URENCO

MAY 12 2010

LES-10-00095-NRC

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

Louisiana Energy Services, LLC
NRC Docket Number: 70-3103

Subject: Reply to Notice of Violation 70-3103/2010-006-Part 2

Reference:
1) Letter from Deborah A. Seymour (NRC) to Gregory Smith (LES), NRC Inspection Report No. 70-3103/2010-006 and Notice of Violation, dated May 3, 2010.
2) Letter from LES to NRC, LES-10-00091-NRC, Reply to Notice of Violation 70-3103/2010-006, dated May 10, 2010.

In response to the NRC's Notice of Violation (NOV) (Ref. 1), URENCO USA (UUSA) herewith provides the enclosed (Part 2) reply to Violations A and B, which relate to nuclear criticality safety issues (see Enclosure). UUSA's (Part 1) reply to Violations C, D and E, which relate to Commercial Grade Dedication (CGD) issues, was previously submitted under separate cover (Ref. 2).

In the Enclosure UUSA addresses for Violation A: a) the reason for the respective violations; b) corrective steps that have been taken and the results achieved; c) corrective steps that will be taken to avoid further violations; and d) the date when full compliance will be achieved. However, UUSA is contesting Violation B, the basis for which is also provided in the Enclosure.

Should there be any questions regarding this submittal, please contact Gary Sanford, Director of Quality and Regulatory Affairs, at 505.394.5407.

Sincerely,

Stephen Cowne

Stephen Cowne for
David E. Sexton
Chief Nuclear Officer and Vice President of Operations

Enclosure: Reply to Notice of Violation 70-3103/2010-006 - Part 2

IE07

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ENCLOSURE

Louisiana Energy Services/National Enrichment Facility (LES/NEF)

REPLY TO NOTICE OF VIOLATION (NOV) 70-3103/2010-006 – PART 2

Restatement of Violation A:

During Nuclear Regulatory Commission (NRC) inspections conducted from February 1, 2010 – April 1, 2010, violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

A. Special Nuclear Material (SNM) License Number (No.) 2010 requires, in part, that the licensee shall conduct authorized activities at the Louisiana Energy Services, L.L.C., National Enrichment Facility (LES NEF) in accordance with statements, representations, and conditions, or as revised in accordance with the Safety Analysis Report (SAR) dated December 12, 2003, and supplements thereto.

Section 5.1.1 of the SAR states, in part, that the nuclear criticality safety analyses are performed assuming a uranium-235 (^{235}U) enrichment of 6.0 weight percent ($^{w}/_{o}$), except for Contingency Dump System traps which are analyzed assuming a ^{235}U enrichment of 1.5 $^{w}/_{o}$.

Contrary to the above, as of February 25, 2010, the licensee failed to perform analyses assuming a ^{235}U enrichment of 6.0 $^{w}/_{o}$ for systems other than Contingency Dump System traps. Specifically, in all or part of analyses and calculations, ETC4104887, ETC4107395, ETC4100854, NCS-CSA-011, and NCS-CSE-014, ^{235}U enrichment of 1.5 $^{w}/_{o}$ was used for systems other than the Contingency Dump System including the Tails Take-off System.

This is a Severity Level IV Violation (Supplement VI).

The Reason for Violation A:

Criticality analyses for the Tails Take-Off System and Contingency Dump System use an enrichment of 1.5 w/o contrary to the SAR Section 5.1.1 which states an enrichment of 1.5 w/o is used only for the Contingency Dump System traps.

The inconsistency in the analyses was due to unnecessarily limiting the SAR discussion on use of an enrichment of 1.5 w/o to only the Contingency Dump System (CDS) NaF traps. The 1.5% enrichment represents an upper mean enrichment in a mixed process stream containing feed, product and tails. This enrichment was actually intended to be applicable to any system with a mixed process stream such as the CDS and any process associated with a cascade dump (e.g., dump to a tails cylinder).

The preparer, reviewer and approver of criticality analyses for the Tails Take-Off System and Contingency Dump System all should have identified and corrected the inconsistency between the enrichment used in the criticality analyses and the statements in Safety Analysis Report (SAR) Section 5.1.1. User aids in Procedure EG-3-3200-02 were too generic to help prevent the inappropriate action.

Corrective Steps Taken and Results Achieved for Violation A:

To correct the inconsistency, CC-LS-2010-0012 was initiated to revise the SAR to clearly distinguish between systems bounded by criticality analyses performed at 6 w/o enrichment and systems bounded by analyses performed at 1.5 w/o enrichment. Completed 3/30/2010

The following criticality analyses and the evaluation cited in NRC Inspection Report No. 70-3103/2010-006 were all completed prior to the NRC inspection, with exception of analysis ETC4100854-4, for the systems or processes associated with a cascade dump, using 1.5% enrichment:

- ETC4104887-1, *Criticality Safety of an Assay Dump to a Single Tails Cylinder*, 9/30/2009.
- ETC4107395-2, *Criticality Safety Analysis of NEF Assay Unit 1001 Process Gas Pipe Work*, 1/21/2010.
- ETC4100854-4, *Criticality Safety Analysis of the Contingency Dump System*, 4/23/2010.
- NCS-CSA-011-00, *NCSA to Increase Tolerances for the Cascade Valve Frame for Field Verification*, 11/20/2009.
- NCS-CSE-014-00, *Evaluation of ETC4104887, NQA-1 Criticality Safety of Assay Dump to a Tails Cylinder*, 10/20/2009.

Corrective Steps That Will Be Taken To Prevent Further Violation A's:

Create guidance summarizing SAR commitments related to criticality safety analysis, including enrichment. Revise the parameter guidance in Attachment 1, Section 4 of Procedure EG-3-3200-02 regarding enrichment and/or the peer reviewer instructions in Attachment 2 to more specifically correspond to SAR requirements. CR 2010-0694, Due Date: May 26, 2010.

The Date When Full Compliance Will Be Achieved for Violation A:

With completion of CC-LS-2010-0012 compliance was achieved on March 30, 2010.

Restatement of Violation B:

10 CFR 70.72(c) states, in part, that the licensee may make changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel, without prior Commission approval, unless the change as stated in 10 CFR 70.72(c)(4), is otherwise prohibited by this section, license condition, or order.

10 CFR 70.61(d) states, in part, that the risk of nuclear criticality accidents must be limited by assuring that, under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety.

NRC approved the margin of subcriticality for safety, as documented in the licensee's SAR, Revision 6, with the issuance of SNM-2010.

Contrary to the above, as of April 1, 2010, the licensee made changes to the approved margin of subcriticality for safety without prior NRC approval when implementing the following changes to the SAR:

1. SAR Table 5.1-1, Safe Values for Uniform Aqueous Solutions of Enriched UO_2F_2, was changed to increase dimensions of process components after the licensee identified an error when calculating the safe values in the table.

2. SAR Section 5.1.1, Management of the Nuclear Criticality Safety Program, stated in part, that the nuclear criticality safety analyses are performed assuming a ^{235}U enrichment of 6.0 $^{w}/_{o}$, except for Contingency Dump System traps which are analyzed assuming a ^{235}U enrichment of 1.5 $^{w}/_{o}$. The licensee revised this section to expand the analyses that were performed at 1.5 $^{w}/_{o}$ to include the entire Dump System. The Dump System includes the Tails Take-Off System and the Contingency Dump System.

3. SAR Section 5.1.2, Control Methods for Prevention of Criticality, stated that NEF does not use neutron absorbers as a criticality control parameter. The licensee made a change to the SAR to take credit for neutron absorbers in standard materials used in construction and processes.

4. SAR Section 5.2.1.3.4, Vessel Movement Assumption, stated in part that any item in movement must be maintained at 60 centimeters (23.6 inch) edge separation from any other enriched uranium and only one item of each type of vessel may be in movement at one time. This section was changed to state that limits were placed on movement of vessels by procedures or work plans that varied by the type of vessel. For some vessels, the separation distance was reduced from 60 centimeters.

This is a Severity Level IV Violation (Supplement VI).

Response to Violation B

URENCO USA (UUSA) respectfully contests this violation and supports our position with the arguments summarized below:

- The margin of subcriticality for safety at UUSA required by the NRC is the administrative margin of 0.05 used in determining the upper safety (or subcritical) limit, USL. The USL values remain unchanged at 0.9401 for the systems associated with cascade dump, and 0.9415 for other facility systems. These values are documented in the NRC-approved MONK 8A Validation and Verification report and Safety Analysis Report (SAR), Section 5.2.1.2. The SAR sections quoted in this response are taken from Revision 25.

- The NRC-approved criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$ (SAR, Section 5.2.1.2) has not been changed. This criterion is based on $k_{eff} = k_{calc} + 2\sigma_{calc} <$ USL (0.9401 or 0.9415), where to be equivalent USL + σ_{calc} is taken as 0.95. The USL includes an approved administrative margin of 0.05.

- The adequate margin of subcriticality for safety is cited in Safety Analysis Report (SAR), Section 5.2.1.2 and Safety Evaluation Report, NUREG-1827, Section 5.3.6.3 as 0.05 (i.e., $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$). This margin has not been changed.

- The SAR (Section 5.2.1.5) and SER (NUREG-1827, Section 5.3.6.1) clearly state that "If administrative k_{eff} margins for normal and credible abnormal conditions are used, NRC pre-approval of the administrative margins will be sought." This pre-approval requirement is consistent with NUREG-1520, Section 5.4.3.4.4(4) which states: "If the applicant intends to use administrative k_{eff} margins for normal and credible abnormal conditions, the applicant commits to NRC pre-approval of the administrative margins."

- "Significant margin" is maintained for safe-by-design (SBD) components and is compliant with the definition in SAR (Section 3.2.5.2), ISA Summary (Section 3.1.1.5.2) and NUREG-1827 (Section 3.3.3.2.2.2).

- Materials License SNM-2010, Amendment 32 incorporates the SAR dated March 31, 2010 into License Condition No. 10 by reference. The referenced SAR contains the changes cited in the specific examples of this violation. The changes have been implemented consistently using Procedure LS-3-1000-04 as noted in Section 3.a(1) of the NRC Inspection Report 70-3103/2010-006. UUSA is currently compliant with this License Condition that pertains to nuclear criticality safety.

Detailed explanation providing the basis for denial follows.

Definitions

The NRC interim staff guidance document FCSS ISG-10 provides the following definitions:

> **margin of safety**: the difference between the actual value of a parameter and the value of the parameter at which the system is expected to be critical with critical defined as k_{eff} = 1 - bias - bias uncertainty.

margin of subcriticality (MoS): the difference between the actual value of k_{eff} and the value of k_{eff} at which the system is expected to be critical with critical defined as k_{eff} = 1 - bias - bias uncertainty

minimum margin of subcriticality (MMS): a minimum allowed margin of subcriticality, which is an allowance for any unknown uncertainties in calculating k_{eff}

upper subcritical limit (USL): the maximum allowed value of k_{eff} (including uncertainty in k_{eff}), under both normal and credible abnormal conditions, including allowance for the bias, the bias uncertainty, and a minimum margin of subcriticality

In addition, "Significant Margin" is used in the SAR (Section 3.2.5.2), ISA Summary (Section 3.1.1.5.2) and NUREG-1827 (Section 3.3.3.2.2.2), and defined for SBD components as follows:

- SBD Favorable Geometry Components – A margin of at least 10%, during both normal and upset conditions, between the actual design parameter value of the component and the value of the corresponding critical design attribute (k_{eff} = 1.0). [Note - The minimum 10% margin means that the ratio of the actual design parameter value (diameter, slab thickness and volume) of the component to the corresponding critical value is 0.90 or less. In no case does the actual design parameter value exceed the safe value (k_{eff} = 0.95). Both k_{eff} for the critical and safe values include $3\sigma_{calc}$.]

- SBD Non-Favorable Geometry Components – $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$

Regulatory Requirement and Guidance

10 CFR 70.61(d) states, in part, that the risk of nuclear criticality accidents must be limited by assuring that, under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety. This requirement consists of two parts: subcriticality of operations and margin of subcriticality.

Section 5.4.3.4.4 of NUREG-1520 provides regulatory guidance on the acceptance criteria for meeting the requirements in 10 CFR 70.61(d). The criteria include a number of programmatic commitments. The only commitment that relates to NRC pre-approval is the use of administrative k_{eff} margins as stated below:

> "If the applicant intends to use administrative k_{eff} margins for normal and credible abnormal conditions, the applicant commits to NRC pre-approval of the administrative margins."

The administrative margin is variously referred to as the MMS in ISG-10, and as arbitrary margin in ANSI/ANS-8.17. The term "administrative margin" is used in this response for consistency with the usage in the SAR, NUREG-1520 and the NRC NEF SER (NUREG-1827). As stated in ISG-10, the administrative margin (or MMS) is an allowance for any unknown (or difficult to identify or quantify) errors or uncertainties in the method of calculating k_{eff} that may exist beyond those which have been accounted for explicitly in calculating the bias and its uncertainty.

NRC Safety Evaluation Report on Nuclear Criticality Safety

NUREG-1827 states the following:

- Section 5.3.6.1 (p. 5-21) – "If administrative k_{eff} margins for normal and credible abnormal conditions are used, then NRC pre-approval of the administrative margins will be sought;"

- Section 5.3.6.3 (p. 5-29) – "Requested NRC pre-approval of administrative k_{eff} margins for normal and credible abnormal conditions;"

The above second statement is repeated in the revised SAR Sections 5.3.6.3 and 5.5 (Louisiana Energy Services Gas Centrifuge Uranium Enrichment Facility) dated March 3, 2006.

The pre-approval requirement for administrative margins is consistent with NUREG-1520 and the following statement in Section 5.2.1.5 of the SAR:

> "If administrative k_{eff} margins for normal and credible abnormal conditions are used, NRC pre-approval of the administrative margins will be sought."

Use of Administrative Margin at UUSA

Section 5.2.1.2 of the SAR, Chapter 5.0 and the revised NRC SER Section 5.3.6.3 provide the basis for the k_{eff} equation (i.e., $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$) used at the facility. k_{calc} represents the neutron multiplication factor as calculated by the computer code (MONK 8A) and σ_{calc} is the standard deviation of the calculated results. The validation process (MONK 8A Validation and Verification report) established a bias by comparing calculations to measured critical experiments. With the bias determined, an upper safety (or subcritical) limit (USL) was determined by using the following equation from NUREG/CR-6698:

$$USL = 1.0 + Bias - \sigma_{Bias} - \Delta_{SM} - \Delta_{AOA}$$

where σ_{Bias} is the standard deviation of the bias, Δ_{SM} is the administrative subcriticality margin, and Δ_{AOA} is the additional margin to account for extrapolating outside the area of applicability (AOA).

NUREG/CR-6698 indicates that, for normal and credible abnormal conditions, the generally acceptable k_{eff} equation should be $k_{eff} = k_{calc} + 2\sigma_{calc} < USL$. However, the NRC approved the use of the k_{eff} equation of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$ for the entire facility by taking $USL + \sigma_{calc} = 0.95$. The USL and k_{eff} equation include an approved administrative margin of 0.05 as the minimum margin of subcriticality, based on very low risk considerations for low-enriched uranium enrichment facilities.

Adequacy of Margin of Subcriticality

Based on ANSI/ANS-8.17-2004, *Criticality Safety Criteria for the Handling, Storage and Transportation of LWR Fuel Outside Reactors*, ISG-10 provides a mathematical expression of the margin of subcriticality (MoS) as:

$$MoS = USL + \Delta k_m - k_s + \Delta k_{sa} - \Delta k_s \text{ (ISG-10, Appendix A, p. 40)}$$

where Δk_m is the MMS (or administrative margin), k_s is the calculated k_{eff} corresponding to the application, Δk_s is its uncertainty, and Δk_{sa} is the margin or change in k_{eff} due to conservative modeling of the system (i.e., conservative values of system parameters).

Since $k_s + \Delta k_s < USL$ (note that $k_s + \Delta k_s$ is equivalent to k_{eff} used in this response), the minimum value of the MoS is:

$MoS \geq \Delta k_m + \Delta k_{sa}$ (ISG-10, Appendix A, p. 40)

The above MoS is consistent with the statement made in NRC Inspection Report No. 70-3103/2010-006 (p. 4).

ISG-10 states that "Assurance of subcriticality may thus be provided by specifying a margin in k_{eff} (Δk_m), or specifying conservative modeling practices (Δk_{sa}), or some combination thereof." This statement provides the guidance on the adequacy of the MoS.

For processes to be adequately subcritical, UUSA maintains and uses a single k_{eff} limit and the approved administrative margin of 0.05 for the entire facility rather than a process-dependent approach. This generic application is adequate and acceptable by specifying a margin in k_{eff} (Δk_m) per ISG-10 statement cited above. This margin requires and indeed, received NRC approval (MONK 8A Validation and Verification report, and revised SER Section 5.3.6.3 dated March 3, 2006).

The additional margin with Δk_{sa} for conservative modeling does not require NRC pre-approval, as incorporation of conservative values of system parameters into the model will increase k_{eff} and offset the change in k_{eff}. Conservative modeling has been included in the various criticality analyses performed at and for UUSA as part of the programmatic commitments. In all cases, the criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$ is always maintained. This margin is in line with the following statements from SAR, Section 5.2.1.2:

> "Therefore, due to the low risk of accidental criticality associated with NEF operations and the margin that exists in the design and operation of the NEF with respect to nuclear criticality safety, a margin of subcriticality for safety of 0.05 (i.e., $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$) is adequate to ensure subcriticality is maintained under normal and abnormal credible conditions. As such, the NEF will be designed using the equation:
>
> $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$"

Accordingly, the margin of subcriticality for safety at UUSA is 0.05, which is adequate to ensure subcriticality. This margin has not been changed.

Specific NOV Citations

1. SAR Table 5.1-1, Safe Values for Uniform Aqueous Solutions of Enriched UO_2F_2

   UUSA identified a technical error in the calculation of the UO_2F_2/water mixture density in 2007 as documented in Condition Report CR 2007-0221. The error was associated with the use of the empirical constants in the Johnson and Krause method, resulting in an over-estimate in the densities. The corrected densities are lower with the same method.

   To resolve CR 2007-0221, UUSA performed a comprehensive study to determine a suitable, conservative and authoritative method for calculations of the UO_2F_2/water mixture densities. The study included the following four methods available:

- Johnson & Krause (Journal of the American Chemical Society, V. 75 [p. 4594], 1953)
- Jordan & Turner (ORNL/TM-12292, 1992)
- Garner et al (DEG Report 352, 1961)
- Leclaire & Evo (IRSN Paper, 2007)

The focus was placed mainly on the first two methods, as the first method was the basis used in the original calculation for the license application, and the second method is a newer approach available in an Oak Ridge National Laboratory (ORNL) report that has been used in other uranium enrichment facilities for criticality analyses. The third (from the 1961 British report) and fourth methods (un-reviewed French paper) were evaluated for comparison purpose.

Table 1 provides the results of the study, along with the original densities used for various H/U ratios.

Table 1 Comparison of UO_2F_2/Water Mixture Densities at 6% Enrichment

H/U	$UO_2F_2 \cdot xH_2O$ Density (g/cm^3)				
	Original (erroneous)[a] Johnson and Kraus	**Corrected**[b] Johnson and Kraus	**Jordan and Turner**[b]	**Garner, et al**[b]	**Leclaire and Evo**[b]
1	N/A	5.894915	6.181085	NA	5.912591
2	N/A	5.229961	5.918394	NA	5.529356
3	N/A	4.723909	5.631467	NA	5.209836
4	N/A	4.325888	4.760000	4.760000	4.756468
5	N/A	4.004644	4.342312	4.330457	4.327080
6	N/A	3.739921	4.008109	3.988455	3.985224
7	3.771289	3.518011	3.734637	3.709707	3.706610
8	3.569753	3.329306	3.506719	3.478150	3.475175
9	3.388665	3.166875	3.313849	3.282736	3.279871
10	3.225062	3.025589	3.148519	3.115614	3.112850
11	3.076528	2.901572	3.005225	2.971056	2.968382
12	2.941074	2.791841	2.879835	2.844781	2.842188
13	2.817045	2.694063	2.769191	2.733526	2.731008
14	2.703053	2.606386	2.670837	2.634762	2.632312
15	2.597928	2.527322	2.582833	2.546498	2.544110
16	2.500674	2.455663	2.503626	2.467143	2.464812
17	N/A	2.390414	2.431961	2.395413	2.393135
18	2.331285	2.330753	2.366809	NA	2.328030
19	2.276507	2.275991	2.307321	NA	NA
20	2.226051	2.225549	2.252788	NA	NA

a. Table 5-1, AREVA 32-9035369-000, *NEF Criticality Assessment under Flooded Conditions*, September 2007.
b. Table 8, LES-M-0002-0, *Density of Uranyl Fluoride Calculation*, December 2007.

The original densities from the Johnson & Krause method were erroneously over-estimated. The corrected densities are lower, but non-conservative compared to the other three methods. URENCO USA selected the ORNL Jordan & Turner method as the preferred method to provide conservatism in the UO_2F_2/water mixture density.

The safe values provided in SAR Table 5.1-1 are based on the conservative UO_2F_2/water mixture densities determined by the Jordan & Turner method. Further, the safe values were calculated, using the criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$, which includes the approved administrative margin of 0.05. All the safe values in SAR Table 5.1-1 meet the "significant margin" requirement with a margin of at least 10% between the actual design parameter value of the component and the value of the corresponding critical design attribute, as the actual design parameter values for SBD favorable-geometry components are required to be no greater than the safe values.

UUSA implemented the change to SAR Table 5.1-1 under its own authority through the configuration change process (CC-EG-2010-0021) which included a 10 CFR 70.72(c) evaluation. Such change was considered acceptable for the following reasons:

- The change in the safe values reflected a necessary correction to the technical error identified in CR 2007-0221 through the Corrective Action Program.
- The most conservative method was used to calculate the UO_2F_2/water mixture density.
- No change was made to the criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$, which includes the approved administrative margin of 0.05 for deriving the safe values.
- No change was made to the USL determined in the MONK 8A Validation and Verification report where USL was based on the approved administrative margin of 0.05.
- A margin of at least 10% is maintained between the safe and critical values which include $3\sigma_{calc}$ in k_{eff} to meet the "Significant Margin" requirements for the physical parameters.

2. <u>SAR Section 5.1.1, Management of the NCS Program (1.5% vs. 6% enrichment)</u>

The 1.5% enrichment represents an upper mean enrichment in a mixed process stream containing feed, product and tails. This enrichment was actually intended to be applicable to any system with a mixed process stream such as the Contingency Dump System (CDS) and any process associated with a cascade dump (e.g., dump to a tails cylinder). The original statement in SAR Section 5.1.1 was inappropriate, and necessitated a change to this section for clarify.

The clarification made to SAR Section 5.1.1 did not change the criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$, which is applicable to both cascade dump at 1.5% enrichment and other facility systems at 6% enrichment. Granted that the use of 6% enrichment would be considerably more conservative than 1.5%, however, the intent was to use 1.5% enrichment for any system or process associated with cascade dump. The intended use of 1.5% enrichment besides the CDS NaF traps is evident in Document UPD 0202631B, *Criticality Safety Evaluation of Evacuating an Assay Unit into a Single Tails Cylinder*, dated December 5, 2002, which was a supporting document for License Application.

Applying 6% enrichment to the systems or processes associated with a cascade dump would be unnecessarily conservative. If the 6% enrichment were used, the criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$ would not be met for these systems or processes. Design changes and/or additional criticality safety requirements would be necessary to ensure subcriticality (i.e., $k_{eff} < 0.95$). However, the subcriticality requirements would remain unchanged, and the margin of subcriticality of 0.05 would still have to be satisfied.

3. <u>SAR Section 5.1.2, Control Methods for Prevention of Criticality (neutron absorbers)</u>

In SAR Section 5.1.2, UUSA expanded the definition of "neutron absorber" for alignment with ANSI/ANS-8.14-2004, *use of soluble neutron absorbers in nuclear facilities outside reactors*, and ANSI/ANS-8.21-1995, *use of fixed neutron absorbers in nuclear facilities outside reactor*. These ANSI/ANS standards define "neutron absorber" as:

> A neutron-capture material (as applied in nuclear criticality safety, absorption implies nonfission absorption that is capture.)

With this definition, structural or construction material such as steel for the Roots pumps and chemical traps with credit taken in criticality analyses was treated as a neutron absorber, since such credit resulted in a decrease in k_{eff}. This usage is much broader than the traditional term "neutron poisons" which are commonly referred to as materials with significantly high neutron absorption cross sections (e.g., boron and cadmium) specifically and solely provided for criticality control.

The credit for structural or construction material as a neutron absorber at UUSA is not intended to imply that such material is required to provide the criticality safety function. Rather, its continuous presence and effectiveness is necessary to maintain plant operations, and the credit is simply to include its intrinsic property with respect to neutron absorption. Such treatment is no different from other materials such as uranyl fluoride, water and concrete, and consistent with ANSI/ANS-8.1, Section 4.2.3 on Geometry Control which allows the following:

> "Full advantage may be taken of any nuclear characteristics of the process materials and equipment."

Inclusion of the credit for neutron absorbers in standard materials in criticality analyses will tend to reduce k_{eff} relative to the analyses without such credit, unless the material also provides neutron fission, moderation or reflection. However, the analyses still use the criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$, which includes the approved administrative margin of 0.05. The credit for neutron absorbers represents a change in conservative modeling of the system, which can be implemented through the licensee's configuration change process because of no change in the USL and k_{eff} equation. Further, the material and its thickness credited in the criticality analyses have been verified through a QL-1 receipt inspection process as part of the SBD attributes.

4. <u>SAR Section 5.2.1.3.4, Vessel Movement Assumption</u>

The SAR requirements to maintain 60 cm spacing between an item in movement and other enriched uranium proved to be impractical and unnecessary. It is impractical because separation between installed components is less than 60 cm in some cases. Such components could never be moved without a SAR change.

UUSA performed a QL-1 nuclear criticality safety evaluation (NCSE) to address criticality safety requirements for movement of components or vessels. The NCSE was conducted in accordance with Procedure EG-3-3200-01 and documented in NCS-CSE-021, Rev. 0, *Movement of Components*. As a result, the spacing requirements were changed and SAR Section 5.2.1.3.4 was revised to incorporate the results of NCS-CSE-021. The revision did not change criticality safety criterion of $k_{eff} = k_{calc} + 3\sigma_{calc} < 0.95$ or the 0.05 margin of subcriticality.

Conclusion

UUSA and the NRC have had numerous discussions on the ability for UUSA to process changes to the SAR under UUSA approval authority. UUSA has committed to and implemented additional reviews on proposed modification to the SAR. UUSA has always performed 70.72 evaluations on proposed modifications and these changes are within UUSA approval authority. These changes do not impact the approved margin of subcriticality as shown above and thus the changes are not prohibited by 10 CFR 70.72(c)(4) as they are not impacting the approved margin of subcriticality required by 10 CFR 70.61(d).