NON-PROPRIETARY REQUEST FOR SUPPLEMENTAL INFORMATION AND OBSERVATIONS
AREVA INC.
Docket No. 72-1042
NUHOMS-EOS SYSTEM

Structural Evaluation

1. Section 3.9.5, NUHOMS® EOS-TC BODY STRUCTURAL ANALYSIS. Provide a lead slump analysis to demonstrate that shielding capability of the TC is not compromised due to the drop accident induced lead slump of the TC enclosure wall.

   The December 19, 2014, AREVA transmittal letter, E-40553, notes that, "The NUHOMS® EOS System is an improved version of the NUHOMS® HD System described in CoC No. 1030. The EOS-TCs are similar to the previously licensed TCs." Therefore, the staff expects, similar to those presented in the final safety analysis report (FSAR) for the NUHOMS® HD System, a lead slump analysis should be included in the current submittal, as an analyzed configuration, to demonstrate the shielding performance of the loaded TC after the postulated DSC drop accident.

   This information is needed to meet the requirements of 10 CFR 72.236(d).

2. Section 3.7.1.1.1, Stress Analysis. Provide a SAR synopsis in sufficient detail to clarify the SAR statement, "[A]n enveloping technique of combining various individual loads in a single analysis is used in this evaluation for several load combinations." It is unclear what the enveloping technique entails and how it is implemented for structural components with multiple critical sections of interest for reporting stress ratios. It appears that calculated maximum stresses of individual loading cases are simply added together for stress ratios determination even if maximum stresses associated with individual loading cases may have resulted at different locations of interest for the structural component involved.

   Therefore to address this, the SAR synopsis should use DSC stress analysis as an example by properly annotating the finite element analysis (FEA) model depicted in Figure 3.9.1-1 with sufficient detail to illustrate: (1) the element discretization for the closure-lid-to shell weld and (2) locations for all critical stress evaluation paths in both the closure lids and the DSC shell to facilitate safety review of the structural analysis model assumptions and stress results. To facilitate staff assessment of the applicability of approach, apply explicitly the technique with hand calculation to arrive at the maximum stresses, including locating the critically stressed DSC sections, for the two cases with large stress ratios: (1) Load Combination 7A for the DSC shell stress in Table 3.9.1-7 and (2) Load Combination 1 for the DSC ITCP in Table 3.9.1-9.

   This information is needed to meet the requirements of 10 CFR 72.236.

3. Appendices 3.9.5 and 3.9.7. Submit, for staff review, the applicable computer analysis files for Appendix 3.9.5, “NUHOMS® EOS-TC BODY STRUCTURAL ANALYSIS,” and Appendix 3.9.7, “NUHOMS® EOS SYSTEM STABILITY ANALYSIS,” which, as opposed to the computer files made available for other Appendices, are not included in the present SAR submittal.

   This information is needed for reviewing the application to meet the requirements of 10 CFR 72.236.

Thermal Evaluation

1. Provide bounding effective specific heats of EOS-37PTH DSC basket assembly composite plates, bottom cover plates and top cover plates for thermal evaluation.

   The effective specific heat values of EOS-37PTH DSC basket assembly composite plates and bottom cover plates and top cover plates are missing from pages 4-10 and 4-12, respectively, of SAR Section 4.2.1. The applicant should provide the specific heat values of these DSC plate, as functions of temperatures for thermal evaluation.

   This information is needed to determine compliance with 10 CFR 72.236(f).

2. Provide the complete thermal calculation packages to evaluate thermal analysis and verify thermal model.

   The staff checked the SAR thermal evaluation of HSM-with-EOS-37PTH, TC108-with-EOS-37PTH, and TC125-with-EOS-37PTH, provided by the applicant; and is unable to locate the thermal calculation package and input files for evaluation of thermal analysis. The applicant should provide the complete calculation packages and associated analysis files for thermal model verification.

   This information is needed to determine compliance with 10 CFR 72.236(f).

Observations

Structural

1) Section 2.3.4, Seismic Design, and Technical Specification, Section 4.5.3, Site Specific Parameters and Analyses. Revise, as appropriate, the Section 2.3.4 and Technical Specification (TS), Section 4.5.3, descriptions of seismic input to the HSM to recognize that the seismic structural performance of the NUHOMS-EOS system, including HSM stability against sliding and overturning, may need to be reevaluated with the earthquake motion acceleration levels defined at the base of the HSM , which could markedly be different from the free-field or control motion for a power reactor site where cask systems are to be deployed.

   The Section 2.3.4 language appears to suggest that the 0.5 g and 0.33 g zero period accelerations (ZPAs), per RG 1.60, are associated with the free-field horizontal and vertical component motions, respectively. As such, it's unclear how the free-field spectral accelerations corresponding to the predominant resonance frequencies of the HSM are used for evaluating the seismic response of a free-standing HSM, which, by itself, is to react together with the basemat in a soil-structure interaction process. As one of the analyzed site parameters for configuration control for the cask deployment, the applicable seismic input parameters must also be defined in the TS to facilitate the 72.212 (b)(5)(ii) site evaluations by the cask users.

   This information is needed to meet the requirements of 10 CFR 72.212(b)(5)(ii).

2) Technical Specification, Section 4.5.2, Concrete Storage Pad Properties to Limit DSC Gravitational Loadings Due to Postulated Drops. Revise, as appropriate, the TS language referencing the EPRI NP-7551 methodology for determining the concrete pad design parameters.

   It is unclear whether the target hardness approach described in the EPRI report is indeed being used by the applicant for determining the TC decelerations subject to the drop accidents. Appendix 3.9.3 indicates that the TC decelerations were calculated with a LS-DYNA finite element analysis approach instead.

   This information is needed for reviewing the application to meet the requirements of 10 CFR 72.236.

Thermal

1. Systematically describe differences in heat removal design and air flow pattern between HSM system and HSM-EOS system

   The applicant stated in SAR Section 1.1 that EOS-HSM or EOS-HSMS, is equipped with special design features for enhanced heat rejection capabilities. Given that the staff may need to reference to the HSM system for comparison and better insight, it's suggested that the applicant provides the following information to support thermal review:

   (a) A table to list the differences in heat removal design and the resulting impacts to heat rejection between HSM system and HSM-EOS system, and

(b) the schematic figures to show the cooling airflow pattern/path within both HSM system and HSM-EOS systems

This information is needed to determine compliance with 10 CFR 72.236(f).

2. Systematically describe differences in heat removal design between EOS-type transfer cask and OS-type transfer cask.

   The applicant proposed to use EOS transfer casks (TC108, TC125 and TC135) with the EOS-37PTH DSC or the EOS-89BTH DSC. Given that the 37PTH DSC can be shipped by OS200 and OS200FC, it's suggested that the applicant provide a table to systematically describe/compare differences in the heat removal design among transfer casks EOS-TC108, EOS-TC125, EOS-TC135, OS200, and OS200FC. The requested information will help support the thermal review on the heat rejection performance with DSC in EOS-TC108, TC125 and TC135.

   This information is needed to determine compliance with 10 CFR 72.236(f).

3. Provide more information in Grid Convergence Index (GCI) calculations to assure that the thermal analyses for normal storage and onsite transfer are reliable and acceptable.

   GCI method can be used to assess the sensitivity of the solution to the grid density, by following the procedure described in American Society of Mechanical Engineers Verification and Validation 20-2009 (ASME V&V 20-2009), "Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer". The applicant is suggested to perform the GCI calculations to assure the thermal analyses for normal storage and onsite transfer are reliable and acceptable.

   The applicant provided the GCI calculations in SAR Appendix 4.9.3 Mesh Sensitivity, with equations, methodology and calculated results. The applicant is suggested to (1) list the values of the variables (in each equation) next to the equation, and (2) provide GCI in percentage (%). The information is needed to verify the data listed in the Table 4.9.3

   This information is needed to determine compliance with 10 CFR 72.236(f).