From: Mary Adams
To: Valentina Cheney
Date: 3/30/06 7:14AM
Subject: Re: Renewal Criticality questions and MoS

Hi Nancy & Ralph,

We are still chewing on the renewal RAI questions here. However, we're done with the Chapter 6 Nuclear Criticality Safety Program review, and since margin of subcriticality is an "Area Needing Improvement" in the Licensee Performance Review, we thought it would be helpful for you to see the Chapter 6 questions sooner, rather than waiting until I have the entire RAI ready. There is one question, 6-1, about ANSI/ANS-8.23 and another question, 6-2, about CAAS outage times, but the rest of the attached questions are related to margin of subcriticality. The full text of these questions are far more explanatory than the LPR bullet, helping you to prepare your responses to that bullet.

When I do get the full RAI finished, hopefully early next week, I'll specify a response date 30 days after the date of the RAI letter, and I'll ask for responses to the Chapter 6 questions at the same time.

Nancy, I promise to call you Thursday morning.

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WESTINGHOUSE ELECTRIC COMPANY COLUMBIA FUEL FABRICATION FACILITY
SNM-1107 LICENSE RENEWAL APPLICATION, SEPTEMBER 29, 2005
REQUEST FOR ADDITIONAL INFORMATION
NUCLEAR CRITICALITY SAFETY CHAPTER 6

6-1. Provide a statement that WEC will commit to ANSI/ANS-8.23, "Nuclear Criticality Accident Emergency Planning and Response," or provide a detailed specific justifications for using alternative approaches. This information is necessary to determine compliance with the requirements of 10 CFR 70.62(a) that requires an applicant to establish and maintain a safety program demonstrating compliance with the performance requirements of 10 CFR 70.61. Also, 10 CFR 70.65(a) requires a description of the 70.62(a) safety program in the license application. NRC has stated that "if an applicant intends to conduct activities to which a standard applies and the standard has been endorsed by an NRC Regulatory Guide, then a commitment to comply with all the requirements (i.e., "shalls") is necessary but may not be sufficient to meet the acceptance criteria." In addition, any variations from the requirements of the standard should be identified and justified in the application. ANSI/ANS-8.23 is endorsed in Regulatory Guide 3.71, but is not discussed in the license application. If no alternative approaches are provided, then the commitment needs to be to all the requirements and recommendations in the standard, rather than to some of the requirements and recommendations in the standard.

6-2. Section 6.1.8, "Criticality Accident Alarm System (CAAS)", paragraph 3, states in part, "If the CAAS is out of service for more than four hours, all movement and processing of fissile material is prohibited..." Revise Section 6.1.8 to state that should the CAAS be out of service for any amount of time, all movement and processing of fissile material must cease until compensatory measures approved by the nuclear criticality safety function are in place or the alarm service has been restored. Also, WEC should revise the last sentence in Section 6.1.8, paragraph 3, as follows: "Routine testing, calibration, and/or maintenance of the system for up to four hours is permitted without suspension of fissile material movement or processing." These changes are necessary to determine compliance with 10 CFR 70.24 which states, in part, that a CAAS is required for operations containing greater than 700 g of contained ^{235}U.

Minimum Margin of Subcriticality

6-3. Summarize the most important factors providing conservatism in your calculations of k_{eff} in each major process area, including, for both controlled and uncontrolled parameters: (1) the nominal value of the parameter, (2) the value of the parameter assumed in the calculation(s), and (3) the difference in k_{eff} resulting from the difference between nominal and as-modeled conditions. This summary should include, at a minimum: the following process areas: the wet ammonium diuranate process, the UO_2 powder preparation and handling processes, pellet, rod, and assembly fabrication and handling, and uranium recovery. As part of the technical basis for the proposed margin of subcriticality of 0.02, WEC submitted a table, by letter dated December 15, 2005, showing the as-modeled conditions for each calculation note for the facility. This submittal, however, did not identify the nominal values for these parameters, and did not quantify the amount of conservatism resulting in terms of k_{eff}. This information must be provided to enable the NRC to determine that there is sufficient conservatism to be used as the basis for justifying the margin of subcriticality.

The preceding information is necessary to determine compliance with the requirements of 10 CFR 70.61(d) which requires that all processes be subcritical under both normal and credible abnormal conditions, including use of an approved margin of subcriticality for safety.

6-4. Calculate the trend in the bias as a function of the thermal, intermediate, and fast fission fractions, similar to what was done for energy of average lethargy causing fission (EALF) in Figures 3 and 6 of the validation report LTR-ESH-05-146, Rev.1. As part of the technical basis for the proposed margin of subcriticality of 0.02, Westinghouse submitted a study which calculated the thermal, intermediate, and fast fission fractions for each of the benchmark experiments. However, using this analysis as part of the basis for the margin of subcriticality necessitates that the information be used to determine whether there are any additional trends resulting from the neutron spectrum that are not revealed in the analysis of k_{eff} as a function of EALF. Perform separate calculations for the solid and solution subsets of all the experiments analyzed in your benchmark report. Present the results in graphical form and justify whether the existing Upper Subcritical Limit (USL) is still valid.

The preceding information is necessary to determine compliance with the requirements of 10 CFR 70.61(d) which requires that all processes be subcritical under both normal and credible abnormal conditions, including use of an approved margin of subcriticality for safety.

6-5. Based on information provided in the validation report LTR-ESH-146, Rev. 1, justify whether the validated area of applicability (AOA) includes any calculation lying within the H/X-EALF "box" (i.e., any solid case with 17.46 # H/X #972.77 and 0.05 # EALF # 2.369 eV, or any solution case with 453.9 # H/X #1437.51 and 0.0339 # EALF # 0.0592 eV). As part of the technical basis for the proposed margin of subcriticality of 0.02, WEC provided an analysis of the distribution of benchmark experiments in two-dimensional H/X-EALF space. As a result of the strong correlation between moderator content and thermalization, the benchmark experiments only cover a small portion of this box. There is not a high degree of assurance that future applications, that do not lie within the narrow band, will have the same bias as the benchmark experiments that lie within the band. This information is necessary to ensure that the bias is well-characterized as a function of both H/X and EALF.

If the validated AOA does include all points within the H/X-EALF box, then justify why, given that the benchmark experiments are confined to a narrow band within this box. If part of the justification is that it is not possible for future applications to fall outside this band, then justify why this is the case.*

If the validated AOA does not include all points within the H/X-EALF box, then restrict the AOA to that portion of the H/X-EALF box covered by the experiments, or else provide additional margin to cover extension of the AOA outside this band.

The preceding information is necessary to determine compliance with the requirements of 10 CFR 70.61(d) which requires that all processes be subcritical under both normal and credible abnormal conditions, including use of an approved margin of subcriticality for safety.

(*NOTE: The inverse relationship between H/X and EALF is the reason the benchmarks tend to have either low H/X and high EALF or high H/X and low EALF. Two examples of hypothetical future applications that could deviate from this trend are: (1) low H/X and low EALF, which could occur with a low-moderated UO_2 powder or fuel core surrounded by full reflection, under conditions of sufficiently high neutron leakage, such as in a fully reflected slab of powder or pellets; or (2) high H/X and high EALF, which could occur with an optimally moderated but unreflected solution, under conditions of sufficiently high neutron leakage, such as in an unreflected cylinder or slab of uranium solution with small diameter or thickness.)

6-6. Calculate the trend in the bias as a simultaneous function of both H/X and EALF, similar to what was done individually for H/X and EALF in Figures 2, 3, 5, and 6 of the validation report LTR-ESH-05-146, Rev.1. As part of the technical basis for the proposed margin of subcriticality of 0.02, WEC provided an analysis of the distribution of benchmark experiments in two-dimensional H/X-EALF space. However, using this analysis as part of the basis for the margin of subcriticality necessitates that this information be used to determine whether there are any trends in the bias as a function of both parameters. There is a strong correlation between H/X and EALF, so that analyzing the bias as a function of each variable independently, does not provide full information on the presence of any trends. This trend could be analyzed by using multiple regression analysis of k_{eff} as a function of two variables. Perform separate calculations for the solid and solution subsets of experiments. Present the results in graphical form and justify whether the existing Upper Subcritical Limit (USL) is still valid.

The preceding information is necessary to determine compliance with the requirements of 10 CFR 70.61(d) which requires that all processes be subcritical under both normal and credible abnormal conditions, including use of an approved margin of subcriticality for safety.

6-7. Justify the conclusion that the underprediction for low H/X values "is not likely to have an impact upon the CFFF NCS calculations and no specific actions are recommended as these low moderated configurations tend to have very low k_{eff} values." As part of the technical basis for the proposed margin of subcriticality of 0.02, WEC performed an analysis of the bias for different subgroups of experiments. It appears from the conclusion for polyethylene-reflected experiments that a somewhat lower k_{eff} limit is appropriate for these systems. In addition, the "poor characterization" of the ^{238}U cross sections in the resonance region calls into question whether additional margin is needed. These findings would appear to apply especially to low-moderated bulk UO_2 powder applications, for which the resonance region could be significant.

Justify the acceptability of the USL for polyethylene-reflected systems, given your statement from the report entitled "Multi-Dimensional Analysis of Validation Area of Applicability," submitted by letter dated December 15, 2005: "A noteworthy feature is that the Polyethylene reflected experiments tend to slightly underpredict the experimental k_{eff} values. Examination of the individual experiments...shows that this is related to the low $H/^{235}U$ for these experiments and is likely due to the poor characterization of the ^{238}U resonances."

The preceding information is necessary to determine compliance with the requirements of 10 CFR 70.61(d) which requires that all processes be subcritical under both normal and credible abnormal conditions, including use of an approved margin of subcriticality for safety.

6-8. Clarify that the "suggestions" on the use of the code in Section 6.0 of the Validation Report are mandatory. Section 6.0 of the validation report LTR-ESH-05-146, Rev.1, mentions certain limits, but these are stated as "suggestions" rather than "requirements." Use of the word "suggestions" is not sufficiently strong to provide assurance that the code will be properly and consistently used. Demonstrating that WEC utilizes adequately validated calculational methods, requires explicitly specifying any limits and restrictions on the use of those methods.

The preceding information is necessary to determine compliance with the requirements of 10 CFR 70.61(d) which requires that all processes be subcritical under both normal and credible abnormal conditions, including use of an approved margin of subcriticality for safety.

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