



Minimum Margin of Subcriticality to Support Licensing Advanced Fuel Management at the Richland Site

October 2021

Framatome

Introductions

- Framatome Participants:
 - Remote Participation
- NRC Participants:
 - Remote Participation

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1. Overview of Advanced Fuel Management (AFM)

Advanced Fuel Management (AFM) Project

- As part of the continuing work under the U.S. Department of Energy Enhanced Accident Tolerant Fuel Program (EATF Award DE-NE0009034), Framatome is pursuing an increase in allowable U235 enrichment (>5.0 wt%) for the Horn Rapids Road fuel manufacturing site (HRR)
- Advanced Fuel Management (AFM) is Framatome's internal project to implement increased fuel enrichment and increased fuel burnup within the DOE eATF program
- A key initial step of the AFM project is to obtain approval for the Minimum Margin of Subcriticality for enrichments above 5.0 wt% (MMS)
 - Equipment upgrades are current critical path.
- No new technologies or processes are anticipated as a result of the effort to increase allowed enrichment.
- Regulatory approval respecting the schedule is currently viewed as the biggest project risk.

XXXXXXXX are Critical Path for AFM

2. Two-step Licensing Approach

Step 1 of Two-step Licensing Approach

- Obtain Approval for Minimum Margin of Subcriticality:
 - Complete Computer Code Validation for Enrichments above 5.0 wt%
 - The computer code validation effort will follow guidelines in NUREG/CR-6698
 - Request the following License change to be applicable for enrichments beyond 5.0 wt% U-235:

5.4.2.1 “The maximum evaluated neutron multiplication factor ~~at normal and credible abnormal conditions~~ shall not exceed ~~$k_{95/95} = 0.95$ for normal conditions or 0.97 for worst case credible abnormal conditions~~, if justified by a sensitivity analysis. The documented justification accompanying this sensitivity analysis shall clearly discuss the sufficiency of the margin of subcriticality in terms of the parameters being controlled.”

- No other changes are being requested at this time

Minimum Margin of Subcriticality

- Amendment Request expected to be submitted **in November 2021**
- Benchmark experiments from the International Handbook of Evaluated Criticality Safety Benchmark Experiments (IHECSBE) as well as benchmarks used in prior validation will be used
- Codes and Cross sections are limited to SCALE6.2/KENO-VI, ENDF/B-VII.1 continuous energy cross sections
- Area of applicability for calculation bias will include an upper limit on enrichment that will bound the future possession limit increase.

Minimum Margin of Subcriticality

- The areas of applicability for calculation bias will be established for the following broad groups within this enrichment limit:
 - Low-moisture content Low-enriched uranium (LEU) systems
 - Moderated Homogeneous LEU systems
 - Moderated heterogeneous LEU Systems
- Sensitivity based Uncertainty Methods (S/U) are used to establish the applicability of the selected benchmarks experiments to application models for each group

AFM Project Licensing Step 2 Plan

- Pre-application meeting with the NRC For Possession Limit Increase
 - At least 12 months prior to sending in application meet and discuss:
 - Project Overview
 - Project Organization Structure
 - Project Schedule/milestones
 - Licensing plans and Schedule
- License Application and Supplemental Documents:
 - At least 24 months prior to desired startup provide the following with the license amendment application:
 - Integrated Safety Analysis Summary (10CFR70.65)
 - Physical Security Plan (10CFR 73)
 - Safeguards contingency plan depending on enrichment and materials (10CFR 73)
 - Fundamental Nuclear Material Control Plan (also need to update DIQ)
 - Emergency plan

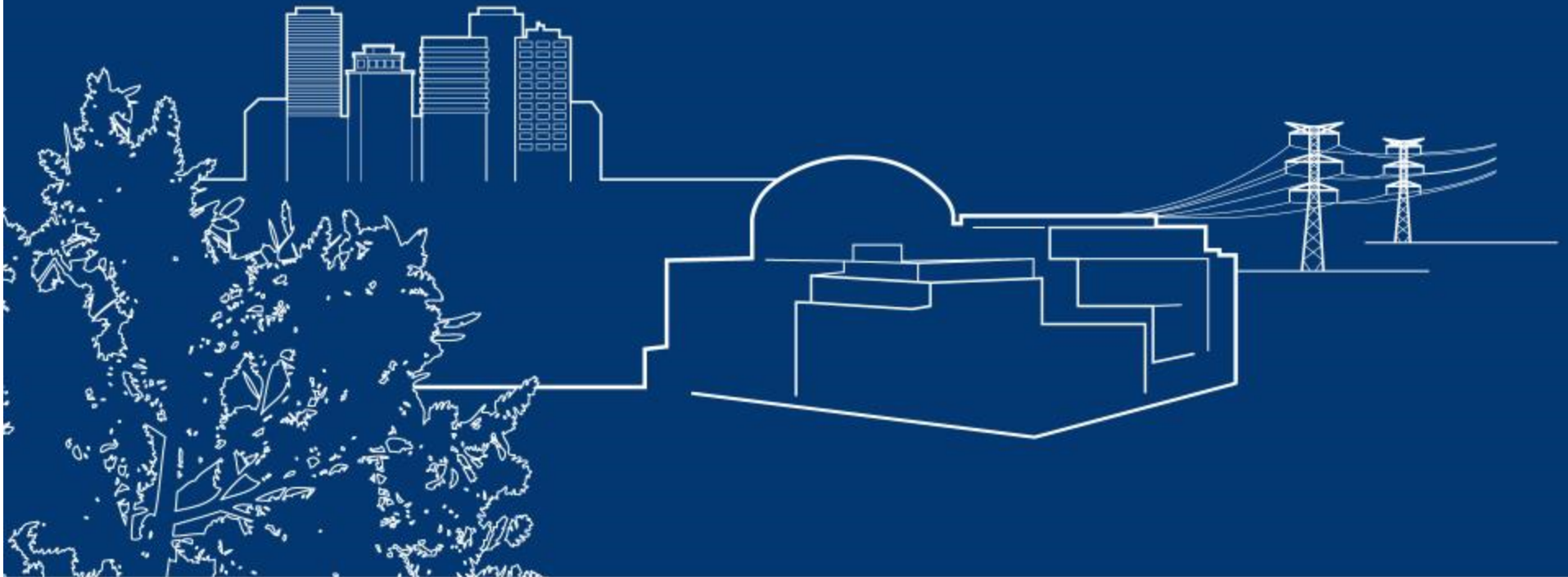
4. Wrap-up

Wrap-up

- Any final questions or comments from the NRC?
- Any final questions or comments from the Framatome team?
- Review action items if any

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Thank You!



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Acknowledgement

This material is based upon work supported by the Department of Energy under Award number DE-NE-0009034, DE-NE0008818 and previously DE-NE0008220.

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Step 2 of Two-step Licensing Approach

- Next Framatome Actions:
 - Complete safety analyses based on the allowed MMSC
 - Establish Safety controls based on these analyses
 - No new technologies or processes are anticipated as a result of this effort

AFM Project Scope Step Two

- Evaluate each of the plant process equipment systems to determine the modifications required to support above 5.0 wt% U-235 enrichment.
 - Determine impacts of modifications during production and communicate
 - Determine recurring impacts/costs resulting from the plant modifications
 - Identify cost/schedule/manpower to implement
 - Proactively evaluate non-AFM changes during the design phase are evaluated against the AFM future state
- Perform Detailed Design
- Perform all Integrated Safety Analyses (ISAs) to support plant NRC license change
- Perform required plant modifications
 - Test and qualify plant modifications
- Obtain NRC approved update to plant license

Step 2 of Two Step Licensing Approach

- Request Possession Limit Change in enrichment

Framatome Inc.	License Number: SNM-1227, Amendment 15
2101 Horn Rapids Road	Expiration Date: April 24, 2049
Richland, WA 99354-0130	Docket Number: 70-1257

1. Byproduct, Source, and/or Special Nuclear Material	2. Chemical and/or Physical Form	3. Maximum Amount that Licensee May Possess At Any One Time
A. Uranium enriched in U-235 to any enrichment	A. Any	A. 350 g U-235
B. Uranium enriched up to 5.00 wt. % U-235	B. Uranium Compounds	B. See Sensitive Conditions

Step 2 of Two Step Licensing Approach

- The Possession Limit Change in enrichment to X.Y wt% U-235 will also include a request for the following change:
- 5.4.2.8 “Designs shall assume 235U enrichment of X.Y wt.% unless at least one of the following criticality safety controls on enrichment is established:
 - Active engineered controls are established to verify enrichment and to prevent the introduction of uranium at unacceptable enrichment levels within the process system.
 - Administrative controls are established to prevent the introduction of unacceptable enrichments within a defined subsystem within the same area. Considerations shall include minimizing human error such as using physical separation of areas of differing enrichment limits when practical.

Step 2 of Two Step Licensing Approach

- All needed changes to the following will be included with this amendment request:
 - Integrated Safety Analysis Summary (10 CFR 70.65)
 - Physical Security Plan (10 CFR 73)
 - Safeguards contingency plan depending on enrichment and materials (10 CFR 73)
 - Fundamental Nuclear Material Control Plan
 - The DIQ will also be updated
 - Emergency plan

Step 2 of Two Step Licensing Approach

- UF6 cylinder design and licensing could be challenging.
 - Time required for the NRC license review may require the equipment design to be completed sooner than initially planned
 - Concerned NRC will not meet the 2026 date for issuing an updated license

Current Status – Technical Basis and Design Criteria

- Task: Create a technical basis and design criteria document which includes the following information for each sub-task. (Note: This document defines the problem to be solved and how it will be accomplished during the design process)
 - What technologies will be used. (R&D, Best Practices, Industrial Standards, etc.)
 - General background and working environment. (radiological, industrial, cleanliness, utility requirements, etc.)
 - Special Requirements. (product requirements, throughput rates, equipment availability, etc.)
 - Equipment acceptance requirements
- Status: Draft input was completed for each sub-task. The final consolidated document will be issued early next year.

Project Assumptions

- Key Assumptions relative to Licensing
 - Design, procurement, installation, testing and licensing activities will occur in parallel
 - All processes within the UO2 building will be upgraded to support the 6.5% enrichment
 - All modifications will be completed, tested and qualified prior to introduction of >5% material
 - All licenses will be approved prior to introduction of >5% material
 - Waste disposal paths will remain unchanged

Activities Underway – Preliminary Design

- Initial ISA/PHA/IROFS Review Safety Meetings- Slightly behind
 - Systematic preliminary review of all impacted safety documents with team
 - Review assumptions made in draft IA (investment authorization)
 - To maintain capacity, buckets will likely require replacement
- Risk Assessment and Risk Mitigation Plan- Currently underway
 - Using Framatome standard methodology
 - Meetings have begun- Preliminary list of project risks created. Sub-task risk lists being developed
 - Multiple meetings already held with Richland Site Management to ensure risk are identified and mitigated
 - Regulatory approval respecting the schedule is currently the biggest risk
- Detailed WBS Task List- Progressing well
 - Detailed WBS for each sub-task currently being created.
 - Will be used to create an overall implementation resources loaded WBS for the entire project
 - Consolidation has begun

Other Licenses Potentially Impacted by This Project

- WDOH Licenses
 - Radioactive Air Emissions License (RAEL)
 - APQ (by isotope) for each area serviced by an exhaust stack
 - BACT Analysis if a new or modified stack license is needed
 - Radioactive Materials License (RML)
 - No change to this license is anticipated
- BCAA Permit
 - No change to this permit is anticipated
- City of Richland (COR) Wastewater Discharge Permit
 - No change to this permit is anticipated
- IAEA DIQ
 - A change to the DIQ will be required