January 06, 2005

MEMORANDUM TO: Michael Markley, Acting Chief
Fuel Manufacturing Section
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
and Safeguards

FROM: Robert Lukes, Project Manager /RA/
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

SUBJECT: SUPPLEMENT TO ADAMS DOCUMENT ML043550014
DECEMBER 7, 2004, MEETING WITH FRAMATOME ANP, INC.
LYNCHBURG TO DISCUSS UPPER SUBCRITICAL LIMIT
METHODOLOGY

On December 7, 2004, a meeting was held with Framatome Lynchburg to discuss upper subcritical limit (USL) methodology. A brief meeting summary was entered into ADAMS on December 16, 2004, (ML043550014). The purpose of this meeting summary supplement is to provide a more detailed description of the meeting and of the discussion topics that were addressed at that meeting.

Attachment 1: Detailed description of meeting discussion topics
Attachment 2: Framatome Lynchburg discussion notes
Attachment 3: Meeting Participants

Docket No.: 70-1201
License No.: SNM-1168

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Docket: 70-1201
SNM-1168

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Docket 70-1201 FCFB r/f MGalloway CTripp

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DATE	01/ 05/05		01/05 /05		01/06 /05	

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Detailed Meeting Summary 12/7/2004
Framatome Lynchburg

NRC staff began the meeting by stating that it considers the margin of subcriticality for safety to be an essential part of the safety basis of a facility. Lack of an adequate margin of subcriticality creates the risk that processes calculated to be subcritical will in fact be critical. While there have been no criticality accidents caused by miscalculating k_{eff}, the risk that this could occur in the future increases as new processes and material are evaluated and as licensees seek to reduce margins of subcriticality. The staff also stated that it had taken a risk-informed approach to the issue in the draft ISG-10, which addresses many of the issues encountered during the FANP-Lynchburg review. In such a risk-informed approach, a smaller margin of subcriticality requires a more substantial technical justification, and warrants additional scrutiny of licensees' validation efforts. This could result in technical concerns that were previously not considered safety-significant with larger margins being more significant with smaller margins. The staff pointed out that the section of ISG-10 entitled "Rigor of Validation Methodology" would address many of the technical issues raised as Requests for Additional Information (RAIs) during the amendment review. These issues include extrapolation beyond the range covered by the benchmark data, non-normality of the data, the use of pooled bias in the presence of discrete clusters of benchmarks, and the discarding of outliers without a strong technical basis. The staff mentioned that selection of an adequate margin of subcriticality for safety was very much process and facility-dependent and therefore could not be justified based solely on general programmatic commitments.

The staff then summarized the five main criteria discussed in ISG-10 as possible justifications for the margin of subcriticality for safety. These are:(1) benchmark similarity, (2) system k_{eff} sensitivity, (3) knowledge of the neutron physics of the system, (4) rigor of the validation methodology, and (5) margin in system parameters.

FANP then gave a brief presentation on its previous license amendment request and proposed approach for a future amendment request. FANP acknowledged that its previous amendment request lacked technical clarity that did not adequately address the NRC's RAIs. FANP stated that it planned to use technical information in NUREG/CR-6698 to respond to NRC's previously identified issues and that it had not planned to use the draft ISG-10. The NRC staff stated that many of these issues were specifically addressed in draft ISG-10. FANP stated that the proposed margin of subcriticality of 0.02 was applicable only to well-defined heterogeneous systems. The NRC asked whether this applied to pellets, rods, and fuel assemblies, or only to finished fuel assemblies. FANP clarified that this meant pellets, rods, and assemblies. The NRC staff then noted that the benchmarks consisted of finished assemblies and that flooded arrays of pellets and rods may have different moderation (H/X) conditions and thus different neutron spectra, and may not be within the benchmarks' defined area of applicability (AOA).

FANP stated that the bounding plant k_{eff}, including uncertainties, was only 0.9624, and that this applied to a single fully-flooded and water-reflected fuel assembly. In response to an NRC question, FANP stated that the flooded pellet and rod calculations had much lower k_{eff}. FANP then described several types of calculational conservatism that it stated amounted to a margin in k_{eff} of approximately 3%, including:(1) use of full theoretical density for pellets, (2) use of the maximum allowed enrichment of 5.1wt% ^{235}U (as opposed to 4.98wt% ^{235}U), (3) neglecting the materials of construction, (4) neglecting chamfering in modeling pellet geometry, and (5) neglecting internal absorbers, such as boron and gadolinium. The NRC stated that the use of

such calculational degrees of margin in k_{eff} was one of the criteria discussed in draft ISG-10. However, crediting such margin required that the margin be shown to be consistently and reliably present in all facility calculations. The staff noted that a technical justification that was process-dependent could not be used to justify plant-wide margins of subcriticality. The staff further reiterated that draft ISG-10 contained guidance that addressed many of the previously identified RAIs and the use of conservatism in k_{eff} to justify the margin of subcriticality for safety. These issues would need to be addressed in any future licensing submittal.

FANP stated that it anticipated submitting a new license amendment request by the end of January 2005 and that to support current production schedules, it would need to know how the staff's evaluation was proceeding by mid-April 2005.

Framatome Lynchburg discussion notes

Request for Increased keff Limit for SNM-1168

- Previous submittal lacked technical clarity
- Use of NUREG/CR-6698 to prepare responses to previous RAIs
- Use 0.02 Safety Margin for well defined heterogeneous systems
- Example USL calculation: Abnormal Condition
  - USL = $(1 + \text{Bias} - \sigma_{\text{Bias}}) - \Delta_{SM} - \Delta_{AOA}$
  - USL = (0.986) -0.02-0.00
  - USL = 0.966
- Bounding plant condition (keff + 2σ) = 0.9624
- Conservatism in modeling
  - Use of 100% TD for pellets
  - Use of maximum enrichment vs. fuel assembly average
  - No credit for materials of construction
  - No dish/chamfer subtraction for pellets
  - No credit for internal absorbing materials
- Schedule for submittal/evaluation

(NRC Meeting notes 12-7-2004)

Attachment 2

LIST OF ATTENDEES
UPPER SUBCRITICAL LIMIT DISCUSSION
FRAMATOME ANP, INC. LYNCHBURG
DECEMBER 7, 2004

Attendees	**Affiliation**
Robert Lukes	U.S. Nuclear Regulatory Commission (NRC)
Gary Janosko	NRC
Christopher Tripp	NRC
Julie Olivier	NRC
Melanie Galloway	NRC
Merritt Baker	NRC
Kim Hammer	NRC
Charlie Holman	Framatome ANP
Brandon O'Donnell	Framatome ANP
Richard Montgomery	Framatome ANP
Bob Link	Framatome ANP
John Nagy	NFS
Steve Toelle	USEC

MEMBERS OF THE PUBLIC

Attendees

None

Attachment 3