal Safety Evaluation Report, Section 6.3.5, "Process Safety Management") include: process hazards analysis (i.e., integrated safety analysis), training of contractors, pre-startup safety reviews, training, procedures, audits and assessments, and management of change.

The chemical safety review for this SF Building amendment examined four areas from the ISA Summaries related to TRISO fuel production: process description, identification of hazards and accident sequences, analysis of chemical accident consequences, and identification of chemical safety IROFS. The review examines the ISA Summaries for those nodes that involve new operations in the SF Building (i.e., Nodes 695 through 699).

Process Description

The ISA Summaries Part 2 (E15-01-2.11, Version 23) provided an overview/summary of SF Building Operations in Section 11.4, "Overview of Operations." Additional information on the new processes is provided in Section 11.4.7.1 for Solution Gelation (system 695), in Section 11.4.8.1 for Kernel Conversion, TRISO Coating and CVI (system 696), in Section 11.4.9.1 for Scrap Recovery (system 697), in Section 11.4.10.1 for Upgrading, Shell Filling, Inspection, He Leak Testing, and Block Loading (system 698) and in Section 11.4.11.1 for Ancillary Support Systems (system 699).

The NRC staff reviewed the descriptions and find that they are sufficiently detailed to allow understanding of chemical process hazards and the theory of operations. The process description information is considered consistent with the regulatory acceptance criteria of NUREG-1520, Rev. 2, Section 6.4.3.1, "Chemical Process Description."

Chemical Hazard Identification

ISA Summaries, Part 1 Chapters 1-8, version 32, Appendix A, Table 1, "TRISO Fuel Manufacturing Applicability Screening," listed the process chemicals that are used in the TRISO fuel fabrication operation. The table identified which of the chemicals could result in either high or medium consequences (i.e., the chemicals that present the greater hazards). The chemicals identified as potentially resulting in high or medium consequences include acetylene, ammonia, ammonium hydroxide, argon, carbon monoxide, hydrogen, methyl trichlorosilane (MTS), natural gas, nitric acid, nitrogen dioxide, nitrogen, and propylene.

The listed chemicals are consistent with the process description information for Nodes 695 through 699 presented in the ISA Summaries Part 2 Chapter 11 SF Building (E15-01-2.11, Version 23).

Potential reactive chemical hazards associated with SF Building operations were also identified by Framatome. ISA Summaries Part 1 Chapters 1-8, Appendix C, "Hazardous Materials Interaction Matrix," (Page C-4, 5), presents a table which identifies chemical mixtures that could be reactive. Most of the reactive hazards are associated reactions between nitric acid and organic material, materials reacting with MTS, and reactions involving UF₆. Nitric acid and organics are used in Node 695 (solution gelation). MTS is used in Node 696 (kernel conversion, TRISO coating, and CVI). UF₆ is not used in the TRISO fuel fabrication process.

ISA Summaries Part 2, Chapter 11, Section 11.4.7.2, "Hazard Identification (Solution Gelation)," identified UO_x, NO_x, nitric acid, ammonium hydroxide and uranyl nitrate (UNH) as the chemical hazards for Node 695. ISA Summaries Part 2, Chapter 11, Section 11.4.8.2, "Hazard Identification (Furnaces)," identified methyl trichlorosilane (MTS) as the chemical hazard for Node 696. ISA Summaries Part 2, Chapter 11, Section 11.4.9.2, "Hazard Identification (Scrap Recovery Process)," identified UO₂ as the chemical hazard for Node 697 (scrap recovery). ISA Summaries Part 2, Chapter 11, Section 11.4.10.2, "Hazard Identification (Upgrading, Shell Filling, FCM Inspection, FCM Leak Testing, and Graphite Block Loading)," identified UO₂ as the chemical hazard for Node 698 (upgrading, shell filling, inspection, He leak testing, and block loading). ISA Summaries Part 2, Chapter 11, Section 11.4.11.2, "Hazard Identification (Ancillary Support Systems)," identified NO_x and scrubber effluent as the chemical hazards for Node 699 (ancillary support systems).

The NRC staff reviewed the Framatome ISA Summaries information, including process descriptions and flow diagrams considering both the chemical toxicity and chemical reactivity potential for the identified chemicals. The NRC staff also conducted an independent analysis of the reactivity of combination of chemicals. The NRC staff concluded that the Framatome identification of chemical toxicity and reactivity hazards associated with operations in the SF Building is acceptable because the information complies with the regulatory acceptance criteria of NUREG-1520, Rev. 2, Section 6.4.3.2, "Chemical Hazard Sequences and Accident Sequences."

Chemical Accident Sequence Identification

Accident sequences for the SF Building are identified in ISA Summaries Part 2, (E15-01-2.11, Version 23), Chapter 11 Specialty Fuels Building. This chemical safety review focused on the chemical accident sequences identified for TRISO fuel fabrication operations (Nodes: 695, 696, 697, 698, and 699) which will be new operations for the Framatome facility.

The ISA Summaries for Node 695 identified four accident sequences that involved chemical hazards. These accident sequences (229, 230, 231 and 236) involve reactive hazards that could produce explosions resulting in a dispersion of comingled chemicals and radioactive material. The ISA Summary stated that each of these sequences was not credible or at least highly unlikely for reasons that are documented for each sequence.

The ISA Summaries for Node 696 identified one accident sequence, 638, that involves the release of MTS and a reaction to produce a hazardous byproduct, hydrochloric acid.

The ISA Summaries for Node 697 identified one accident sequence, 220, that involves the energetic reaction between hexamethylenetetramine (HMTA) and nitric acid. The ISA Summary stated that this sequence was not credible or at least highly unlikely for reasons that are documented for the sequence.

The NRC staff reviewed the accident sequences identified in the Framatome ISA Summaries considering available information on the TRISO processes and chemical hazards. Based on its review of the planned operations and considering the chemicals hazards involved in the various process steps, the NRC staff found the accident sequences identified by Framatome and documented in its ISA summaries to be reasonable and consistent with the regulatory acceptance criteria of NUREG-1520, Rev. 2, Section 6.4.3.2.

Chemical Accident Consequence Analysis

The methods used by Framatome to estimate the consequences of chemical hazards are discussed in ISA Summaries, Part 1 Chapters 1-8, Rev 32, Section 7.2.2.1, "Chemical Consequences."

New bounding chemical consequences for TRISO operations are presented in ISA Summaries Part 1, Chapters 1-8, Version 32, Table 7-2, "Summary of Bounding Chemical Consequence Scenarios for Richland Facility." The two TRISO-related chemicals with the potential for high consequences are hydrogen (potentially high for the worker but low for the public) and MTS (potentially high for both the worker and the public).

The NRC staff reviewed an internal Framatome document that analyzed the consequences of chemical release and exposure in the TRISO operations and controls for mitigating the effects of exposure. The analysis addressed exposure to toxic material as well as exposure to asphyxiants. The NRC staff found the consequence estimates reasonable and useful in assessing compliance with the performance requirements of 10 CFR 70.61. The Framatome approach is consistent with the regulatory acceptance criteria of NUREG-1520, Rev 2., Section 6.4.3.3, "Chemical Accident Sequence Likelihood and Consequences."

Chemical Safety Items Relied on for Safety

The Framatome ISA Summary, Part 2, Chapter 11, identifies IROFS for the individual chemical accident sequences for each node in the SF Building. Following the discussion of the accident sequences for each node, there is a table that summarizes the IROFS for that node.

The NRC staff reviewed the IROFS in the ISA Summaries as well as an internal Framatome document that identified Plant Wide Chemical Safety IROFS. The internal document also identified implementing documents.

The NRC staff finds the identification and implementation of the chemical safety IROFS to be consistent with the ISA analysis results and reasonable. The Framatome approach is consistent with the regulatory acceptance criteria of NUREG-1520, Rev 2., Section 6.4.3.4, "Chemical Process IROFS and Sole IROFS."

EVALUATION FINDINGS

Based on the NRC staff's review of the commitments in the LAR, the details in the ISA Summaries and information in supporting documents indicates that Framatome is implementing a chemical safety program that provides reasonable assurance of adequate protection of the workers, the public, and the environment from the chemical hazards that are associated with TRISO production operations and under NRC's regulations.

Because Framatome is refining the design and safety analysis of its planned TRISO operation, the required ORR will (1) verify that the ISA is based on the final design for the TRISO facility, (2) verify that the overall consequence estimates are reasonable/conservative given the final design, and (3) verify that Framatome has a process startup procedure to ensure that the process, equipment and facility perform in a manner consistent with design objectives.

Framatome's successful completion of its ORR and a positive finding following the staff review of the ORR will confirm the NRC staff's findings that there is reasonable assurance of adequate protection from chemical hazards under NRC regulation.

2.6 Fire Safety

PURPOSE OF REVIEW

The primary purpose of this fire safety review is to determine if the licensee's planned facility modifications and operational changes are adequate to support the processing of material with U-235 enriched up to 10.0 wt.%, as described in the LAR. This review will also determine if the LAR provides reasonable assurance of adequate fire protection for workers, the public, and the environment from fire hazards that are under NRC's regulatory jurisdiction.

REGULATORY REQUIREMENTS

The regulatory basis for this fire safety review is found in 10 CFR 70.22 and 70.65, which together describe the general and additional content required in an application. The review also considers compliance with 10 CFR 70.23 and 70.66 which identify the requirements for application approval. The fire safety review determines if there is reasonable assurance of compliance with fire safety requirements of 10 CFR 70.61, 70.62, and 70.64. This review also refers to NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications," Chapter 7, "Fire Safety," as NRC staff guidance for fire safety.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

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

STAFF REVIEW AND ANALYSIS

The LAR was submitted with a revised ISA Summary for the proposed changes that would be implemented if the amendment were approved.

The NRC staff's fire safety review focused on: (1) the adequacy of the commitments that support fire safety in the SF Building at the Framatome Fuel Fabrication Facility and (2) the implementation of the fire safety-related commitments to support fabrication of TRISO fuel with enrichment up to 10.0 wt.% U-235.

Technical Review of Fire Safety

For the proposal in this LAR, to process up to 10.0 wt.% TRISO fuel fabrication, the NRC staff reviewed Framatome's commitments in Chapter 7 of the current Framatome license related to fire protection.

Framatome identified, in the ISA Summary, Part 2, Chapter 11, SF Building, (E-15-01-2.11), the process nodes in the SF Building as:

- Node 690 - HALEU UF6 Cylinder Receiving & Storage
- Node 691 - HALEU Vaporization
- Node 692 - HALEU Powder Production
- Node 693 - HALEU Dry Conversion Liquid Effluent & HF Recovery
- Node 694 - Transport and Storage Containers
- Node 695 - Solution Gelation
- Node 696 - Kernel Conversion, TRISO Coating, and CVI Densification
- Node 697 - Scrap Recovery
- Node 698 - Upgrading, Shell Filling, Inspection, Helium Leak Testing, Block Loading
- Node 699 - Ancillary Support Systems

Framatome stated, in the cover letter dated September 20, 2024, of the LAR for TRISO fuel (ML24264A171), that the dry conversion process operations and transport and material storage (Nodes 690-694) are processes with which Framatome has extensive experience and create no new hazards that would require NRC prior approval. Therefore, this fire safety review focuses on new operations (Nodes 695, 696, 697 and 698) of the TRISO fuel fabrication operations which are new operations for the Framatome facility. There are no new fire hazards for the enriched UF6 conversion and associated operations (Nodes 690-694 and 699).

Framatome states, in the LAR, that fire safety controls will be the same as for the current process and combustibles will be limited to what is essential to run and maintain the process, consistent with current facility operations.

Facility Design

Framatome stated, in ISA Summary, Part 2, Chapter 11, SF Building, (E-15-01-2.11), that the SF Building is protected by an automatic fire detection system throughout the building with the use of manual initiating devices, fire suppression systems, and fire alarm system. The NRC staff referred to the 2009 Framatome License Renewal Safety Evaluation Report (ML090760702) and confirmed that the SF Building has been designed and built to the

applicable national, state, and local building, electrical, and fire codes as required by the City of Richland's Fire Marshall and Building Department at the time of construction. In the building design, emphasis was placed on minimizing combustible materials in the construction of facilities, provision and maintenance of effective intra-building fire barriers; and segregating non-radiological and radiological operations to the extent feasible. In addition to the codes cited previously, the Framatome used the guidance provided in the NFPA 13, *Standard for the Installation of Sprinkler Systems*, NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, NFPA 15, *Water Spray Fixed Systems for Fire Protection*, NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, and NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, to meet the intent of NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*.

Based on information above, the NRC staff confirmed that the facility design of the SF Building in the LAR continues to be consistent with the guidance in NUREG-1520, Revision 2, and that the facility meets the requirements of 10 CFR 70.61 and 70.64 as it pertains to facility design for fire protection on the process nodes in the SF Building.

Fire Protection

As stated in the baseline design criteria for the design of new facilities, 10 CFR 70.64(a)(3), the design must provide for adequate protection against fires and explosions. Framatome stated, in ISA Summary, Part 2, Chapter 11, SF Building, (E-15-01-2.11) that (1) Framatome has followed relevant codes and standards for the expected hazards in the design and the new processes in the SF Building to ensure adequate protection against fires and explosions, and (2) Framatome also implements an inspection, testing, and maintenance program for fire protection systems in the SF Building. Framatome noted, in ISA Summary, Part 2, Chapter 11, SF Building, (E-15-01-2.11), that the fire hazards analyses and the ISA demonstrate that the design and construction of the facility comply with the baseline design criteria of 10 CFR 70.64(a)(3) and the defense-in-depth requirements of 10 CFR 70.64(b).

The NRC staff finds that the fire protection systems discussed above have not changed since the previous license renewal (2009) and applies to the new processes in the SF Building. The NRC staff concludes that the design of the new process nodes meets the requirements of 10 CFR 70.64(a)(3) and 70.64(b) with respect to fire protection and are consistent with the guidance provided in NFPA 801.

Fire Sequences

Framatome provided evaluations of fire sequences in ISA Summary, Part 2, Chapter 11, SF Building, (E-15-01-2.11), for Nodes 695 and 696:

Node 695

Framatome discussed the fire sequence at Node 695, in which a leak or spill from the HMTA-UREA-CARBON (HUC) tank mixes with nitric acid long enough to generate hexogen, which, if ignited, could result in an explosion.

- Framatome stated that while combustible chemicals are present in the solution gelation process, none of them created consequences of concern in fire and/or explosion.
- Concentrations are lower than the lower explosive limit while in process.
- The standard combustible loading IROFS remain in effect in the Sol-Gel process room to prevent a small fire from becoming a large fire.

- Hydrogen gas is no longer used in the process and will reduce the large fire/explosion risk.

Based on the conditions described above, the NRC staff determined the initiating event is “not credible” or at least “highly unlikely” and the potential source of combustibles at Node 695 does not pose a fire and/or explosion risk.

Node 696

Framatome discussed fire sequences at Node 696, in which a leak of vaporized Methyl Trichlorosilane (MTS) and its byproduct Hydrogen Chloride (HCl) to room atmosphere exposes personnel to hazardous chemicals and creates a flammable environment and fire, if an ignition source is present. Framatome described fire safety IROFS 302.10 (passive engineered control) and IROFS 8231.10 (enhanced administration) in ISA Summary, Part 2, Chapter 11, SF Building, (E-15-01-2.11), Table 11-8, “Summary of IROFS (Kernal Conversion, TRISO Coating, and CVI Densification – System 696.”

The NRC staff notes that (A) IROFS 302.10 (vessel and pipe integrity by use of appropriate materials and procedures in their construction) will prevent loss of containment in the form of sprays or aerosols from the subject vessel and/or associated connecting lines even if subject to expected impact during operation and/or maintenance or construction activities and (B) IROFS 8231.10 (installation of audible and visual alarms associated with multiple HF detectors) will warn of minor leaks prior to the occurrence of significant powder spills.

The NRC staff refers to the ISA Summary that Node 696 is protected using the same fire protection systems previously utilized at Framatome but includes additional hydrogen detectors. The NRC staff confirmed that the listed initiating event is “not credible” or at least “highly unlikely” and the defense IROFS 302.10 and IROFS 8231.10 will provide adequate fire protection at Node 696.

Management Measures

Framatome stated, in SNM-1227, Chapter 11, Environment, Health, Safety and Licensing (EHS&L) Document (E10-08-011), “Management Measures,” that general health and safety training shall be provided for fire safety as it relates to licensed materials and the audit program will apply to fire protection as it relates to maintaining the safety of licensed material operations.

The NRC staff reviewed SNM-1227, Chapter 11, (EHS&L) Document (E10-08-011), Table 11-1, “Schedule of Audits” and confirmed that:

- Audit of selected areas of the facility and monthly inspection of facility fire extinguishers for industrial safety conditions pertinent to fire protection are performed on the new operations (Nodes 695, 696, 697 and 698) within the SF Building.
- Fire safety measures (e.g., fire safety organization; fire prevention program; inspection, testing, and maintenance of fire protection systems; emergency response organization, and pre-fire plan) are applicable and reliable to TRISO fuel fabrication.

Interbuilding Effects

Framatome evaluated the interbuilding effects, as documented in Framatome (EHS&L) Document (E14-01-017), “Hazard Analyses,” (ML26050A502) for the potential conditions where an event in the SF Building may impact activities in adjacent areas and concluded

that the fire and explosion potential with the new advanced reactor fuel processes are bound by the prior presence of a sintering furnace associated with the manufacture of light water reactor fuel.

The NRC staff reviewed Framatome (EHS&L) Document (E14-01-017) document and the minimum distances between closest buildings potentially containing SNM. The NRC staff accepts Framatome's interbuilding effect study that activities within the SF Building will not impact activities in adjacent areas.

EVALUATION FINDINGS

After reviewing information in the LAR and the ISA Summary, the NRC staff makes the following findings which are related to fire safety:

- The SF Building meets the building code and Factory Mutual requirements for fire safety for fabrication of the TRISO fuel enriched up to 10.0 wt.% U-235.
- The fire hazards, accident sequences, and mitigating items relied on for safety (IROFS), identified in the ISA Summary, are still applicable for fabrication of TRISO fuel enriched up to 10.0 wt.% U-235 and there are no new fire hazards and no need for new or revised fire IROFS.
- There are no significant changes in fire protection and detection systems which are a function of facility design and processes and are not directly influenced by enrichment levels.
- There are no significant changes needed in training and emergency response which were developed by facility design and processes and are not significantly influenced by the fabrication of the TRISO fuel with enrichment level up to 10.0 wt.% U-235.

The NRC staff finds that the application and ISA Summary provide reasonable assurance of compliance, and that the approved fire safety program from the 2009 license renewal is still acceptable for this LAR. The NRC staff confirmed that the Framatome facility continues to meet the regulatory acceptance criteria described in NUREG-1520, Revision 2, Chapter 7, "Fire Safety," and maintains an adequate level of fire protection in compliance with 10 CFR 70.61 and 70.64 for fabrication of the TRISO fuel enriched up to 10.0 wt.% U-235.

2.7 Emergency Management

PURPOSE OF REVIEW

The NRC's emergency management review is conducted to determine if Framatome's planned facility modifications and operational changes to support increase of the overall site enrichment of U-235 to up to 10.0 wt.% U-235, as described in the license amendment request (LAR), will require Framatome to submit an emergency plan under of 10 CFR 70.22(i)(1) as part of its LAR.

REGULATORY REQUIREMENTS

10 CFR 70.22(i) states, in part, that licensees requesting a license for radioactive material exceeding certain thresholds must submit either (1) 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 (2) 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.

Additionally, 10 CFR 70.32(i) states that licensees that are required to submit emergency plans in accordance with 10 CFR 70.22(i) shall follow the emergency plan approved by the Commission. The licensee may change the approved plan without Commission approval if the changes do not decrease the effectiveness of the plan. Within six months after each change is made, the licensee shall, using an appropriate method listed in 10 CFR 70.5(a), furnish the Director, Office of Nuclear Material Safety and Safeguards, a copy of each change, with copies to the appropriate NRC Regional Office specified in Appendix D to 10 CFR Part 20 of this chapter and to affected offsite response organizations. Proposed changes that decrease the effectiveness of the approved emergency plan may not be implemented without prior application to and approval by the Commission.

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. Framatome states that the emergency plan conforms to RG 3.67.

STAFF REVIEW AND ANALYSIS

In Section 4 “Regulatory Evaluation,” of their submission letter for the application, Framatome stated, in part:

Not included in this submittal are changes to:

- b) Framatome’s Emergency Plan as updates to the Emergency Plan were not identified as a decrease in effectiveness as described in 10 CFR 70.32(i) and NRC prior approval is not needed. The evaluation to determine whether prior approval for the revision is needed follows Framatome’s procedures and will be available for inspection by the NRC.

EVALUATION FINDINGS

As provided above, Framatome stated that there were no changes to the Emergency Plan requiring NRC prior approval, therefore the NRC staff did not review Framatome’s Emergency Plan. However, the updates to the Emergency Plan will remain subject to future NRC inspection.

2.8 Financial Assessment (Decommissioning)

PURPOSE OF REVIEW

The purpose of the review of Framatome’s decommissioning plans is to determine with reasonable assurance that Framatome will be able to decommission the facility safely and in accordance with the requirements of the NRC if approved to produce TRISO fuel and to determine if the decommissioning plan supports the requested

increase of the overall site enrichment of U-235 from 6.5 wt.% to up to 10.0 wt.%, as described in the LAR.

REGULATORY REQUIREMENTS

The regulations in 10 CFR Part 70 state that nuclear facilities are required to provide adequate financial assurance for decommissioning, decontamination and reclamation pursuant to 10 CFR 70.25, "Financial assurance and recordkeeping for decommissioning." 10 CFR 70.25(e)(2) state that the licensee must submit an updated decommissioning cost estimate (DCE) for NRC's review and approval. 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. The licensee remains liable for any decommissioning costs not covered by the financial instrument. The licensee 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, the licensee 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 Framatome's decommissioning plan are outlined in NUREG-1520, Revision 2, Section 10.4, "Acceptance Criteria."

STAFF REVIEW AND ANALYSIS

The NRC staff previously approved Framatome's DCE by letter dated August 12, 2021 (ML21166A200), in the amount of \$81,580,000. In its revised DCE, as supplemented by the letter dated September 6, 2024 (ML24250A201), Framatome provided a 2023 DCE total of \$90,908,000, representing an increase of \$9,328,000 over the previously approved estimate.

In its submittal, Framatome stated that the decommissioning funding plan (DFP) and associated DCE were prepared in accordance with 10 CFR 70.25 and the guidance in NUREG-1757, Volume 3," Rev. 1 "Consolidated Decommissioning Financial Guidance Assurance, Recording Keeping and Timeliness."

The NRC staff noted that Section 2 of the updated DFP includes Framatome's justification for key assumptions used in developing the DFP and cost estimate for decommissioning the Richland Facility. The NRC staff also observed that Table 7 of the 2023 DCE provides detailed cost estimates for the facility's decommissioning activities, based on billing rates (wages, benefits, overhead, and profit) from third-party contractors located in Washington State. In addition, the NRC staff noted that the DCE assumes decommissioning to unrestricted use and includes a contingency factor in calculating total estimated costs.

On March 10, 2026, the NRC staff requested that Framatome provide additional information describing the impacts associated with the eight event categories specified in 10 CFR 70.25(e)(2). By letter dated March 11, 2026 (ML26070A331), the NRC staff determined that Framatome had addressed the effects of these events in its submittal as follows:

1. Spills of radioactive material.
Framatome has indicated there have not been any spills of radioactive materials associated with the modifications to support this LAR that will have an impact on the current DFP.
2. Waste inventory increases.
Framatome has indicated there have not been any waste inventory increases associated with the modifications to support this LAR that will have an impact on the current DFP. This is unchanged by this LAR.
3. Waste disposal.
Framatome has indicated the activities associated with this LAR do not cause an increase in waste disposal costs. Costs associated with inflation are updated as required at each periodic update of the DFP. This is unchanged by this LAR.
4. Facility modifications.
Framatome has indicated the volume of equipment being placed into the building is comparable to the volume of equipment removed. The updated volumes were provided in previous communication to the NRC and will be included in the next DFP update as required by 10 CFR 70.25. This is unchanged by this LAR.
5. Changes in authorized possession limits.
Framatome indicated that the LAR is specific about the requested change in the authorized possession limit. This change will not have any impact on the DFP.
6. Actual remediation
Framatome has indicated that the D&D costs associated with this LAR will be used to inform Framatome's next update to the DFP. This is unchanged by this LAR.
7. On-site disposal.
Framatome does not have on-site disposal of waste. This is unchanged by this LAR.
8. Use of a settling pond.
Framatome does not make use of settling ponds. This is unchanged by this LAR.

EVALUATION FINDINGS

Based on the NRC staff's review of the September 6, 2024, DFP (ML24250A202) and Framatome's LAR to increase site enrichment in the SF Building to up to 10.0 wt.% (ML24264A171), Attachment 4, the introduction of Advanced Reactor Fuel Production activities in the SF Building is expected to increase overall site decommissioning costs by approximately \$4.2 million. This represents a 4.6% increase over the current estimated decommissioning cost of \$91 million. Framatome indicated that this additional cost will be incorporated into the 2026 DFP update. Therefore, the NRC staff concludes that the LAR does not result in any changes to the DFP requirements.

Based on this analysis, the NRC staff finds that Framatome's DFP provides adequate financial assurance for decommissioning, decontamination and reclamation, as required by 10 CFR Part 70.

2.9 Management Measures

PURPOSE OF REVIEW

The purpose of this review is to verify that the administrative, and MM that Framatome will apply to IROFS that are described in EHS&L document E15-01-1 Part 1 - "Richland Facility Integrated Safety Analysis (ISA) Program, Chapter 8, "Horn Rapid Plant Administrative and Management Measures," Version 32.0, provide adequate assurance that IROFS will be available and reliable, consistent with 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," Subpart H, "Additional Requirements for Certain Licensees Authorized To Possess a Critical Mass of Special Nuclear Material" and 10 CFR 70.61, "Performance Requirements."

Management measures shall be implemented to ensure compliance with performance requirements and the degree to which they will be applied will be a function of the item's importance in terms of meeting performance requirements as evaluated in the ISA. This chapter addresses each of the MM included in the definition of MM in 10 CFR Part 70, Subpart H including: (a) configuration management (CM); (b) maintenance; (c) training and qualifications; (d) procedures; (e) audits and assessments; (f) incident investigations; (g) records management; and (h) other quality assurance (QA) elements.

REGULATORY REQUIREMENTS

The regulatory basis for the review is 10 CFR 70.22, "Contents of Applications," and 10 CFR 70.65, "Additional Content of Applications." In addition, the NRC staff evaluated Framatome's MM program for compliance with the following regulations:

10 CFR 70.4 state that MM include: configuration management, maintenance, training and qualification, procedures, audits and assessments, incident investigations, records management, and other QA elements.

10 CFR 70.22(a)(8) require that each application for a license must contain proposed procedures to protect health and minimize danger to life or property.

10 CFR 70.62(a)(3) state that records must be kept for all IROFS failures, describe required data to be reported, and set time requirements for updating the records.

10 CFR 70.62(d) require an applicant to establish MM for engineered and administrative controls and control systems that are identified as IROFS, in accordance with 10 CFR 70.61(e), so that they are available and reliable to perform their functions when needed.

10 CFR 70.64(a)(1) state that, in accordance with MM, IROFS must be designed, implemented, and maintained to provide reasonable assurance that they will be available and reliable to perform their safety function when needed. 10 CFR 70.64(a)(1) further states that appropriate records of IROFS must be maintained by the licensee throughout the life of the facility.

Facility change and change processes must conform to 10 CFR 70.72, "Facility Changes and Change Process."

The regulations in 10 CFR 70.74(a) and 10 CFR 70.74(b) require incident investigation and reporting.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The Regulatory Acceptance Criteria is in NUREG-1520, Section 11.4.3, "Regulatory Acceptance Criteria," "Standard Review Plan (SRP) for Fuel Cycle Facilities License Applications."

The following reference is not used as guidance regarding the applicant's MM program:

American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) NQA-1-2008 and the NQA-1a-2009 Addenda, "Quality Assurance Requirements for Nuclear Facility Applications," as endorsed by Regulatory Guide 1.28, "Quality Assurance Program Requirements (Design and Construction)," Revision 4, issued June 2010.

STAFF REVIEW AND ANALYSIS

The NRC staff reviewed Framatome's MM program described in the LAR Chapter 11, "Management Measures," to determine if the availability and reliability of IROFS are consistent with the performance requirements of 10 CFR 70.61.

Framatome commits to apply MM to IROFS on a continuing basis to ensure that the proposed facility will be operated safely and provide adequate protection of the workers, the public, and the environment from credible hazards presented in the ISA. Framatome states that MM include CM, maintenance, training and qualifications, procedures, audits and assessments, incident investigations, records management, and other QA elements.

Configuration Management

The NRC staff's review of Framatome's CM program was guided by the acceptance criteria in NUREG-1520, Section 11.4.3.1, "Configuration Management." The NRC staff determined whether Framatome meets these acceptance criteria in the following elements of the CM program: design requirements, document control, change control, and assessments.

Framatome's CM program ensures that the facility's technical baseline is established and maintained throughout all phases - design, construction, modification, testing, and operation. The CM program is implemented through several key programs and procedures, including the NCS program, ISA program, Engineering Change Notice (ECN) program, and the Manufacturing Software QA Plan. The Site Manager is responsible for overall safety policy and objectives, while the Project Engineering Manager oversees CM during design and modification phases. All changes are evaluated in accordance with 10 CFR Part 70 to ensure continued compliance with safety bases from design through operation.

The NRC staff has reviewed the CM function for fabrication of TRISO/Fully Ceramic Micro-Encapsulated (FCM) Fuel at the Framatome Fuel Fabrication Facility according to Chapter 11 of the standard review plan NUREG-1520, Revision 2. The NRC staff evaluation of the CM function included the review of Framatome's CM and its elements: design requirements, document control, change control and assessments.

NRC staff identified several items in the CM program that do not currently satisfy the acceptance criteria of NUREG-1520, Revision 2. These items will need to be updated and will be reviewed as part of the ORR to confirm that the CM program meets the acceptance criteria. These items include the following:

CM Program

Framatome's CM program procedure must be updated to include a description of the elements of CM that meet the acceptance criteria in NUREG-1520, Section 11.4.3.1, (1) excluding design reconstitution.

Design Requirements

Framatome must include descriptions of the design control and design requirements to control design during design, construction, and operations for fabrication of TRISO/FCM Fuel. Design control and design requirements include provisions for the identification, documentation, selection, review, and verification of design inputs, design outputs, design analysis, design verification/validation, identification and management of interface control and coordination among participating design organizations, computer software programs, and the design process leading to drawings and other statements of requirements that proceed logically from the design-basis, and technical management review and approval functions. The NRC staff will verify that Framatome's design control and design requirement program meets the acceptance criteria in NUREG-1520, Section 11.4.3.1, (1), (4), and (5), during the ORR.

Document Control

Framatome's document control element must ensure documentation is identified and documented within the CM program consistent with the physical configuration and design requirements for fabrication of TRISO/FCM Fuel. The document control element must include a description of the process of controlling documents, such as identification of documents, storage, control, tracking, retrieval, changing, releasing, and approving documentation. The NRC staff will verify that Framatome's document control procedures meet the acceptance criteria in NUREG-1520, Section 11.4.3.1, (6) and (7) during the ORR.

Change Control

Framatome's change control element of CM, through established procedures, must maintain consistency among the design requirements, the physical configuration, and the facility documentation as changes are made for fabrication of TRISO/FCM Fuel. The change control elements must include a description of the documentation process following changes made in accordance with 10 CFR 70.72, and the process to evaluate, implement, and track each change to the site, structures, processes, systems, equipment, components, computer programs, and personnel activities. The change control element must ensure that each specific proposed change is reviewed and approved by design authority and management prior to implementation to ensure that each change package is complete and ready for implementation; that the change process includes a mechanism for field change requests; that the change process generates accurate as-built information; and that each change is documented and controlled through records management. Changes to the affected on-site documentation must be made promptly to avoid inadvertent access by facility personnel to outdated design and other specifications for IROFS. The NRC staff will verify that Framatome's change control procedures meet the acceptance criteria of NUREG-1520, Section 11.4.3.1, (8), (9), and (10) during the ORR.

Assessments

Framatome must include provisions for the performance of an initial assessment of the CM program to determine the program's effectiveness and to correct deficiencies for fabrication of TRISO/FCM Fuel. The NRC staff will verify that Framatome's assessment procedure and plans that address the conduct of the initial assessment of the CM function meet the acceptance criteria in NUREG-1520, Section 11.4.3.1, (11) during the ORR.

Maintenance

The NRC staff reviewed Framatome's maintenance program in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.2, "Maintenance." Framatome describes how it meets these acceptance criteria in the following sections: preventative maintenance, surveillance and monitoring, corrective maintenance, and functional testing.

In the LAR, Section 8.2, "Maintenance," Framatome states that the purpose of the maintenance program is to ensure that IROFS are available and reliable to perform their intended functions when needed.

Preventive Maintenance

In the LAR, Section 8.2.1, "Preventive Maintenance (PM)," Framatome states that all IROFS are included in the PM program to prevent unexpected failures that could compromise safety. PM/Instrument Repetitive Maintenance (IRM) procedures used for testing or verification of IROFS are identified by an appropriate cautionary statement identifying them as being IROFS-related. If these procedures are not completed within the assigned frequency, the affected equipment or process is evaluated for its safety status. Unless acceptable controls remain or are put into effect, the affected equipment or process is shut down until the required PM/IRM procedure is successfully completed. PM/IRM procedures are performed by qualified personnel following written and approved procedures and using calibrated equipment and standards, as applicable.

Surveillance and Monitoring

In the LAR, Section 8.2.2, "Surveillance/Monitoring," Framatome states that the frequency of PM/IRM procedures is established by the Maintenance organization with concurrence from EHS&L. This frequency may be adjusted as needed based on the failure history, the results of incident investigations, or recommendations from root cause or apparent cause analyses in order to reasonably assure the availability and reliability of the associated IROFS.

Corrective Maintenance

In the LAR, Section 8.2.3, "Corrective Maintenance," Framatome states that corrective maintenance consists of describing and securing approval to do maintenance on an item within the CM program requirements; identifying the measures to be taken to assure safety while the item to be repaired is out of service; notification of affected parties; performing the work; determination of post-maintenance testing necessary to reasonably assure the availability and reliability of the related IROFS; and, if acceptable, putting the item back into service.

Functional Testing

In the LAR, Section 8.2.4, "Functional Testing," Framatome states that maintenance activities are identified as either corrective maintenance (breakdown repair or planned maintenance) or preventative maintenance (PM or IRM). Procedures include requirements for the level of post-maintenance functional testing necessary to reasonably assure the

availability and reliability of the entire IROFS safety function. For corrective maintenance, a programmatic approach is followed in which maintenance, and operations personnel access the IROFS database and the work order system to determine the appropriate level of functional testing required before returning the repaired equipment to service.

Maintenance Evaluation Findings

The NRC staff finds that Framatome's maintenance program, including preventive and corrective maintenance, surveillance, and functional testing, is adequately described and meets the requirements of 10 CFR 70.62(d). The program provides reasonable assurance that IROFS will be available and reliable to perform their safety functions when needed.

Training and Qualifications

The NRC staff reviewed Framatome's training and qualifications program in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.3, "Training and Qualification." In the LAR, Section 8.3, "Training and Qualifications," Framatome states that the training and qualification program ensures that all personnel whose activities may affect IROFS are appropriately trained and qualified. The program is based on a graded Systematic Approach to Training, with initial, continuing, and refresher training, as well as on-the-job training (OJT) and qualification. Training requirements are periodically reviewed and updated to reflect current systems, procedures, and policies. The program includes classroom and OJT, with evaluation through observation, skills demonstration, written tests, or oral interviews. Training records are maintained to verify the qualification status of individuals. The effectiveness of the training and qualification program is periodically assessed through audits and assessments.

The NRC staff finds that the training and qualification program meets the requirements of 10 CFR 70.62(d) and the acceptance criteria of NUREG-1520, Section 11.4.3.3.

Procedures

The NRC staff reviewed Framatome's procedures program in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.4, "Procedures." In the LAR, Section 8.4, "Procedures Development and Implementation," Framatome states that all operations involving SNM and/or IROFS are conducted in accordance with approved procedures, including standard operating procedures, standard work instructions, and manufacturing control procedures. Procedures are developed, reviewed, approved, distributed, revised, and deleted under formal administrative controls. Safety-related procedures, especially those involving IROFS, are subject to formal review and approval by the EHS&L function. Procedures are periodically reviewed, and most of the current versions are made available to workers. Temporary changes are controlled by a formal process. The Corrective Action Program ensures that procedural deficiencies are tracked to completion.

The NRC staff has reviewed the procedures that Framatome will implement during the fabrication of TRISO/FCM Fuel at the Framatome Fuel Fabrication Facility according to NUREG-1520, Revision 2, Chapter 11. The NRC staff evaluation of the procedures program included management control, operating, maintenance, and emergency procedures.

NRC staff identified several items in the procedures program that do not currently satisfy the acceptance criteria of NUREG-1520, Revision 2. These items will need to be updated by the licensee and will be reviewed during the ORR to confirm that the procedures program meets

the acceptance criteria. Framatome's MM should include the following elements of the procedures program:

Management Control Procedures

Framatome must include a description of management control procedures to be used for controlling activities that support operations at the proposed facility. The management control procedures must be established for the following activities: (1) design, (2) CM, (3) procurement, (4) construction, (5) radiation safety, (6) maintenance, (7) QA elements, (8) training and qualification, (9) audits and assessments, (10) incident investigations, (11) records management, (12) criticality safety, (13) fire safety, (14) chemical process safety, and (15) reporting requirements. The NRC staff will verify that Framatome's management control procedures meet the acceptance criteria in NUREG-1520, Section 11.4.3.4, (5), during the ORR.

Operating Procedures

Framatome must describe the method for identifying, developing, approving, implementing, and controlling operating procedures. The operating procedures must include detailed instructions for use of equipment, instructions for disposition of radioactive waste, controls established for safety and regulatory purposes, including IROFS as well as required actions and limits for startup and shutdown; actions to prevent or mitigate accidents identified in the ISA Summary; and responses to alarms and applicable off-normal conditions, including failure of an IROFS. The operating procedures must include provisions to allow operations to be stopped and placed in a safe condition if a procedural step cannot be performed as written. Additionally, workplace posting limits and controls, training and other communication devices must be used to enhance comprehension and understanding of the operating procedures for conducting activities involving processing of radioactive materials. The NRC staff will verify that Framatome's operating procedures meet the acceptance criteria in NUREG-1520, Section 11.4.3.4, (6), during the ORR.

Required Elements in the Procedures

Framatome must incorporate the following elements in its procedures: (a) title and identifying information, such as number, revision, and date; (b) statement of applicability and purpose; (c) prerequisites; (d) precautions (including warnings, cautions, and notes); (e) important human actions; (f) limitations and actions; (g) acceptance criteria; (h) checkoff lists; (i) reference materials. The NRC staff will verify that Framatome's procedures meet the acceptance criteria in NUREG-1520, Section 11.4.3.4, (8), during the ORR.

Temporary Procedures

Framatome must describe a formal process for making temporary changes through the use of temporary procedures to address changes in normal conditions that are not addressed in operating procedures; these conditions can be related to safety, quality, production, or maintenance procedures. Temporary procedures must be controlled, reviewed and approved in the same manner as permanent procedures. The NRC staff will verify that Framatome's temporary procedure meets the acceptance criteria in NUREG-1520, Section 11.4.3.4, (10), during the ORR.

Audits and Assessments

The NRC staff reviewed Framatome's audit and assessments program in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.5, "Audits and Assessments."

In the LAR, Section 8.5, "Audits and Assessments," Framatome states that it maintains a program of audits and assessments to verify compliance with regulatory requirements and license commitments. Audits are compliance-based and cover all safety functions, including radiation protection, NCS, chemical safety, fire safety, environmental protection, emergency preparedness, QA, CM, maintenance, training, procedures, incident investigation, and records management. Audits are conducted by qualified individuals independent of the activities being audited. Assessments are performance-based and focus on the effectiveness of safety and environmental compliance functions, particularly the continued availability and reliability of IROFS. Findings are entered into the Corrective Action Program and tracked to completion.

The NRC staff finds that the audits and assessments program meets the requirements of 10 CFR 70.62(d) and the acceptance criteria of NUREG-1520, Section 11.4.3.5.

Incident Investigations

The NRC staff reviewed Framatome's incident investigation process in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.6, "Incident Investigations." In the LAR, Section 8.6, "Incident Investigations," Framatome states that it implements an integrated incident investigation and Corrective Action Program to ensure that safety-adverse incidents or conditions are identified, evaluated, reported, and corrected. The program includes a formal condition reporting mechanism, EHS&L involvement in safety significance screening, assignment of issue owner/investigator, graded investigation based on safety significance, and tracking of corrective actions to completion. All incidents are documented, and records are maintained as permanent company records.

The NRC staff finds that the incident investigation program meets the requirements of 10 CFR 70.62(d) and the acceptance criteria of NUREG-1520, Section 11.4.3.6.

Records Management

The NRC staff reviewed Framatome's incident investigation process in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.7, "Records Management." In the LAR, Section 8.7, "Records Management," Framatome states that it establishes controls to ensure that records documenting health, safety, environmental activities, and the safety bases/controls of its facilities and processes are appropriately created, distributed, stored, protected, and, if necessary, restored. Records are maintained for a minimum of two years or as otherwise required by regulation or license condition. Records are readily accessible for use, and historic records can be retrieved within a reasonable timeframe.

The NRC staff finds that the records management program meets the requirements of 10 CFR 70.62(d) and the acceptance criteria of NUREG-1520, Section 11.4.3.7.

Other Quality Assurance Elements

The NRC staff reviewed Framatome's incident investigation process in accordance with the acceptance criteria in NUREG-1520, Section 11.4.3.8, "Other Quality Assurance Elements."

In the LAR, Section 8.8, "Other QA Elements," Framatome states that it applies QA elements to IROFS as MM to ensure their availability and reliability.

Organization and Management Responsibility

The Framatome operating license provides the commitments for organizational structure, authority, and accountability, provided in the LAR, Chapter 2, "Horn Rapids Road Site Information." The NRC staff's evaluation of Framatome organization and management responsibility program has been documented in Chapter 2 of this SER.

Quality Assurance Program

Framatome has established an NRC approved QA program that complies with the requirements of 10 CFR 50, Appendix B. Framatome commits to implement aspects of its existing QA program elements to 10 CFR 70 activities based on factors such as: the type and safety significance of the activity, complexity of design or fabrication, supplier qualification, and industry accepted practices. These QA elements support the MM necessary to ensure reliability and regulatory compliance for 10 CFR Part 70 controlled activities.

Framatome has not made any changes made to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Design Control

The design control process is an element of the CM program described in the LAR, Section 8.1, "Configuration Management System." Framatome states that design control is described in the LAR, Section 11.1, "Configuration Management." However, the NRC staff notes that the LAR lacks detailed information on design requirements and design control programs and is being identified as an ORR condition in the license.

The NRC staff will verify that the design control process meets the acceptance criterion in NUREG-1520, Section 11.4.3.8, (A-3), during the ORR.

Procurement Document Control

The purchasing program ensures specifications, reviews, and approvals for IROFS conformance. Framatome has not made any changes made to this element from the previous NRC approval. Therefore, the NRC staff conclude that this element is acceptable.

Instructions, Procedures, and Drawings

Framatome commits that all licensed activities will be prescribed and performed in accordance with a system of standard operating procedures, company standards, and policy guides in the LAR, Section 8.4, "Procedures, Development, and Implementation." However, above in section 2.9, "Procedures," the NRC staff identified certain procedures that do not currently address the acceptance criteria of NUREG-1520, Revision 2.

The NRC staff will verify that Framatome's operational procedures and temporary procedures are consistent with the acceptance criteria in NUREG-1520, Section 11.4.3.1, during the ORR.

Document Control

Framatome states that its document control program described in the LAR, Sections 8.1 and 8.4, will ensure that all new/modified documents receive appropriate review and approval. However, the NRC staff identified that Framatome did not adequately address the document control program in MM that meets the acceptance criteria of NUREG-1520, Revision 2.

The NRC staff will verify that Framatome implements a document control system consistent with the acceptance criteria in NUREG-1520, Section 11.4.3.1, during the ORR.

Control of Purchased Material

The control of purchased material program provides reasonable assurance of conformance of IROFS with specified requirements. This program allows for appropriate receipt inspection, storage, and shelf-life requirements for materials. Framatome has not made any changes to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Identification and Control of Materials and Parts

The identification and control of materials and parts program include lock and tag procedures to prevent the use of nonconforming IROFS. Framatome has not made any changes made to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Control of Special Processes

In the LAR, Section 8.4, Framatome states that all licensed activities will be performed per written procedures by qualified personnel. Framatome has not made any changes to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Inspection

Acceptance testing is performed as part of the CM program to ensure that IROFS meet requirements prior to initial use. PM and Instrument Repetitive Maintenance programs, described in the LAR, Section 8.2, ensure that IROFS and other safety-related equipment continue to meet requirements by scheduling and implementing regular inspections. Framatome has not made any changes made to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Test Control

Test control program is integrated with inspection and maintenance. Acceptance testing is required before initial use of IROFS. PM and IRM programs provide ongoing assurance that IROFS continue to meet requirements by scheduling and implementing necessary testing activities. All testing is conducted according to written procedures, and results are documented. Framatome has not made any changes made to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Calibration of Equipment

Equipment calibration is part of the maintenance program described in the LAR, Section 8.2 and applies to both newly installed components and those requiring periodic recalibration. Calibration activities are performed according to written procedures to ensure measurement accuracy and reliability of safety-related equipment. Framatome has not made any changes made to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Handling Storage and Shipping

The spare parts program ensures that safety-important items are stored to prevent damage, loss, or deterioration due to environmental conditions. Testing for potential damage during handling or shipping is completed as part of post-installation, pre-operational testing.

Framatome has not made any changes to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Inspection, Testing, and Operating Status

Acceptance testing verifies that IROFS meet requirements before initial use. PM and IRM programs, described in the LAR, Section 8.2, ensure continued compliance by scheduling and implementing inspections and tests. Lock and tag procedures are used to identify nonconforming IROFS during testing, ensuring they are not used until repaired and able to perform their required function. Framatome has not made any changes to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Nonconforming Material

The lock and tag procedures are used to identify and segregate nonconforming IROFS, preventing their use until they are repaired and able to perform their required function. The Corrective Action Program, described in the LAR, Section 8.6, ensures that all conditions adverse to safety are promptly identified and that appropriate corrective actions are implemented to prevent recurrence. Framatome has not made any changes to this element from previous NRC approval. Therefore, the NRC staff finds that this element is acceptable.

Corrective Actions

In the LAR, Section 8.8, (18), "Other QA Elements," Framatome commits to maintain a Corrective Action Program. Framatome has established necessary measures and governing procedures to promptly identify, control, document, classify, and correct conditions adverse to safety or quality. Framatome will implement approved written policies, plans, and procedures to control the identification, classification, and follow-up of conditions adverse to safety or quality and the trending of conditions adverse to safety or quality. Reports on conditions adverse to safety or quality are analyzed to identify trends, which are documented and reported to responsible management. In the case of a condition adverse to safety or quality, the cause is determined and actions to preclude recurrence are taken. The NRC staff finds that the information provided by Framatome regarding performing corrective actions for conditions adverse to quality meets the acceptance criteria in NUREG-1520, Section 11.4.3.8, (A-16), and is therefore acceptable.

Quality Assurance Records

In the LAR, Section 8.7, Framatome described its provisions for the identification, retention, retrieval, and maintenance of records that furnish evidence of the control of quality of IROFS.

The NRC staff's conclusion of Framatome's QA records management program is documented in SER Section 2.9, "Records Management." Framatome's QA records meet the acceptance criterion in NUREG-1520, Section 11.4.3.8, (A-17), and are therefore acceptable.

Audits

Framatome's commitment for scheduling and implementing audits assessments is described in the LAR, Section 8.5, "Audits and Assessments." The NRC staff's evaluation of Framatome's audits and assessments program are documented in SER Section 2.9. The NRC staff finds that the audit program meets the acceptance criteria in NUREG-1520, Section 11.4.3.8, (A-18), and is therefore acceptable.

QA Element Evaluation Findings

The NRC staff finds that Framatome's Other QA Elements meet the requirements of 10 CFR 70 and the acceptance criteria of NUREG-1520, Section 11.4.3.8, except for design control, instructions/procedures/drawings, and document control. The NRC staff will verify that these QA elements satisfy the acceptance criteria of NUREG-1520, Revision 2 during the ORR.

2.10 Material Control and Accounting

PURPOSE OF REVIEW

The purpose of this review is to determine whether the proposed LAR to authorize the production of TRISO fuel and to increase the maximum enrichment to up to 10.0 wt.% U-235 at the fuel fabrication facility as referenced in the submittal will not result in any significant impact from a safeguards perspective and that Framatome's material control and accounting (MC&A) program will continue to detect and protect against the loss, theft, or diversion of SNM that Framatome will possess, store, and utilize at its facility.

REGULATORY REQUIREMENTS

The regulations in 10 CFR 70.22(b) state that each licensee authorized to possess and use SNM in a quantity exceeding one effective kilogram must provide a full description of its program for 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 74.31, "Nuclear Material Control and Accounting for Special Nuclear Material of Low Strategic Significance," apply to the establishment of an MC&A program for Category III fuel fabrication facilities. The requirements in 10 CFR 74.31 cover the specific MC&A program capabilities needed to establish an acceptable MC&A program. In accordance with 10 CFR 74.31(b), Category III fuel fabrication facilities are required to submit a fundamental nuclear material control (FNMC) plan describing how the performance objectives in 10 CFR 74.31(a), the system features and capabilities of 10 CFR 74.31(c) and the recordkeeping requirements of 10 CFR 74.31(d) will be met.

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The NRC regulatory guidance for an acceptable MC&A program applicable to Category III fuel fabrication facilities is NUREG-1065, "Acceptable Standard Format and Content for the FNMC Plan Required for Low-Enriched Uranium 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.

STAFF REVIEW AND ANALYSIS

The NRC staff has evaluated the application using the criteria provided in Chapter 12 of NUREG-1520, Rev. 2. As specified in 10 CFR 70.22(b), a licensee must submit a full description of its program for the control and accounting of the SNM in its possession under license to demonstrate how compliance with the requirements in 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material," will be accomplished. For certain facility types and safeguards categories, this MC&A program is provided in the form of a

Fundamental Nuclear Material Control Plan (FNMCP). Framatome has an NRC approved FNMCP for the control and accounting of SNM that describes acceptable methods for achieving the performance objectives in 10 CFR 74.31(a) and the system capabilities of 10 CFR 74.31(c) associated with its current processes.

In the LAR, Framatome stated that changes to its FNMCP are not included in the submittal as the changes and updates do not represent a substantive change. Framatome stated that they have determined that NRC prior approval is not required per 10 CFR 70.32 as the updates do not represent a decrease in effectiveness of the MC&A program. Framatome further stated that the MC&A program changes will be made available for inspection by the NRC. While 10 CFR 70.32(c) allows, without prior NRC approval, for changes that would not decrease the effectiveness of the MC&A program, the NRC must make a determination that the proposed MC&A controls for the proposed TRISO fuel fabrication process is adequate in accordance with 10 CFR 70.23(a)(6). Therefore, the NRC staff requested Framatome provide supplemental information regarding the MC&A controls applicable to the TRISO fuel fabrication process and the anticipated changes to the FNMCP.

In response to the RSI, Framatome provided, for each section of the FNMCP, a summary of the expected changes that are related to the LAR. Framatome stated that the anticipated FNMCP changes will address the following topics with respect to the proposed TRISO fuel fabrication process: TRISO facility being managed under the current site management structure; procedures and training under current processes; a new satellite laboratory and new measurement points; batch sampling and material sampling methods to be established; TRISO control areas to be included in the current physical inventory process; item control areas to be created, and items to be subject to the item control program; and shipper-receiver comparisons, including limits of error and use of new standards, to be conducted using current procedures. Framatome stated that the modified descriptions utilize similar procedures, classifications, material controls, and techniques that are currently used in other areas of the facility and are currently described in the approved FNMCP. Consequently, Framatome determined that these FNMCP changes will not decrease the effectiveness of the MC&A program. Additionally, Framatome will provide an updated FNMCP in accordance with the provisions of 10 CFR 70.32(c) at a time that is acceptable to the NRC and Framatome, prior to the start of the TRISO fuel fabrication process.

EVALUATION FINDINGS

Based on the review of the LAR, the supplemental information, and Framatome's current FNMCP, the NRC staff finds that Framatome provided sufficient information to satisfy the regulatory requirement contained in 10 CFR 70.32(c)(1)(iii) regarding the anticipated changes to the MC&A program associated with the LAR. The changes involve adding new elements and components to the existing MC&A program with respect to organization and management, measurements and measurement control, physical inventory, item control, and shipper-receiver comparisons. The NRC staff therefore finds there is reasonable assurance that Framatome's MC&A program will continue to detect and protect against the loss, theft, or diversion of SNM that Framatome will possess, store, and utilize at its facility.

In accordance with 10 CFR 70.32(c), each license authorizes the use of uranium source material at a uranium enrichment facility or authorizing the use of SNM in a quantity exceeding one effective kilogram, must contain a license condition to ensure that such material is adequately controlled and accounted for within the licensed facility. Material license SNM-1227 will continue to include license condition SG-1.1, which is applicable to

the TRISO fuel fabrication processes and satisfies the noted regulatory requirement contained in 10 CFR 70.32(c).

Additionally, in the response to RSIs (ML25097A221), Framatome committed to updating FNMCP prior to the startup of the TRISO fuel fabrication process. Therefore, license condition SG-1.1 has been modified accordingly.

2.11 Electrical Power and Instrumentation and Control

PURPOSE OF REVIEW

This chapter of the SER contains a summary of the U.S. NRC staff's review and evaluation of key aspects of the electrical power and I&C systems for the proposed facility amendment. The objective of this review is to determine if the aspects of the design of the electrical and I&C systems meet the regulatory requirements specified in Title 10 of the Code of Federal Regulations (10 CFR) Part 70, Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material." To conduct this review, the NRC staff evaluated the adequacy of the proposed licensee commitments to completing the conceptual design and intended operations of the 10.0 wt. % enrichment ceramic and TRISO fuel processes as reflected in Framatome's goals for the design of the electrical and I&C systems to meet the regulatory requirements and applicable acceptance criteria. Framatome's proposed commitments to completing the electrical power and I&C system designs are described within the LAR and the revised ISA Summary, along with its responses to the staff's requests for additional information. The NRC staff's review of the electrical and I&C systems contains proprietary and Security-Related information, and is documented in the non-public version of this SER.

REGULATORY REQUIREMENTS

The regulations applicable to the electrical power and I&C systems are as follows:

- 10 CFR 70.22, "Contents of applications;"
- 10 CFR 70.23, "Requirements for the approval of applications;"
- 10 CFR 70.61(e), "Performance requirement;"
- 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
- 10 CFR 70.65, "Additional content of applications."

REGULATORY GUIDANCE AND ACCEPTANCE CRITERIA

The guidance for NRC's review of the electrical and I&C systems section of the Framatome Fuel Cycle Facility 10.0% wt. enrichment Dry Conversion and TRISO fuel processes LAR is provided in Chapter 3 of Standard Review Plan for the NUREG-1520, Revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications" (NUREG-1520). The acceptance criteria for this review are specified in NUREG-1520, Sections 3.4.3.2 "Integrated Safety Analysis Summary and Documentation," 3.4.3.2(4)(d), and 3.4.3.2(6). Section 3.4.3.2(4)(d) specifies that the ISA Summary should explain how each baseline design criterion (BDC), as set forth in 10 CFR 70.64(a), is addressed in the facility design. Section 3.4.3.2(6) also specifies that the ISA documentation should identify the essential utilities and support

systems on which IROFS depend to perform their intended functions. In addition to NUREG-1520, the staff also considered guidance from the National Electric Code (NEC), NFPA, relevant IBC and IEBC, certain Underwriters Laboratory (UL) standards, and Framatome Company standards which have been implemented in the design of facility processes previously approved for implementation by the NRC staff during license application or amendment proceedings.

STAFF REVIEW AND ANALYSIS

The NRC staff's review of the electrical power system and I&C IROFS within the scope of the Framatome LAR includes the following criteria:

1. Adequacy of MM proposed for the development lifecycle and QA procedures governing the IROFS design, implementation and maintenance as being consistent with the nuclear fuel cycle industry recognized practices.
2. Provisions so that safety components can be inspected, tested and maintained periodically for operability and required functional performance;
3. Electrical and physical separation between systems and components performing safety and non-safety functions, and between redundant safety functions, to ensure that any required independence is maintained and that failures occurring within non-safety systems and components do not adversely affect safety functions;
4. No single failure vulnerability which would act to prevent the accomplishment of safety functions;
5. Sufficient capacity and capability to ensure the IROFS supported by the electrical systems perform their intended functions;
6. Adequate protective relaying and breaker control to ensure required functional performance and adequate response to electrical fault/overload conditions;
7. Status monitoring of the behavior of the systems and components that are identified as IROFS; and
8. System capability to maintain safety action functionality when subjected to environmental conditions, dynamic effects and NPH such as tornadoes, tornado missiles, earthquakes, floods, and any other appropriate severe natural phenomena as established in the ISA.
9. The safety system design must be based on defense-in-depth practices.

Limitations and Conditions Associated with the Electrical and I&C Review

At the time the NRC staff conducted its evaluation of the electrical and I&C aspects of the LAR, Framatome had not yet completed detailed design documents depicting the proposed electrical distribution system or the proposed design, implementation, and maintenance of the identified IROFS for the new 10.0 wt.% fuel manufacturing line processes or of the TRISO fuel process lines to be installed at the facility. Consequently, in response to the NRC staff's RAI, Framatome supplemented its LAR with copies of several programmatic

design documents outlining proposed facility electrical and I&C design criteria for NRC staff evaluation which describe the facility overall approach to providing electrical power and developing IROFS, as well as which identified facility standards that were previously used for the design of existing processes at the facility. These documents included applicable Management Control Procedures (MCPs), Work Aid Procedures (AIDs), Controls Design Descriptions (CDDs) and associated work order forms. Framatome informed the NRC staff that the design, implementation, and maintenance of the electrical supply and facility IROFS for the new up to 10.0 wt.% and TRISO fuel processes would follow the same programmatic and design processes that had been applied to the safety equipment serving as IROFS for the existing facility fuel fabrication processes, previously reviewed and approved by the NRC staff during its 2006 license amendment application for the facility (ML063110083).

Without completed electrical utility and IROFS development information or proposed design and implementation drawings for the specific electrical and I&C equipment designated to perform safety functions for the proposed up to 10.0 wt.% enrichment and TRISO fuel processes, the NRC staff, therefore, conducted audits of facility documents describing how the existing plant process safety equipment had been developed and configured to serve as IROFS. Further, Framatome provided examples of designs for the facility Uranium Recovery process that had been completed in 2020, using a licensee-approved and completed Engineering Change Notice (ECN) package, which Framatome stated was representative of the processes and completed designs they will be following to complete the detailed design of IROFS for the up to 10.0 wt.% and TRISO fuel product lines. The NRC staff evaluated the completed ECN design documents for the Uranium Recovery System as representative of the processes that will be used for developing IROFS covered within the scope of the license amendment.

License Condition

The NRC staff is adding a license condition (S-11) that requires Framatome to provide to the NRC documents describing the completed design of the TRISO process line I&Cs aspects of item(s) relied on for safety (IROFS) serving as active engineered controls and any EA controls. These documents must demonstrate that Framatome is implementing processes and procedures for the design of IROFS consistent with those processes and procedures implemented for the dry conversion processes. This required information shall be provided to the NRC at least 30 days prior to completion of the design phase and not later than 30 days before the scheduled ORR.

The documents describing the completed design that the licensee shall provide must include:

- CDDs for the TRISO process, describing the IROFS Boundary Packages
- List of Baseline Design Criteria addressed in the TRISO process CDDs
- Preventative Maintenance procedure documents and IRM procedure documents called out from the CDD
- Schematic Diagrams/P&IDs of active engineered controls IROFS for the TRISO process
- Procurement Documents for IROFS Components serving as active engineered and EA controls functions
- Engineering evaluations of the suitability of IROFS components for their expected service conditions

- Operating procedures which implement TRISO process active engineered and EA controls IROFS
- Approved ECN implementing TRISO process IROFS

2.11.1 Electrical Power Review

The NRC staff reviewed Framatome's commitments with regard to implementing an amendment to its licensed electrical power systems for the Framatome facility as described in the following sections.

Electrical Power Supply Systems

As described above, Framatome's ISA Summary and LAR did not include a detailed description of the proposed electrical distribution systems and equipment that would be supporting the new fuel manufacturing processes. ISA Summary, Part 2, Chapter 11, SF Building, Section 11.3.6, "Utility Systems," provides, at a high-level, the scope of utility systems planned for the Specialty Fuels Building. In lieu of a design description of the electrical power systems, Framatome explained that the proposed design of the electrical systems for the new processes would implement the same design principles, design practices, and design codes and standards that had been approved by the NRC staff for the original design of the Framatome Richland Washington Fuel Fabrication Facility.

The new processes being implemented at this facility are largely being installed in the SF Building. This building will be supporting Framatome's higher enriched fuel operations, including a new Dry Conversion process, new TRISO fuel Sol-Gel and FCM processes, and new Solid Waste Uranium Recovery processes. This building currently has a main power feed supplied from the City of Richland, Washington Electrical Department.

Framatome states in the ISA Summary that the building will be serviced by both normal and standby (emergency) power capability. Incoming power from the city electrical supply is routed to electrical switchgear cubicles located at strategic locations within the SF Building. Framatome Procedure MCP-30397 indicates that from the switchgear cubicles, power is routed to stepdown transformers to produce 480 volt, and 277 volt three phase facility distribution power, and then to distribution cabinets within the building to distribute 120/240 volt single phase and 120/208 volt three phase power. From there, raceways and feeder cabling are provided to power all outlets and equipment in the building.

In response to the NRC staff's RAI, Framatome provided several supplements to its LAR, which provided high-level descriptions of Framatome's proposed approach and design criteria to be used for the design of the electrical system for the Framatome Fuel Fabrication Facility. In addition, the NRC staff evaluated information provided by Framatome during a combined on-site audit and horizontal and vertical slice review held April 14-16, 2026 (ML26117A074) and evaluated information provided by Framatome as Supplemental Information or in responses to other NRC staff's RAIs. Framatome proposes to maintain a reliable power supply to the process equipment loads to meet investment protection and facility operational requirements.

Framatome stated in the ISA Summary that the electrical power system is not relied on to ensure IROFS perform their safety function. Instead, facility IROFS are designed such that systems and components perform their safety functions, maintain their safety function, or fail into a safe state upon a total loss of electrical power. Although a standby power system is

implemented for alarm systems and life safety loads in the event of a complete loss of offsite power to the facility, an Emergency Power Supply is not needed to ensure the safety functions of IROFS are completed. Upon loss of normal power, if needed, uninterruptible power supplies (UPSs) provide power to specified facility loads such as programmable logic controllers (PLCs) for manufacturing equipment controls and designated safeguards and security equipment.

Framatome's response to the NRC staff's RAIs stated that Framatome intends to ensure that the performance-based criteria that will be met by the electrical, digital I&C systems will include:

- Environmental and dynamic effects: The design must provide for adequate protection from environmental conditions and dynamic effects associated with normal operations, maintenance, testing, and postulated accidents that could lead to loss of safety functions.
- Inspection, Testing, and Maintenance: Systems—including electrical, digital I&C—must be designed to support inspection, testing, and maintenance to ensure their availability and reliability.
- Utility Services: The design must ensure essential utility services (which include electrical power) continue to function as needed to support safety functions.
- I&C: The design must include I&C systems adequate to monitor and control the behavior of IROFS.

Normal Power Supply System

The principal Framatome design document applicable to the design of the electrical distribution features at the facility is the Framatome Management Control Procedure MCP-30397, Version 12, "HRR Electrical Standard." Framatome provided this document for NRC staff evaluation in its letter of May 29, 2026 (ML26149A383). This document provides general guidelines for the design of electrical systems for the facility. The document points to other Framatome guidelines such as "Manufacturing Engineering Design & Drafting Guide," (AID-10430), "Guideline for Piping and Instrumentation Diagrams," (AID-10464), as well as guidance for conforming to recognized national and local standards described below.

The grounding system for the facility is implemented in accordance with the criteria in Framatome MCP-30397, Section 2.5, "Grounding Systems," which is based on criteria in the National Electrical Code (NFPA 70), with conductor sizing in accordance with NEC Table 250-122.

Effects of a Loss of Normal Power Supply on IROFS Safety Functions

The ISA Summary identifies that a total loss of the normal electrical power system does not have any safety implications. In the event of a loss of normal electrical power, the safety functions that are to be achieved through systems, equipment, and circuits implemented within IROFS are still achieved. This is accomplished by designing each IROFS served by normal electrical power such that once the IROFS is activated, the safety function is maintained, or the IROFS design features force the IROFS to fail into a safe condition upon loss of electrical (or air) supply.

Further, Framatome stated in its response to the NRC staff's RAIs that, although IROFS do not require electrical power to perform their required safety functions, UPSs are used to

maintain continuous power during momentary outages. The UPSs are selected/sized with adequate ride-through capability to bridge power gaps until backup sources engage or until “normal” power is restored. These UPSs are used to support business needs to reduce impacts related to process upsets. However, all IROFS normally operated with electrical power are designed to fail safe upon loss of power or signal. Thus, IROFS do not depend on the power system being energized to perform their safety functions, and the systems providing power to equipment serving as IROFS are considered to be outside the IROFS boundary.

This is accomplished by designing the associated powered IROFS to tolerate a break in the normal power supply by causing the IROFS to fail into their safe states. If a total power loss is sensed, IROFS are powered down and latch to their intended safe states, as designed. When power is restored, safety components stay in their safe state until system restoration is completed, which requires procedural confirmation of the safe state prior to enabling a return to normal operation.

The design requirements for supplying normal power to facility IROFS originate in system-level component design documents for the facility. These component design documents detail the engineering provisions, logic configurations, and hardware specifications that enable IROFS to achieve and sustain their safety function without reliance on UPS support. This design strategy enhances reliability, reduces complexity, and eliminates potential single-point vulnerabilities associated with auxiliary power systems.

The IROFS connected to buses from the Normal Power Supply System are protected from the effects of short circuits, ground faults, or power surges through adherence to design codes and standards outlined in MCP-30397 for such electrical protection. These codes and standards are further described in the sections below.

Standby Power for Critical Loads other than IROFS

Standby power is provided by a combination of battery backups and diesel generator systems. Facility life safety and security systems with the capability of connection to the standby (emergency) power system (as well as normal power) include the following systems:

- Nuclear criticality detection/warning system
- Airborne contamination monitoring system
- Hydrogen detection system
- Hydrogen Fluoride detection system
- Building exhaust fans
- Process cooling tower freeze protection heat trace
- Radiation Survey instrumentation
- Emergency lighting
- Process off-gas blowers
- Radiological safety office lights and outlets
- Heat Trace Freeze Protection
- Furnace Gas Shutoff
- Central Control System
- Carbon Dioxide detection system
- Hydrogen Chloride detector system

Modifications to the SF Building impacting building integrity are made in accordance with the 2021 IBC and the 2021 IEBC. All electrical systems are designed and installed in accordance with national codes and industry best practices.

The codes include, but are not limited to, NFPA 70, 72, 72B, 75, 79, 101, and applicable ULs, and National Electric Manufacturers Association (NEMA) standards. The applicable codes and standards to be applied are described further below. Life safety loads, emergency egress lighting, and other building safety requirements are designed and installed to meet NFPA 101 standards. Certain of these national electric codes are subject to amendment by the Washington State Electrical Code WAC 296-46B and are enforced by both Washington State and local building and fire authorities.

Continuous Power Level Status Monitoring of IROFS

To verify that facility IROFS are functioning and ready to perform their required safety actions, the status of IROFS is monitored. The safety of plant operations is ensured based on the ability to actively monitor process parameters important for safe operation and initiate protective actions to isolate and safely shut down processes.

Satisfaction of Regulatory Criteria for Electrical Power Systems Design for Powering IROFS

Based upon a review of the description of the electrical system contained in the ISA Summary, the NRC staff finds that Framatome has satisfied the acceptance criteria of NUREG-1520, Section 3.4.3.2(6), "Descriptive List of All IROFS," with respect to providing a description of the assumptions and conditions under which the electrical power supply is relied upon to provide continuous power to IROFS. Further, the NRC staff has determined based on the above information, that in committing to design all IROFS fed from the Normal Power Supply System to fail into their safe mode in the event of a loss of normal power supply, Framatome has ensured that the proposed electrical power systems design for the facility provides reasonable assurance that the regulatory performance requirements of 10 CFR 70.61 will be met.

BDC Regarding Continued Operation of Essential Utility Services

Since there are no features within the electrical power supply system that are considered to be IROFS or form a part of the IROFS boundary, the design, operations, maintenance, and testing of the electrical power supply system is not required to have the same level of quality rigor applied as those for IROFS (i.e., the electrical power system does not require the implementation of QA Elements in the QA Program). However, IROFS connected to the electrical power supply are protected from the effects of potential failures or faults originating within the electrical power supply system.

With regard to protection of IROFS, ISA Summary, Part 2, Chapter 11, SF Building, Section 11.3.5.2, "Natural Phenomena Hazards," outlines Framatome's commitment to apply design criteria appropriate for maintaining independence between safety-related and non-safety-related systems. This section states that the "FFF design, as discussed in the ISA summary, [is] considered the most severe documented events for the site. It should be noted that the building has been designated as an IROFS in the ISA summary. Framatome will also perform an evaluation of the potential impacts of natural phenomena events on the items relied on for safety, including the natural phenomena design loads and interactions of non-safety-related equipment impacting the safety function of IROFS in the new configuration of the SFB. This evaluation will be performed after completion of the final design of the TRISO fuel fabrication process. The evaluation cannot be accurately performed until the detailed design of the needed equipment is completed and sufficient anchoring is determined. The

design will follow all of the applicable codes and standards as stated in Section 11.3.4. The evaluation will be available for on-site inspection by the NRC as part of the operational readiness review.”

As stated above, IROFS operate correctly with their power supply and default to a safe state upon power or signal loss, and do not depend on the power system being energized to perform their safety functions. With the considerations described for assuring adequate independence and isolation between IROFS and non-IROFS systems, circuits, equipment and components, the NRC staff finds that Framatome’s proposed electrical system design satisfies the BDC at 10 CFR 70.64(a)(7) with regard to the assurance of continued availability and reliability of IROFS to meet the safety performance requirements for the Framatome SF Building.

BDC on Environmental Conditions and Dynamic Effects

ISA Summary, Part 2, Chapter 11, SF Building, Section 11.3.5.4, “Environmental and dynamic effects,” describes Framatome’s proposed commitments with regard to 10 CFR 70.64(a)(4) regarding the reliability of IROFS which may be impacted by failures within the electrical system design due to environmental and dynamic effects. Framatome proposes to design the electrical system with high-quality commercial grade equipment arranged to comply with the codes identified above. Under normal conditions for operation, electrical power is supplied to facility IROFS that are designed to provide for adequate protection from environmental conditions and dynamic effects associated with normal operations, maintenance, testing, and postulated accidents that could lead to loss of safety functions.

The ISA Summary states that such IROFS perform their required safety functions under normal and accident conditions, e.g., pressure, temperature, humidity, seismic motion, chemical exposure, electromagnetic interference, and radio-frequency interference, as indicated in the ISA Summary. Since IROFS are designed to fail safe, the electrical power system for the facility does not have to be specifically designed to meet the extremes of environmental conditions and dynamic effects of testing and maintenance. However, the main components of the electrical power system, including the switchgear and electrical distribution equipment that deliver normal electrical power to the facility IROFS, are housed and protected within the Framatome SF Building structures and are designed to meet the IBC 2021 and the IEBC 2021 requirements. The hazards evaluated for this facility include potential adverse effects of weather (high winds, tornadoes, rain, snow, hail, etc.) and fire and flooding conditions.

ISA Summary, Part 2, Chapter 11, SF Building, Section 11.3.5.4 states that the IROFS established by Framatome will comply with design requirements established by the ISA Summary and applicable codes and standards. The design accounts for normal operations, maintenance, testing, and events that could lead to loss of safety functions. The design also considers the expected operating conditions (vibration, temperature, pressure, corrosion, weather conditions impact, etc.) with respect to environmental and dynamic effects. With the above described considerations for assuring adequate design of IROFS to be qualified to perform their required safety functions under normal and accident conditions, in the presence of adverse environmental and dynamic effects, the NRC staff finds that Framatome’s proposed electrical system design adequately satisfies the BDC at 10 CFR 70.64(a)(4) with regard to the assurance of continued availability and reliability of IROFS to meet the safety performance requirements for the SF Building.

BDC to Provide for the Capability of IROFS to be Inspected, Tested, and Maintained

The BDC at 10 CFR 70.64(a)(8) requires that IROFS design must provide for adequate inspection, testing, and maintenance of IROFS to ensure they are available and reliable to meet their required safety functions when needed. However, the electrical power supply aspects of IROFS are not credited with supporting IROFS safety functions. Section 1.4 of the Framatome's Management Control Procedure MCP-30397 (HRR Electrical Standard) describes Framatome's proposed electrical system design standards. Framatome proposes to design the electrical system with high-quality commercial grade equipment arranged to comply with NFPA 70, NFPA 72B, NFPA 75, NFPA 79, and NFPA 101. The "authority having jurisdiction" (e.g., Washington State or City of Richland, Washington) may impose local inspection or testing requirements for certain aspects of the power supply, such as for electrical aspects of fire protection or emergency lighting.

Although Framatome has proposed to design the electrical power system such that it is not relied upon to enable the facility to achieve its required safety performance objectives, in order to assure that there are no adverse effects on the IROFS due to a failure or degraded condition occurring within the electrical power system, appropriate protective relay devices and isolation devices are utilized to protect against electrical faults, shorts, and grounding, while maintaining independence between IROFS equipment, circuits and systems, and non-IROFS equipment, circuits, and systems. During audit meetings Framatome informed the NRC staff that such isolation devices, if required, would be a part of the IROFS boundary, and that IROFS are inspected, tested, and maintained in accordance with the appropriate MM for those items. Further, Framatome MCP-30153, "Guidelines for Design and Documentation Requirements for Critical Components," Section 14.6, "Functional Testing" identifies that specific functional tests are typically required for IROFS after installation or modification. Such tests are typically a requirement that is executed under the preventative maintenance or IRM program. Functional testing should be performed to verify correct operation. Interlocks should be tested from stimulus to final element response.

With the above described considerations for assuring that such isolation devices are a part of the IROFS boundary and are inspected, tested, and maintained in accordance with the appropriate MM for those IROFS, the NRC staff finds that Framatome's proposed electrical system design satisfies the BDC at 10 CFR 70.64(a)(8) with regard to the assurance of continued availability and reliability of IROFS to meet the safety performance requirements for the SF Building.

Defense-in-Depth Design Practices

Framatome's proposed design of the electrical system for the SF Building makes use of defense-in-depth practices. Under normal conditions IROFS are provided with a normal source of electrical power. Event sequences with high or intermediate consequences are provided with independent IROFS to provide a high-level of risk reduction capability for the event sequences. For these event sequences, if normal power is lost to one or both of the IROFS such that they may not function appropriately to apply a required safety function, each IROFS will fail to its safe state to accomplish the required safety function. Additionally, the independent IROFS is still available to perform its required function to prevent or mitigate the risk posed by the event sequence by the first IROFS failing to its safe state.

Upon detection of a loss of electrical power to the bus feeding critical facility alarms and monitoring systems identified in this SER, a standby diesel generator is automatically started and connected to supply power to the connected short break loads.

The NRC staff finds that these proposed design features provide evidence that Framatome incorporates defense-in-depth principles with its redundant normal and standby power design features when completing the design of the SF Building. Further, the use of multiple active engineered IROFS to prevent or mitigate high and intermediate-consequence events and that fail safe on loss of power meets the requirements of 10 CFR 70.64(b).

Applicable Industry Codes and Standards for the Normal Electrical Power Supply Systems

In ISA Summary Section 2.3.3, "Applicable Codes and Standards for Electrical Service," Framatome lists the industry codes and standards which it commits have been and will be applied to the design of the SF Building, including relevant standards from ANSI/IEEE, ANSI/UL, NEMA and NFPA. These codes and standards address the following design, implementation and maintenance features:

- Independence between IROFS and non-IROFS equipment;
- Design, life safety, and electrical workplace safety;
- Design of protective relaying of the bus distribution system;
- Coordination of load protection;
- Electrical equipment grounding;
- Surge Protection; and
- Standby Power System design.

Framatome identifies that the use of applicable portions of industry design codes and standards results in a high reliability electrical power supply that support operations, life safety, and process controls, and does not adversely impact the operation of facility IROFS.

These codes and standards include applicable portions of:

UL

- UL 508A, Underwriters Laboratories, "Standard for the Design, Construction, and Safety of Industrial Control Panels"

ICC Codes

- IBC, "International Building Code," 2021
- IEBC, "International Existing Building Code," 2021

NFPA

- NFPA 70, "National Electrical Code"
- NFPA 72, "National Fire Alarm and Signaling Code"
- NFPA 72B, "Standard for the Installation, Maintenance, and Use of Auxiliary Protective Signaling Systems for Fire Alarm Service"
- NFPA 75, "Standard for the Fire Protection of Information Technology Equipment"
- NFPA 79, "Electrical Standards for Industrial Machinery"
- NFPA 101, "Life Safety Code"

Local Codes

- WAC 296-46B Washington State Electric Code (Amendments to NEC)

Framatome Company Standards

- MCP-30397, "HRR Electrical Standard"

Findings for the Design of the Process Buildings Electrical Systems

The NRC staff finds, based on the above evaluation of the information presented by Framatome in the ISA Summary, information presented to the NRC staff on the docket as a result of its RAIs, including the commitments to implement applicable portions of the specific industry codes and standards listed above, and commitments discussed above regarding the proposed design of the facility electrical system, that the proposed approach and design of the electrical systems meets the requirements of 10 CFR 70.64(a) and (b). Note: The implementation of the electrical systems will be reviewed during the NRC staff's ORR to ensure they are implemented in accordance with the commitments in the LAR and information in the ISA Summary. The NRC staff also finds that the information contained in the documents referenced in the above summary demonstrates satisfaction of the acceptance criteria in NUREG-1520, Revision 2, Sections 3.4.3.2(4)(d) and 3.4.3.2(6), as they pertain to electrical systems.

Based on the ISA results documented in the ISA Summary, and the responses to the NRC staff's RAIs, the design of the electrical systems for the SF Building, and Framatome's proposed MM and programmatic commitments, the NRC staff finds that the approach to electrical systems proposed by Framatome will provide reasonable assurance that the IROFS required to ensure compliance with the performance requirements of 10 CFR 70.61 will accomplish their required safety function when needed, including by ensuring any credible intermediate-consequence events are unlikely and any credible high consequence events are highly unlikely.

Instrumentation and Control Systems

Framatome states in its ISA Summary that "Administrative and MM at Framatome are instituted and maintained to ensure ... that all engineered and administrative controls identified as IROFS in the ISA shall be designed, implemented and maintained to reasonably assure they are available and reliable to perform their function when needed." The NRC staff has examined Framatome's internal ECN process, and relevant supportive MCPs, Work Aid (AID) documents, CDD and associated work order forms, to evaluate how Framatome confirms that the I&C IROFS are designed, implemented and maintained with acceptable confidence that they are available and reliable when they are needed.

Management Measures Applicable to I&C IROFS

ISA Summary Part 1 – Chapter 1-8 – Richland Facility ISA Program, Sections 3, 4, and 7 provide, respectively, an overview of plant operations, the process for identifying hazards, and a high-level description of external and facility hazard consequences along with the controls designed to mitigate them. A high-level, functional description of Framatome's proposed IROFS used in the up to 10.0 wt.% dry conversion and TRISO processes at the Framatome SF Building, along with discussions on how these IROFS mitigate or prevent the event sequences, are presented in ISA Summary, Part 2, Chapter 11, SF Building, Sections 11.3, "Building Information," and 11.4, "Overview of Operations." Attachment 2 to the Framatome's RAI response includes a listing of 34 IROFS associated with the Fuel Facility license amendment that were identified as Active Engineered Controls. It also includes a reference to existing IROFS that Framatome currently uses that perform the same safety function as the individual IROFS listed for the new up to 10.0 wt.% and TRISO processes to be installed in the SF Building.

IROFS Design and Implementation

ISA Summary Part 1 – Chapter 1-8 – Richland Facility ISA Program, Section 8, “Horn Rapids Plant Administrative and Management Measures,” presents brief descriptions of the MM that govern the development (e.g. design, implementation) and maintenance of the IROFS.

Adequate confidence that the IROFS will be developed and maintained to ensure their availability and reliability when needed is supported by the detailed information in substantial number of internal procedures, guidance and request forms provided during the audit and in the RAI responses. MCP 30153, Figure 1, “Guidelines for Design and Documentation Requirements for Critical Components,” illustrates the MM (e.g. engineering steps) used to identify hazards and map them to safety requirements for new designs or modifications to existing systems. The figure included in Framatome’s RAI response further shows how the plant uses the ECN process to develop the IROFS for new systems or changes to existing systems.

Framatome’s procedure, MCP-30379, “Construction or Modification Change Control,” defines the IROFS system lifecycle as five phases: initiation, planning, execution, control, and closure. Procedures MCP-30379A through MCP-30379E correspond to and govern each of these five phases. Each phase is also supported by at least one Operator Aid (AID) document. For example, AID-30379A provides guidance for preparing and reviewing the Technical Design Bases and Criteria. The initiation phase begins with the FRM-30379A “New Project Request” form. Additional technical information, such as safety system descriptions, safety function and design requirements, software design features, setpoint calculations, FMEA analyses, and environmental and dynamic effects evaluations, is documented in the CDD packages.

The IROFS utilize digital technology to implement their safety functions. The software development lifecycle is further described in Framatome’s procedure, MCP-30675 “Creation and Modification of Manufacturing Software.” This MCP, along with the MCP-30379 series procedures, outlines a structured, high-quality development process for the design, implementation, and maintenance of these digital IROFS. This lifecycle process includes requirements for verification and validation (V&V) at critical transition points, procurement under the Framatome quality program, and systematic testing of components and subsystems to ensure compliance with design specifications.

For IROFS that incorporate software, firmware, PLCs, or other digital devices, Framatome commits to:

- Adhering to accepted best practices in software and hardware engineering, including software QA controls integrated throughout the lifecycle;
- Applying nuclear fuel industry recognized best practices lifecycle requirements for conceptualization, design, testing, installation, operations, maintenance, modification, and retirement;
- Performing independent V&V activities at key stages to confirm requirements are fully defined, implementable, and verified against acceptance criteria;
- Ensuring qualification of components for environmental, electromagnetic, and operational conditions as required by the ISA Summary; and
- Maintaining configuration control and QA measures consistent with Framatome’s quality program for IROFS.

IROFS Maintenance

ISA Summary Part 1 – Chapter 1-8 – Richland Facility ISA Program, Section 8 outlines the Framatome maintenance program to ensure that IROFS are able to perform their safety functions when needed. This program includes PM, surveillance/monitoring, corrective maintenance and functional testing. Corresponding procedures and detailed technical maintenance tasks are included in MCPs, AIDs and FRM documents.

MCP-30383A outlines the PM process, and FRM-30383A itemizes the detailed PM task checklist. MCP-30325 defines the Instrument Repetitive Maintenance (IRM) process, and step-by-step details of how to conduct this maintenance are outlined in engineering forms such as FRM-30325 “IRM Request,” FRM-30325D “Instrument Information Sheet,” and FRM-30325F “IRM Checklist.”

Based on these findings on IROFS development and maintenance MM, the NRC staff finds that Framatome’s MM for the IROFS development lifecycle, covering each development phase and step from hazard analysis, allocation of safety functions to protection features, safety requirements specification, system design and engineering, and IROFS installation/commissioning, as well as the defined inputs, outputs, and acceptance criteria for each phase, and its MM for operation and maintenance, including testing, validation, IROFS modification, and independent V&V activities, are consistent with recognized nuclear industry practices. Therefore, these measures provide reasonable confidence that the IROFS designed, implemented, and maintained under this framework will be available and reliable when needed.

BDC Applicable to the I&C

The following sections summarize the NRC staff’s findings on the BDC as they apply to the design, implementation, and maintenance of the I&C systems proposed by Framatome for use as IROFS for the new up to 10.0 wt.% dry conversion and TRISO processes.

BDC Regarding the Inclusion of I&C to Monitor and Control the Behavior of IROFS

As discussed in ISA Summary, Part 2, Chapter 11, SF Building, Section 11.4, the SF Building processes are divided into multiple systems, each corresponding to a step in the up to 10.0 wt.% dry conversion or TRISO processes. For example, System 690 designates the Cylinder Storage and Handling step. Details for each system are provided in a CDD, which includes descriptions of major components (including IROFS), functional requirements for each component, alarms and interlocks, IROFS design features, and discussions of the software used in the system, covering software structure and functions, security considerations, data retention and historical operating data, requirement traceability, and the test plan and test cases. Setpoint calculations, FMEA results, and environmental and dynamic effects evaluations are appended to the CDD.

Framatome designs all 34 IROFS using a consistent approach that employs both a primary PLC and a diverse secondary PLC. In its RAI responses, Framatome confirmed that potential common-cause failures (CCFs) are addressed by ensuring the primary and secondary PLCs are independent and diverse. This means the two PLCs use different models and operate as separate autonomous control systems, each implementing the IROFS function using different technologies or hardware.

For example, when an IROFS requires a primary and secondary PLC, the PLC models must differ (e.g., ControlLogix versus GuardLogix), with distinct model numbers for each safety function. This design requirement is documented in the CDDs for each process system.

MCP-30518, "Dry Conversion Controls Design Description," provides a CDD for a fuel process system. MCP-30518, Section 4, "System Overview," describes the system and its major IROFS, including the boundaries of IROFS and how they interface with safety-related and non-safety systems. MCP-30153, Section 12, "Guidelines for Design and Documentation Requirements for Critical Components," includes Item 3, "Independence," which requires that any IROFS credited as a defense for an accident sequence be independent. Framatome's RAI response explains that the IROFS design includes features such as using a dedicated PLC core for non-safety communications that is separated from the cores executing safety functions, thereby maintaining independence of safety logic. Based on its review, the NRC staff finds that the IROFS design, supported by the associated administrative controls and the application of failsafe design principles, provides sufficient independence to ensure that a failure in one PLC channel does not adversely affect the other, independent channel.

The NRC staff reviewed the I&C IROFS to mitigate or prevent event sequences associated with identified SF Building process hazards. In addition, the NRC staff reviewed Framatome's program for designing, implementing, and maintaining IROFS to ensure the availability and reliability of the initiation of safety functions; and providing for I&C to monitor and control the behavior of IROFS. The NRC staff also finds that the applicant's proposed design criteria for I&C IROFS satisfy the 10 CFR 70.64(a)(10) BDC by ensuring the inclusion of appropriate I&C systems that would adequately monitor and control the behavior of IROFS, which in turn contributes to the assurance of continued availability and reliability of IROFS at the SF Building to meet the safety performance requirements of 10 CFR 70.61.

BDC Regarding the Provision for Adequate Protection from Environmental Conditions and Dynamic Effects

MCP-30153, "Guidelines for Design and Documentation Requirements for Critical Components," Section 12, "Design Features and Requirements," Item 9, "Environmental and dynamic effects," requires that effects from the immediate surroundings around a safety component should be evaluated during the design. These environmental effects include: weather, vibration, corrosion, and/or process discharge, etc. In addition, protection of equipment from dynamic effects such as shock or external impacts should be assessed.

MCP-30518, Appendix C, "Environmental and Dynamic Effects Evaluation," provides a CDD for a fuel process system and summarizes the results of the environmental and dynamic effects evaluations. The summary identifies how the system and its components were evaluated for factors such as protection of fittings from external impact, corrosion, vibration from pumps or fans, water discharge from sprinkler systems or other splash sources, weather conditions, and other facility or site considerations, including nearby railway activity, air-traffic patterns, and surrounding commercial operations.

With the above described considerations for assuring adequate design of IROFS to be able to perform their required safety functions under normal and accident conditions, in the presence of adverse environmental and dynamic effects, the NRC staff finds that Framatome's proposed design of the I&C IROFS satisfies the BDC at 10 CFR 70.64(a)(4) with regard to the assurance of continued availability and reliability of IROFS to meet the safety performance requirements for the Framatome SF Building.

BDC Regarding the Provision for the Capability of IROFS to be Inspected, Tested, and Maintained to Ensure their Availability and Reliability

ISA Summary, Part 2, Chapter 11, SF Building, Section 11.3.5.8, "Inspection, Testing, and Maintenance," states that IROFS are designed to allow for periodic inspection, testing, and maintenance. These surveillances may include performance checks, calibrations, tests, and inspections. In addition, PM on IROFS equipment is conducted in accordance with site procedures to ensure continued availability and reliability.

The Framatome IROFS development life cycle, as discussed above, incorporates structured V&V activities supported by the Framatome QA program. Because each engineering task is formally reviewed and approved under this program, the process provides reasonable assurance that the IROFS are properly inspected and tested to function as designed.

ISA Summary Part 1 – Chapter 1-8 – Richland Facility ISA Program, Section 8 describes the Framatome maintenance program, which ensures that IROFS remain capable of performing their safety functions. The program covers PM, monitoring and surveillance activities, corrective maintenance, and functional testing, with the specific procedures and technical task details provided in the applicable MCPs, AIDs, and FRM documents. For instance, MCP-30383A defines the PM process, and FRM-30383A lists the associated task checklist. Similarly, MCP-30325 establishes the IRM process, while forms such as FRM-30325 "IRM Request," FRM-30325D "Instrument Information Sheet," and FRM-30325F "IRM Checklist," provide step-by-step instructions for carrying out the IRM activities.

The NRC staff finds that Framatome's proposed design of the I&C IROFS satisfies the BDC at 10 CFR 70.64(a)(8) regarding the assurance of continued availability and reliability of IROFS to meet the safety performance requirements for the Framatome SF Building.

BDC Regarding the Use of Defense-in-Depth Design Practice and a Preference for Engineered Controls over Administrative Controls

MCP-30153, "Guidelines for Design and Documentation Requirements for Critical Components," Section 11, "Preference of Defenses," states that, when designing a safety component, active engineered controls are the preferred means for mitigating accident sequences, while administrative controls are considered the least preferred.

In addition, MCP-30153, Section 12, Item 4, "Diversity" and Item 5, "Redundancy" require applying diversity to IROFS credited for a given accident sequence and avoid using simple redundancy to address potential common cause failures.

ISA Summary, Part 2, Chapter 11, SF Building, Section 11.3.5.10, "Defense-in-depth," states that Framatome applies a design philosophy that ensures defense-in-depth is maintained. Under this approach, the facility is designed so that protection of health and safety does not rely on any single feature of design, construction, maintenance, or operations. The overall result is a conservatively designed facility and set of systems with sufficient tolerance to equipment failures and external challenges.

Framatome applies a uniform design strategy across all 34 IROFS, using a primary PLC paired with a diverse secondary PLC to provide independent safety functions. In its RAI responses, Framatome explains that potential common cause failures are mitigated by ensuring that the two PLCs are both independent and diverse, for example by using different PLC models that function as separate, autonomous control systems and implement the IROFS logic using different technologies or hardware. The CDDs for each process system

document this requirement, specifying that whenever an IROFS relies on both a primary and a secondary PLC, the two must be different models, such as a ControlLogix unit paired with a GuardLogix unit, each with distinct model numbers associated with the credited safety function.

Applicable Industry Codes and Standards for the I&C

Framatome's licensing application and Integrated Safety Analysis Summary (ISAS) do not include explicit commitments to comply with any specific industry codes or standards for the design, implementation, or maintenance of IROFS. As discussed in this SER, the NRC staff reviewed Framatome's MM governing IROFS design, implementation, and maintenance, and reached the following conclusions:

- Framatome uses structured engineering development and maintenance procedures for the design and implementation of IROFS. This process includes conducting hazard analyses, developing safety requirements, allocating safety functions to protective features, procuring and implementing safety components, performing V&V activities, installing and testing systems, carrying out maintenance during operation, and repeating these steps as needed for future modifications.
- Framatome implements a comprehensive internal QA program throughout the design, implementation, and maintenance of IROFS. This QA program covers planning, procedures, training, indoctrination, and qualification, and addresses key elements such as design control, procurement control, instructions, procedures and drawings, safety component identification and control, inspection and testing, control of measuring and test equipment, management of nonconforming items, corrective actions, and audits.

During the on-site audit, as described in this SER, the NRC staff reviewed relevant procedures, engineering forms, and control documents. The NRC staff found that Framatome's practices for IROFS design, implementation, and maintenance are consistent with nuclear industry best practices as reflected in applicable industry codes and standards.

Findings for the Proposed Design of the I&C Design

The NRC staff has determined, based on the above evaluation of the information presented by the applicant in the LAR and ISA Summary, supplemented by RAI responses, that the proposed approach and design of the I&C IROFS satisfy the requirements of 10 CFR 70.64(a) and 10 CFR 70.64(b).

The NRC staff also concludes that the information contained in the documents referenced in the above summary satisfies the acceptance criteria in NUREG-1520 Sections 3.4.3.2(4)(d) and 3.4.3.2(6), as they pertain to I&C IROFS.

Based on results documented in the ISA Summary, the design of the I&C IROFS and associated MM, and Framatome's programmatic commitments, the NRC staff finds that Framatome's proposed approach provides reasonable assurance that the identified I&C IROFS will perform their required safety functions when needed. This supports facility compliance with the performance requirements of 10 CFR 70.61 by ensuring that any credible intermediate-consequence events are unlikely and any credible high consequence events are highly unlikely.

Note: The NRC staff will verify, prior to the ORR, that Framatome's programmatic commitments regarding I&C design for the TRISO process are properly implemented before licensed material is permitted on-site, as indicated in condition S-11.

EVALUATION FINDINGS

Based on the licensee's commitments to implement the electrical and I&C design criteria for the IROFS associated with the new 10 wt.% enrichment fuel processes that will utilize the dry conversion process in the same manner as was implemented in the existing facility for the current enrichment fuel, the NRC staff concludes that Framatome's design criteria commitments, QA requirements, and MM, regarding the proposed elements of the electrical power system and I&C IROFS design portion of Framatome's safety program implemented for the dry conversion process for the 10 wt. % enrichment fuel will be adequate to provide reasonable assurance that IROFS will be available and reliable to perform their intended safety function(s) when needed to ensure compliance with the performance requirements of 10 CFR 70.61.

For the proposed 10 wt. % enrichment dry conversion process, the NRC staff finds that Framatome's ISA appropriately analyzes proposed electrical power and I&C systems in the context of identifying and evaluating relevant hazards, potential accidents, and IROFS as required by 10 CFR 70.62(c)(1). Based on the NRC staff's review of the LAR and ISA Summary, Framatome's associated MM and programmatic commitments, and other information as it pertains to the electrical power system and I&C used as IROFS, including the NRC staff's review of the ISA documents during the horizontal and vertical slice audit and the Framatome BOX website, the NRC staff finds that the foregoing information provides reasonable assurance that, with respect to electrical power systems and I&C systems, Framatome has identified appropriate IROFS and established engineered and administrative controls that will ensure compliance with the performance requirements of 10 CFR 70.61, including by ensuring any credible intermediate-consequence events are unlikely and any credible high consequence events are highly unlikely.

Framatome shall not receive, possess, handle, store, or process any special nuclear material in excess of 6.5 wt. % U-235 until the NRC staff verifies its above findings through Framatome's acceptable completion of all license conditions, including conditions S-10 and S-11.

3.0 ENVIRONMENTAL REVIEW

NRC staff reviewed the Framatome LAR for increased site enrichment at the Framatome Fuel Fabrication Facility in Richland, Washington. The application dated September 20, 2024, included an environmental report (ER) update and a statement that the application was categorically excluded under 10 CFR 51.22. The proposed amendment changes the license to support increased enrichment up to 10.0 weight percent (wt%) U-235. Framatome stated that the change requires only small modifications, improvements and fortifications to existing systems and processes to support safety.

The requirements of the categorical exclusion in 10 CFR 51.22(d)(7) state that a categorical exclusion is appropriate if the following apply:

(d) The following categories of NRC actions are excluded from the requirement to prepare an environmental assessment or environmental impact statement provided that any ground disturbance is limited to previously disturbed areas and there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, no

significant increase in individual or cumulative public or occupational radiation exposure, and no significant increase in the potential for or consequences from radiological accidents.

(7) Actions that result in a change in process operations or equipment under licenses for fuel cycle facilities or radioactive waste disposal sites, or under the materials licenses identified in [§ 51.60\(b\)\(1\)](#).

Staff's evaluation of each of the specific requirements of 10 CFR 51.22(d) are as follows:

any ground disturbance is limited to previously disturbed areas

There is no significant expansion or proposed new construction of the site. All activities will be within the processes and footprint of the current operational activities. On page 1 of the ER, Framatome states that “[t]here will not be any construction activities that could create dust, increase noise in surrounding areas, nor will there be any impact on visual resources as no changes to the exteriors of buildings will occur.”

there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite

This requirement is met because the proposed enrichment activities will not generate any new chemical or radiological attributes with the potential to enter the surface water. The current processes already generate liquid waste, solid waste, and airborne effluents. Liquid effluent, treatment, and monitoring will not require any changes for the revised license activities. Solid waste includes obsolete equipment and hardware, used ventilation filters, used personal protective equipment, waste treatment residues/filter cakes, demolition debris, and miscellaneous combustible waste. As stated in the response to the NRC staff's RSI, “No new waste categories (radiological or non-radiological) will be generated with the addition of TRISO fuel fabrication.” Increases to waste generated by the proposed processes will not be significantly different than existing waste volumes.

[there is] no significant increase in individual or cumulative public or occupational radiation exposure

Framatome's air emission biannual report data reveal that the annual radioactive air emissions total (all stacks combined) for calendar years 2019–2023 ranged from 0.101 Bq (2.75 pCi) to 0.269 Bq (7.28 pCi) alpha radiation, showing consistent compliance with the modified airborne radioactivity limits in 10 CFR Part 20, Appendix B, Table 2, “Concentration Limits.” According to Framatome's LAR, the proposed action will likely be implemented by increasing enrichment to up to 10.0 wt% across approximately one-quarter of the site, which would result in an increase in the annual radioactive airborne emissions of 1.74 times the current average and a sitewide output of up to 666,000 Bq (18 µCi) annually across all stacks. Accounting for the total radioactive air emissions from the 2019-2023 period, the expected increase in specific activity associated with the proposed action would reasonably be expected to remain within the limits in 10 CFR Part 20, Appendix B, Table 2. Though the specific activity will measurably increase, the NRC staff expect that increase to continue to be sufficiently addressed by maintaining the existing monitoring program and best

management practices. Increasing enrichment and adding the TRISO based fuel production line is not expected to significantly increase the combined dose from all stacks.

[there is] no significant increase in the potential for or consequences from radiological accidents

The consequences of accidents will not change because there is likely no effect to criticality. The ER states that “[w]hile Framatome recognizes the potential for these types of accidents, the probability of any of them occurring is low due to engineered safety factors incorporated into the process design. Framatome process designs incorporate sufficient safety controls to ensure that any accident sequence (radiological or chemical) resulting in high or intermediate consequences meet the performance requirements specified in 10 CFR Part 70.61.”

The Supplement to Applicant’s ER September 2024 on pg. 50 states:

“Calculated annual radiological doses to the public from Framatome operations from 2019–2023 ranged from 3.0×10^{-4} to 4.0×10^{-3} mSv [0.03 to 0.4 mrem]. This is approximately 4 percent of the 0.1 mSv [10 mrem] annual dose limit from 10 CFR 20.1101 from combined emissions of radioactive material. Dose impact to a member of the public is limited by the constraint limit in 10 CFR 20.1101(d) to 10 mrem per year. Calculated doses to the theoretical maximally exposed individual from the Framatome site radioactive stack emissions (not including radon) for calendar years 2019–2023 ranged from 1.64×10^{-6} to 1.2×10^{-4} mSv/yr [1.64×10^{-4} to 1.2×10^{-2} mrem/yr]. The calculated doses are 0.1 percent or less than the 10 CFR Part 20 limit.”

Framatome notes in its ER, section 4.7, “Air quality,” that even if the largest calculated dose was increased commensurately with the expected increase in specific activity, the public dose would remain below the regulatory standard for air emissions. Framatome also included TRISO-specific updates to the ISA in the LAR to support the proposed increased enrichment level, and that any facility changes required to ensure criticality safety at 10.0 wt% enrichment will not increase the probability of radiological accidents.

The proposed action must meet safety requirements, as determined by the NRC staff during the safety review. A few conditions frame the NRC staff’s analysis that can be used for the preemptive purposes of this categorical exclusion determination. Since the proposed action will not involve new construction, all new processes will fit within the same SF Building that housed previous processes. This limits the potential for radiological accidents and the number of sequences should be generally similar. Furthermore, the other existing processes at the Framatome fuel fabrication facility and the previous processes that are being replaced were already considered to have the potential for “high consequence” events. A significant increase from the baseline is not expected and the accident scale would be comparable to existing conditions. Finally, any increase to the potential consequences to radiological accidents would be within the same category as those associated with existing processes.

Building designs/requirements are changing, and while some facilities are grandfathered in to continue operations at the same level of safety, any with a large change will be required to meet the new safety requirements. Therefore, the NRC staff’s safety review supports the determination that the potential for consequences from radiological accidents will be similar

for the proposed action, and no additional requirements or findings are made during the safety review, this requirement of the categorical exclusion will be met.

National Historic Preservation Act – Section 106 Consultation:

The NRC staff has determined that the undertaking is a type of activity that does not have the potential to cause effects on historic properties. Therefore, in accordance with 36 CFR 800.3(a)(1), the NRC has no further obligation under Section 106 of the National Historic Preservation Act.

Endangered Species Act – Section 7 Consultation

The proposed action has been evaluated for potential effects on federally listed species and critical habitats and was determined to have no effect. Because the action would not result in any direct or indirect effects, Section 7 consultation is not required, and the NRC's obligations under Section 7 have been satisfied.

Conclusion:

An early review of this action did not conclude that a categorical exclusion was applicable and determined that more information was needed. The NRC staff made an RSI from Framatome. Based on the NRC staff's review of the application and the Framatome responses to the RSI, the NRC staff have concluded that the LAR can be categorically excluded under the NEPA requirements.

4.0 CONCLUSION

The NRC staff reviewed Framatome'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 Framatome's ISA program, radiation program, nuclear criticality program, chemical safety program, emergency management, structural safety program, human factors program, fire safety program, MC&A program, MM 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, Framatome's decommissioning 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-1227 from 6.5 to 10. wt.% U-235 for areas involving TRISO fuel fabrication. 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.

As part of this licensing action, Materials License SNM-1227 is amended by modifying License Conditions S-9, S-10, S-11 as follows:

S-9. The licensee shall control the entire fuel fabrication facility to safely process enrichments up to 6.5 wt.% U-235 except for the SF Building.

The licensee shall control the entire fuel fabrication facility to safely process enrichments up to 10.0 wt.% U-235 within the Specialty Fuels Building.

S-10. Framatome shall not receive, possess, handle, store, or process any special nuclear material in excess of 6.5 wt. % U-235 until the NRC completes an ORR that verifies that the facility will be operated safely and in accordance with the requirements of Material License SNM-1227. Framatome shall notify the NRC at least 120 days prior to the receipt of special nuclear material in excess of 6.5 wt. % U-235.

S-11. The licensee shall provide to the NRC documents describing the completed design of the TRISO process line I&Cs aspects of item(s) relied on for safety (IROFS) serving as active engineered controls, and any EA controls. These documents should demonstrate that Framatome is implementing processes and procedures for the design of IROFS consistent with those processes and procedures implemented for the dry conversion processes. This required information shall be provided to the NRC at least 30 days prior to completion of the design phase and not later than 30 days before the scheduled ORR.

The documents describing the completed design that the licensee shall provide must include, at a minimum:

- CDDs for the TRISO process, describing the IROFS Boundary Packages
- List of Baseline Design Criteria addressed in the TRISO process CDDs
- Preventative Maintenance procedure documents and IRM procedure documents called out from the CDD
- Schematic Diagrams/P&IDs of active engineered controls IROFS for the TRISO process
- Procurement Documents for IROFS Components serving as active engineered and EA controls functions
- Engineering evaluations of the suitability of IROFS components for their expected service condition
- Operating procedures which implement TRISO process active engineered and EA controls IROFS
- Approved ECN implementing TRISO process IROFS

As part of this licensing action the following administrative corrections are also being made to the license:

- Materials License SNM-1227 is amended by modifying Item SG-1.1. SG-1.1 will now reference section 0 through 6 of the FNMCP, version 19.

SG-1.1 The licensee shall follow Sections 0.0 through 6.0 of the Fundamental Nuclear Material Control Plan, Version 19, and as the plan may be further revised in accordance with, and pursuant to, the provisions of 10 CFR 70.32(c).

- Materials License SNM-1227 is amended by modifying Items SG-2.1. SG-2.1 will now reference Revision 12 of the Physical Protection Plan.

SG-2.1 The licensee shall follow the Physical Protection Plan entitled "Physical Protection Plan for SNM for Low Strategic Significance, Revision 12.0 for Framatome

Inc.'s Richland, Washington Fuel Fabrication Facility," submitted June 29, 2018; and as it may be further revised in accordance with the provisions of 10 CFR 70.32(e).

- Materials License SNM-1227 is amended by modifying Items SG-3.1 and SG-3.2. SG-3.1 is modified by referencing the new date July 7, 2021. SG-3.2 is corrected to indicate IAEA's Design Information Questionnaire.

SG-3.1 The licensee shall follow, as applicable, Codes 2 through 7 of Transitional Facility Attachment No. 1a dated July 7, 2021, to the U.S./ International Atomic Energy Agency Safeguards Agreement.

SG-3.2 Notwithstanding the requirements of 10 CFR 75.11(d) to submit facility data on forms supplied by the Commission (including IAEA's Design Information Questionnaire), the licensee may submit required data in the license paper format.

- License condition S-6 is being deleted as all CO₂ extraction process pressure cylinders have been decommissioned and the CO₂ extraction process is no longer in operation (ML#26173A022). A license amendment would be required for any restart of such operations in the future.
- License condition S-8 is being deleted as it is no longer necessary. The condition provided an exemption from the biennial emergency plan exercise only for calendar year 2021. Additionally, regular inspections will be performed to review requirements related to the biennial emergency plan exercise.

5.0 PRINCIPAL CONTRIBUTORS

The individuals and organizations listed below are the principal contributors to the preparation of this SER:

Logan Crevalt, NMSS
Zee St. Hilaire, NMSS
Lisa Pope, NMSS
Eli Goldfeiz, NMSS
James Hammelman, NMSS
Nicole Cortes, NMSS
Jimmy Chang, NMSS
Glenn Tuttle, NMSS
Brian Wagner, NMSS
Langston Lewis, NMSS
Bharatkumar Patel, NMSS
DaBin Gibbs, NRR
Charles Teal, NSIR
Davonte Hinton, NSIR
Yilia Vega Claudio, NMSS
Ming Li, NRR
David Rahn, NRR

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