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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
		Section 3.7 - AREVA Overview presentation of NI embedded seismic analysis (numbers in parenthesis represent related RAIs)			
• Path Forward, AREVA Action	No	• Modeling of embedment effects and SSSI (3.7.1-26)	• Output response spectra at footprints of structures adjacent to the Nuclear Island to account for structure-soil-structure interaction (SSSI) effects of structures adjacent to the NI (in particular, include the NAB and AB). SSSI effects on adjoining structures are modeled by determining the free field response at the locations of adjoining structures and taking into account their proper elevation relative to the NI basemat.	**3.7.1-26: Added to reconciliation list for RAI 320 response.**	N/A
• Path Forward, AREVA Action	No	• Mat flexibility and the use of thin plate elements in the SASSI model (3.7.2-45 and -66)	• Provide justification that the wall to NI Basemat transition is appropriate.	N/A	N/A
• Path Forward, AREVA Action	No	• Frequency transmission characteristics of the NI seismic model (3.7.2-44 and -68)	Verify frequency transmission characteristics of the NI by performing parametric analyses. If necessary, provide other justification (e.g., demonstrate that other soil cases govern high frequency transmission.) AREVA will perform parametric analyses to assess the impact of soil layers that are not capable of high frequency transmission. If it is determined that high frequency responses have not been captured is a particular analyzed soil case, such as a soft backfill case, it may be possible to show that other stiffer soil cases bound the response of the subject soil case with insufficient high frequency transmission.	**3.7.2-44: Added to reconciliation list for RAI 320 response.**	N/A
• Path Forward, AREVA Action	No	• Modeling of flexible floors and walls (3.7.2-46 and -51)	Model both uncracked and cracked slabs. No reduction of axial and shear area is required when cracked slabs are concerned.	**3.7.2-46: Added to reconciliation list for RAI 320 response.**	N/A
• Path Forward, AREVA Action	No	• Determining ISRS for flexible walls and floors (3.7.2-52)	Perform generation of ISRS by determining response at both rigid (at wall-floor junctions) and flexible walls and slabs (where there are ZPA hot spots). ISRS will be generated with SSE damping satisfying the requirements discussed under "Justification for NI structural damping values (7%) used in generation of ISRS".	**3.7.2-52: Added to reconciliation list for RAI 320 response.**	N/A
• Path Forward, AREVA Action	No	• Seismic model of the NAB (3.7.2-50)	Refer to discussion below under "Seismic models (NAB, TB, AB)"	**3.7.2-50: Added to reconciliation list for RAI 320 response.**	N/A
• Path Forward, AREVA Action	No	• Compatibility of SASSI and ANSYS models (3.7.2-67)	1. Document ISRS comparisons between the MTR SASSI dynamic and ANSYS static models, 2. Document ISRS comparisons in a calculation. 3. Generate RAI response including excerpts from the compatibility calculation.	N/A	N/A
		Section 3.8 - AREVA Overview presentation of any changes developments to the methodology Issues (numbers in parentheses represent related RAIs)			
• Path Forward, NRC & AREVA Action	No	• Hydrogen pressurization of RCB – Identification of maximum load from hydrogen generation burn event; evaluation of RCB integrity for higher pressure from this event and 45 psig; use of proper loads, load combinations, acceptance criteria, and analysis description in FSAR (3.8.1-6)	1. AREVA Action Item to revise FSAR to correct the following: Definition of Combustible Gas (C) to be in agreement with 10 CFR 50 44 (e.g., delete carbon dioxide at least in 2 places.) 2. Explain whether dynamic effects due to the pressure load transient (spike) affects the response of the containment. This will be included in a calculation that can be reviewed by the staff in the future if required. 3. NRC Action Item to verify that the pressure & temperature transients are acceptable since the PARS are not considered to be safety related. 4. The loads, load combinations, model, analysis, results, acceptance criteria are available in an AREVA calculation which can be reviewed in the future. In	N/A	N/A

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
			addition, a summary description will be added to the FSAR for this evaluation. Both items should include the global model analysis and local analysis description.		
• **Resolved Pending Review of Formal Response**	No	• Seismic modification factors for equivalent static analysis – Technical justification for values used (3.8.1-48)	1. (1): AREVA provided the specific steps used in developing the seismic modification factors – will provide brief description of the process from SASSI (3D FEM, 3 directions, algebraic summation, max acceleration in time, & max difference in interstory shear over time), identify soil conditions, cantilevers for MFs, elevations considered, equation used to calculate MFs, describe which MFs are applied to which structural elements, provide representative plots of the curves demonstrating the conservatism in terms of interstory shears. (2) Justification provided did not adequately demonstrate the acceptability the use of the MFs. AREVA indicated that another study on the 100/40/40 method to be discussed later will provide additional information to demonstrate the conservatism of this approach. Staff needs to confirm whether that study will be adequate to address this RAI as well. 2. AREVA utilized the SASSI results to obtain forces in each of the three global directions. Then the MFs were calculated at each floor elevation for the two horizontal directions to be applied in the plane of the slabs and the vertical MF for the walls in the vertical direction. This approach will be verified by the study discussed under item 1 above. 3. Addressed by item 2. AREVA will decide on whether to verify/justify items 1, 2 & 4 or modify approach per Attachment 1. Staff notes that the discussion below, under the audit subject "Use of 100-40-40 rule for equivalent static analysis," indicates that the path forward is per Attachment 1 (i.e. no modification factors are used).	N/A	N/A
• Resolved (if no mod factors are used)	No	• Confirmatory analysis of RBIS – (3.8.3-18)	No AREVA action if the modification factors are not being utilized.	N/A	N/A
• **Resolved Pending Review of Formal Response**	No	• Design of reinforced concrete structures using ACI 349-01 or ACI 349-06 – Technical justification for using ACI 349-01 or 349-06 (3.8.3-21)	Respond to RAI 3.8.3-21 as shared in draft form with NRC during the audit in addition to two new paragraphs with the following information: • State that the reductions factors used with the anchorage design are compatible with load combinations from ACI 349-01 • State that the regulatory positions of RG 1.199 are applicable to anchorage design using ACI 349-06 Appendix D.	N/A	N/A
• Path Forward, AREVA Action	No	• Design of RCB penetrations – Information on analysis and design of equipment hatch, airlocks, fuel transfer tube, closure for the construction opening, electrical penetrations, and high energy piping penetrations (3.8.2-11, 2-12, 2-13, 2-14, 2-15, 2-16)	AREVA will respond to the RAIs with the following information: • For equipment hatch, construction opening, personnel airlocks and fuel transfer tube AREVA will update the FSAR to include design details (FSAR figures with key structural dimensions), analysis methodology and ASME section III subsection CC and NE stress results including buckling per code case N284-1. • For electrical penetrations: Typical design detail (FSAR figures) and analytical methodology. • For high energy lines: Provide details for Main Steam and Main Feedwater penetrations only supplied with qualitative basis of selection and only one of each of the penetration details of main steam and another for main Feedwater given the selection is based on the highest loaded penetration (quantitative). The FSAR will be updated to include design details (FSAR figures with key structural dimensions), analysis methodology and ASME section III subsection CC and NE stress results including buckling per code	N/A	N/A

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
			case N284-1. • HVAC penetrations: AREVA to investigate a relief opening discussed in Chapter 6 and include typical design detail (FSAR figures) and analytical methodology if it is still included in Chpt 6. • Gasket seals: Information on vendor qualification and testing to be added to FSAR Section 3.8.2		
• **Path Forward, AREVA Action**	No	**Design of RCB penetrations - Information on analysis and design of equipment hatch, airlocks, fuel transfer tube, closure for the construction opening, electrical penetrations, and high energy piping penetrations (3.8.2-11, 2-12, 2-13)** • **Confirm MS and FW penetrations are the bounding cases for HE penetrations-** • **Confirm that SAM's are small** • **Address hydrogen generated CB pressure loads** • **Address jet impingement as a load for large penetrations** • **Address 36" penetration dedicated for containment filtered pressure release** • **Address additional hydrostatic and hydrodynamic loads in FTT** • **Provide the basis for excluding concrete displacements imposed on boundary of penetrations for NE qualification** • **For nonlinear buckling analysis, provide additional information to address:** ▪ **1) Incremental and non-incremental loads used. Justify use of external pressure only.** ▪ **2) Whether the factor of safety of 3 accounts for generic imperfections. Provide additional justification whether nonlinear analysis is insensitive to geometric imperfections** ▪ **3) Discrepancy between margins computed from nonlinear buckling analysis and code case calculation for airlock and airlock hatch**	• **Provide a qualitative description of the (1) basis that the MS and FW lines bound the HE penetrations (2) selection of MS and FW penetrations that were evaluated. (3) Supplement 3.8.2-11 response to document the basis.** • **Provide a qualitative justification for why SAMs are negligible. Include method used to develop justification. Supplement response to Q3.8.2-12** • **Ensure CC and NE evaluations include applicable load combinations considered in the design** • **Update response to 3.8.2-11 to address the applicability of jet impingement loads. Identify existing ITAAC to verify final design.** • **Show that the configuration of the spare penetration is bounded by existing analysis; otherwise perform CC and NE evaluations. Document results in 3.8.2-11 response Supplement.** • **Update seismic analysis to include hydrostatic and hydrodynamic loads associated with water stored on fuel transfer pit side during operations for water inventory control. Supplement 3.8.2-12 response.** • **Describe in the FSAR the basis for NE analysis assumptions (i.e., geometry and secondary stresses) including any credit taken for construction and installation procedures where the components are not installed until post tensioning activities. Document information in Q3.8.2-11 response Supplement and FSAR.** • **In RAI Q3.8.2-13 response 1) Describe how all loads applied (e.g., incremental and non-incremental loads used. Justify use of external pressure only 2) Provide justification for not including geometric imperfections in nonlinear analysis 3) Review code case calculation for airlock and airlock hatch and explain the discrepancy between margins computed from nonlinear buckling analysis and code case calculation for airlock and airlock hatch.**	**Open items from the October 28/29, 2010 Audit.**	**N/A**
• **Path Forward, AREVA Action**	No	• Design of Seismic Category I structures – Information on load combinations, analysis and design procedures identified during telephone conference (3 22 10) between AREVA and NRC (3.8.1-20, 1-24, and 4-6)	**Add Vent Stack and Tendon Gallery as Critical Sections.**	**3.8.1-20: Added to reconciliation list for RAI 155 response.**	**N/A**
• **Resolved Pending Review of Formal Response**	No	• Use of 100-40-40 rule for equivalent static analysis – Clarification on how the 100-40-40 rule is implemented (3.8.3-24)	The path forward is documented in attachment #1. Also see 'Seismic modification factors for equivalent static analysis – Technical justification for values used (3.8.1-48)'	**N/A**	**N/A**
• Path Forward,	No	• Design of Seismic Category I foundations – Information on modeling, analysis, and design of Seismic Category I foundations, including:	• 3.8.5-24: RAI was not discussed during the audit. Parts of the question were discussed	**N/A**	**3.8.5-25:** **Full value of Gazetas was not used for**

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
AREVA Action		modeling of soil stiffness, spatial variability of soil stiffness, lateral soil pressures, soil friction, sliding and overturning stability, etc. (3.8.5-24, 5-25, 5-26, 5-27, 5-28)	in other RAIs and documented here. Need to complete the discussion via telecon. • 3.8.5-25: 1. AREVA indicated that for gravity loads and equivalent static loads, the Gazetas' equation using 50% of the dynamic shear modulus are used for the soil springs. For the seismic dynamic loading, the full value of the Gazetas equation is used. When the new seismic dynamic analysis is performed, the full Gazetas spring values will be used and compared to the equivalent springs determined from the SASSI impedance data for confirmation. For soil bearing pressure calculation, the SASSI calculated values will be used. 2. The tri-linear soil springs will no longer be used in any of the analyses. 3. No studies have been performed to evaluate the horizontal variability in the soil springs. AREVA will specify a +/- 10% criteria in the FSAR to ensure that the COLA will confirm minimal horizontal variation in the soil properties with respect to the uniform soil properties based on shear wave velocities. 4. AREVA will respond in RAI Batch 376 to acknowledge that the COLA will need to perform a site specific evaluation and compare the site specific design against all soil cases and not just the soft soil case which was used in design. • 3.8.5-26: AREVA will respond to this follow-up RAI by explaining that the phrase in response to RAI 3.8.5-6 meant to say "variation of soil properties in the layered soil profile as defined in the FSAR." Furthermore, AREVA will demonstrate that the spring values from Gazetas equation are similar to those from the Wong-Luco methodology and SASSI derived values. • 3.8.5-27: Components of this RAI were discussed during the audit. • 3.8.5-28: Item 3) For dynamic lateral pressure loads in the foundation (e.g., at the interface between the soil and the exterior foundation walls, tendon gallery walls, and vertical edges of the NI Common Basemat Structure): AREVA indicated that they use the seismic soil pressure on the walls derived from the SASSI analysis. The compressive pressure loads on one side of the NI is added to the tensile pressure load from the other side plus the two side wall resisting forces. A sketch showing this process will be provided.		**dynamic analysis. For the seismic analysis, dynamic loading are generated using MTR/SASSI where the supporting soil is explicitly modeled.**
• Path Forward, AREVA Action	No	• Seismic Category I Foundations Construction Sequence and Differential Settlement – NI, EPGB, ESWB (3.8.5.22, 30)	AREVA will revise the description of the settlement criteria used in the DC to explain how the settlement capacity is calculated. The description will be in terms of the methodology used to determine how forces and moments resulting from settlement are calculated (including potential effects on walls above basemat) and will be adequate enough such that the COLA will be able to reconcile with predicted settlements for the COL project. These criteria will be a predictive evaluation by COLA. Will require the COL to address the construction sequence and long term settlement effects.	**N/A**	**N/A**
		Section 3.7 - Break-out session #1			
• Path Forward, AREVA	Yes	• Review of NI embedded analysis calculations (**3.7.2-73**)	• Review existing transfer functions to ensure that calculated spikes are real and do not represent modeling errors or numerical instability. AREVA will check to ensure that sufficient frequency points were calculated to ensure	**N/A**	**N/A**

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
Action			adequate definition of transfer functions. • Confirm that the soil pressures around the shear key are reasonable. Review results for a time slice to assess adequacy of the pressure distribution. • Verify that pressures around the wall edges make sense, as the pressure stresses sometimes drop near the edges, contrary to conventional wisdom. • Ensure coordination of handoffs of pressures, accelerations, etc. In particular, make sure tension loads are appropriately transferred to the compression side.		
		Section 3.7 - Break-out session #2			
• Path Forward, AREVA Action	No	• Justification for use of cable-tray damping values in excess of R.G. 1.61 recommendations (3.7.1-28)	Item A – Provide a summary of how damping and degraded stiffnesses are obtained from ANCO and used in analysis. Item B – Clarify intended reference to models in previous RAI response. Refer to Item E on how modeling and analysis is performed. Item C – Provide clarification of systems tested in ANCO and applicability of results. Item D – Establish criteria for evaluating similarity (e.g., # spans, hardware, etc.) of AREVA cable tray systems with the cable tray systems tested in ANCO. Item E – Describe step by step process used for analysis and determination of seismic demands on cable trays that are determined to be similar to those tested in ANCO. This process includes the qualification hierarchy going from first choice being equivalent static load approaches with damping values that comply with RG 1.61 to more refined analysis methods with damping values higher than those provided in RG 1.61. Item F – Clear up inconsistencies in FSAR Tables and Figures.	N/A	N/A
		▪ Method used to determine cable tray damping values			
		▪ Calibration of analytic models with test results			
		▪ Applicability of ANCO test results to three directions of input motion			
		▪ Similarity of tested configurations to AREVA cable tray designs			
		• Step by step process used to determine the seismic loads in the design of cable trays			
▪ Resolved Pending, Review of Formal Response	No	• Basis for accepting a 10 percent increase in ISRS and structural design loads without additional technical justification (3.7.2-72)	Locate and delete any reference to the 10% exceedance allowance for ISRS and design loads.	N/A	N/A
• Resolved Pending, Review of Formal Response	No	• Follow up on mesh size for EPGB and ESWB (3.7.2-71)	• Identify the ground motions used in the mesh study. • Add a high frequency motion such as Bell Bend. • Include more mass participation. • Fix the response spectrum anomaly in Figure 4.9 of 32-7002098-000, where the spectral peak does not coincide with the fundamental mode of the slab. • Document the mesh study in a calculation and send excerpts to the NRC in response to their RAI.	N/A	N/A
		Section 3.8 - Break-out session #1			
• Path Forward – NRC & AREVA Action	No	• Discussion and review of hydrogen pressurization evaluation of RCB (3.8.1-6) and associated calculations	Discussed above.	N/A	N/A
		Section 3.8 - Break-out session #2			
• **Resolved Pending**	No	• Discussion and review of seismic modification factors used in equivalent static analysis (3.8.1-48) and associated calculations	Discussed above.	N/A	N/A

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
Review of Formal Response					
		Section 19 - Break-out session #3			
• **Resolved Pending Review of Formal Response**	No	• Discussion and review of the structural analyses of the Reactor Containment Building in support of AREVA response to RAI No. 234, Supplement 1, Question 19.305 to address Part 50.44 (c)(5)	Revise FSAR Chapter 19 to expand the discussion and add details about models used in analysis of containment.	**19-305: Details provided in response in lieu of FSAR markups.**	**N/A**
• **Resolved Pending Review of Formal Response**	Yes	• Discussion and review of the structural analyses of the Reactor Containment Building in support of AREVA response to RAI No. 234, Supplement 1, Question 19.306 to address the SECY-93-087 containment deterministic structural performance expectation (**19-337**)	Revise FSAR Chapter 19 to expand the discussion and add details about models used in analysis of containment and expand curves shown in response to RAI 19.306 to 72 hours. New RAI question 19-337 (PHASE 4 RAI) was received as a follow-up to Open Item RAI 234, Question 19-306: "During the April 26-30, 2010, Chapter 3 audit, AREVA informed the NRC staff that Figures 19-306-1 thru 19-306-4 submitted in RAI 234, Supplement 1 response have been revised. The staff requests that these revised figures be submitted in order to complete the review of the response to the open item."	**19-337: Details provided in response in lieu of FSAR markups.**	**N/A**
		Section 3.7 and 3.8 - Description and justification for design basis of Cat II structures whose failure could affect the safety function of a Category I structure (3.7.2-64 and -65; 3.8.3-17, 4-7, and 4-9)			
▪ Resolved Pending Review of Formal Response	No	• Design Approach for NAB, TB and AB	• Analyze and Design to SC I Criteria (NAB-CSDRS, AB & TB-Site SSE) • Distance between structures will be adequate to prevent interaction • Construction materials, testing and examination will be to conventional standards • TB and AB design criteria will be placed in brackets in the FSAR. • RWB is designed in accordance with RG 1.143 Category RW-IIa, demonstrate qualitatively that the RWB will not interact with the NAB.	**N/A**	**N/A**
		• Description of NAB lateral force resisting system (LFRS) with a controlled collapse zone	Changed to state that Category II structures will be designed and analyzed to Category I criteria. This will ensure the required equivalent margin of safety is achieved.	**N/A**	**N/A**
		• Seismic models (NAB, TB, AB) • Method of analysis • Design approach that ensures collapse of a structure does not affect safety function of an adjacent Category I building • Description of codes and standards applicable to NAB, TB and AB and how they are utilized in the building design	Determine AB and NAB motions. Note that the NAB is modeled in the NI SSI analysis and free-field motions representative of the SSSI effects on the NAB need to be obtained.	**N/A**	**N/A**
▪ Resolved Pending Review of Formal Response	No	• Effect of failure of the AB on the tendon gallery	As stated above, the AB is analyzed and designed to SC I criteria. No further action is required.	**N/A**	**N/A**
▪ Resolved Pending Review of Formal Response	No	• Design of Seismic Category II structures - Seismic analysis methods and acceptance criteria applied to Seismic Category II structures	Category II structures are analyzed and designed to SC I criteria. For RAI 3.8.3-17: AREVA will provide criteria for design of seismic Category II miscellaneous structures (e.g., platforms, stairs, etc.) as described under "Discussion of SRP 3.7.2 Acceptance Criteria 8 and its application to the design	**N/A**	**N/A**

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
			of non-Cat I seismic subsystems (3.7.2-38 and -39)" below. This information may be included as part of the response to RAI 3.8.4-9. Information to be included in relevant sections of FSAR Section 3.8.		
• **Path Forward, AREVA Action**	No	• Stability of NAB (**3.7.2-64**)	• Establish the methodology for a new stability calculation for the NAB as follows: 1. Determine the NAB motion. Note that the NAB is modeled in the NI SSI analysis and free-field motions representative of the SSSI effects on the NAB need to be obtained. 2. Develop a "box" model of the NAB. The "box" model is a simple representation of the actual structure. The use of a simplified model is typically sufficient to assess the stability of a structure. For the case of the NAB, a stick model of the NAB from the new embedded 3D FEM NI SSI analysis is available for use. AREVA will use it unless justified otherwise. 3. Run a nonlinear stability analysis of the NAB. 4. Determine any sliding of the NAB and quantify. 5. Demonstrate overturning stability. 6. Determine bearing stresses and ensure that stresses are within acceptable limits based on engineering judgment. • Document the methodology and results in the FSAR	**N/A**	**N/A**
• Path Forward, AREVA Action	No	**Section 3.7 - Justification for NI structural damping values (7%) used in the generation of ISRS (3.7.1-27)**	1. Document the concrete cracking studies. 2. Design capacities to be based on revised seismic analysis of the NI 3. Develop stress ratios for the additional critical sections to provide a more comprehensive stress state within the NI (lower elevations). 4. If the general state of stress is above 50% then the use of SSE damping is acceptable otherwise use OBE damping.	**N/A**	**N/A**
		Section 3.8 - Break-out session #1			
• Resolved (if no modification factors are used)	No	• Discussion and review of confirmatory analysis of RBIS (3.8.3-18) and associated calculations	Discussed above.	**N/A**	**N/A**
		Section 3.8 - Break-out session #2			
• **Resolved Pending Review of Formal Response**	No	• Discussion and review of 100-40-40 rule used for equivalent static analysis (3.8.3-24) and associated calculations	Discussed above.	**N/A**	**N/A**
		Section 3.7 and 3.8 - Description of the analysis methods and stability results for Cat I structures (3.7.2-69)			
• Path Forward, AREVA Action	Yes	• Dynamic model • Seismic input • Coefficients of friction • Computer codes utilized • Modeling of subgrade passive resistance • Stability results factors of safety for NI and NAB • Impact of stability results on structural design loads and ISRS	• NI Stability (see also Attachment 1): 1. Reduce or eliminate the use of passive pressure as resistance against sliding. 2. Identify Safety Factors (SF) that fall below 1.1 on a time basis when passive pressures are reduced or eliminated. If possible, justify that such spikes are limited in the number SF exceedances of 1.1, of sufficiently short duration whereby the structure would not respond, and lack sufficient energy to be of concern and that otherwise the global SF of ≥ 1.10 is maintained. 3. Use a friction coefficient of 0.5 or justify others.	**N/A**	**N/A**

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
			4. Review the displacements calculated in the nonlinear Basemat analysis (based on an ANSYS model with soil springs and meshing consistent with the SASSI model) 5. Confirm that any displacements from the ANSYS analysis are very small, consistent with the findings from the SASSI-based stability analysis. 6. Investigate if displacements are large.		
• **Path Forward, AREVA Action**	Yes	• **Fluid / Structure Interaction (3.7.2-74)**	**Fluid/Structure Interaction:** **1. Justify freeboard is sufficient to accommodate sloshing in the IRWST.** **2. Provide basis for water level assumptions when determining the effects of sloshing.** **3. Evaluate effect of sloshing loads, if any.** **4. Evaluate potential overspill in Spent Fuel Pool.** **5. Justify that vertical seismic impact loads are of no concern.** **6. Determine whether assuming the total water mass acting in the impulsive mode in the seismic model is appropriate, although it was recognized that water mass is relatively low compared to the concrete mass.**	**N/A**	**N/A**
• Resolved Pending Review of Formal Response	No	**Section 3.7 - Explanation of damping value selection for nonlinear analysis of RCS (3.7.1-29)**	Add clarification to RAI response for RCS damping value by showing the important frequency range.	**N/A**	**N/A**
		Section 3.8 - Break-out session #1			
• **Path Forward, AREVA Action**	No	• *Discussion and review design of Seismic Category I structures (3.8.1-20, 1-24, and 4-6) and associated calculations*	N/A.	**N/A**	**N/A**
		Section 3.8 - Break-out session #2			
• Path Forward, AREVA Action	No	• Discussion and review of Seismic Category I foundations (issues related to modeling, spatial variability of soil stiffness, construction sequence and *differential settlements* 3.8.5-22, 5-24, 5-25, 5-26, 5-27, 5-28, 5-30) and associated calculations	*Discussed above.*	**N/A**	**N/A**
	No	**Section 3.7 - Method used to determine building forces and moments**			
• **Resolved Pending Review of Formal Response**		• Seismic acceleration modification factors (3.7.2-61)	Discussed above.	**N/A**	**N/A**
• **Resolved Pending Review of Formal Response**		• SRSS 100-40-40 rule (3.7.2-62)	Discussed above.	**N/A**	**N/A**
		Section 3.7 - Break-out session #1			
• Path Forward, AREVA Action	No	• Review of stability calculations	*Discussed above.*	**N/A**	**N/A**
		Section 3.7 - Break-out session #2			

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
• Path Forward, AREVA Action	No	• Review of load distribution calculations	Discussed above.	N/A	N/A
• Path Forward, AREVA Action	No	• Review of wall and slab flexibility calculations	Discussed above.	N/A	N/A
		Section 3.8 - Break-out session #1			
• **Resolved Pending Review of Formal Response**	No	• Discussion and review of technical justification for using ACI 349-01 or 349-06 (3.8.3-21) and associated calculations	Discussed above.	N/A	N/A
		Section 3.8 - Break-out session #2			
• Path Forward, AREVA Action	No	• Discussion and review of Seismic Category I foundations (issues related to lateral soil pressures, soil friction, and stability, 3.8.5-22, 5-24, 5-25, 5-26, 5-27, 5-28, 5-30) and associated calculations	Discussed above.	N/A	N/A
		Section 3.7 - Break-out session #1			
• Resolved Pending Review of Formal Response	No	• Discussion of SRP 3.7.2 Acceptance Criteria 8 and its application to the design of non-Cat I seismic subsystems (3.7.2-38 and -39)	Revise the wording in the FSAR to clarify intent showing the evaluation process and to include this discussion: If a Non-Category I System/Component (SC) exists at a higher elevation than a Seismic Category I SC, then proof that the Seismic Category I SC is not adversely affected is demonstrated by either: • Category I System/Component remains within its code allowables for the concurrent Seismic + Impact loading condition. In addition, show that the safety function of the component is not impaired by impact load. • Prevent the Non-Category I System/Component from Interacting with the protected Category I SSC Clarify the answer provided in RAI Question 3.7.3-39 by revising FSAR Section 3.7.3 to indicate the scope of the 3.7.3 is for sub-systems other than piping except were noted.	N/A	N/A
		• Method for determining additional loads on a Cat I SSC due to failure of a non seismic SSC			
		• Method for determining continued functionality of CAT I SSC			
		• Action required by COL applicant			
		• Design requirements for Cat II subsystems that are part of a Cat I subsystem analysis			
		▪ Design basis for Cat II subsystem			
		▪ Determination of loads on supports at the seismic non seismic interface			
• Path Forward, AREVA Action	No	• Application of anchor motions to subsystem analysis (3.7.1-37)	Analytical SAMs for subsystems were identified by revising the FSAR as part of RAI 370 Question 3.7.3-39 as such: • At the jurisdictional boundary between Cat 1 and Non-Cat. 1 the model would include the Non-Cat 1SSC to the first anchor (or equivalent anchor). Inclusion of this section would place the SSE loading affect (SAM) on the system. • AREVA responded to a piping question concerning the same issue from a piping design viewpoint by revising FSAR Section 3.7.3 to address analytical techniques at the jurisdictional boundary. The analytical technique is correct and is correct for subsystems other than for piping. But, the revision was made to an FSAR section that was specifically identified as not being applicable to piping (because of differences contained in the Piping Topical). It will be a necessary to reword the FSAR to soften the prohibitive wording to something along the line of "not applicable to piping unless specifically identified."	N/A	N/A
		Section 3.7 - Break-out session #2			

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
• Path Forward, AREVA Action	No	• Review of Computer Codes (3.7.2-54 and -70)	Discussed above.	N/A	N/A
• **Path Forward, AREVA Action**	No	• Qualification of the SASSI MTR code	Demonstrate that MTR/SASSI can compute forces using DEPRES accurately at locations where shell elements are perpendicular to each other (e.g., wall to basemat junction).	**Documentation will be available for audit**	N/A
• Resolved Pending Review of Formal Response	No	• Qualification of GTSTRUDL and SASSI	Add clarification to RAI response.	**Addressed in RAI 320 response.**	N/A
• **Resolved Pending Review of Formal Response**	No	• Comparison of AREVA SASSI Version 4.2PC with Bechtel SASSI 2000 Version 3.1	• Address spike Bechtel SASSI and confirm that there is no instability. Mention that interpolation routines are likely different. • Mention that models are different and explains why response are not exactly identical.	N/A	N/A
		Section 3.8 - Break-out session #1			
• Resolved Pending Review of Formal Response	No	• RBIS Uplift (3.8.1-29, 3.8.1-37)	RAI response will capture the information presented in the presentation. In addition, explain 1. document that the analysis demonstrates that uplift does not impose any loads on the liner on the uplift side that exceed ASME code allowables (i.e., no contact while moving up or down, a gap is always present) 2. Compare the liner strain(s) from the design of the liner calculation (NI static model analysis) to the strains(s) from the uplift study. 3. Provide the ASME Code allowable as a measure to show the significant margins available. If margins are large, no need to confirm selected soil case. 4. Compare the bearing pressures calculated from the uplift study against the equivalent bearing pressures used in the design of the haunch region.	N/A	N/A
		Section 3.8 - Break-out session #2			
• Path Forward, AREVA Action	No	• Complete the discussion and review of Seismic Category I foundations (3.8.5-22, 5-24, 5-25, 5-26, 5-27, 5-28, 5-30) and associated calculations	Discussed above.	N/A	N/A
		Section 3.8 – Discussion of Other RAI Issues			
• **Path Forward, AREVA Action**	No	• Design of RCB and other Seismic Category I structures – Additional information on the effects of concrete cracking on design of RCB and other Seismic Category I structures (3.8.1-22, 1-27, 1-44)	N/A.	N/A	N/A
• **Path Forward, AREVA Action**	Yes	• ISI program – Information which demonstrates that ISI program satisfies RG 1 90 (3.8.1-12, 1-31, **1-50, 1-53**)	N/A.	N/A	N/A
• **Path Forward, AREVA Action**	Yes	• Spent fuel pool and loads from fuel racks – Analysis and design procedures (3.8.4-10; **3.8.4-15 thru 27**)	N/A.	N/A	N/A
• **Resolved**	No	• Design of tendon gallery under NI basemat – Details of connection	**AREVA addressed this item during a telecon.**	N/A	N/A

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BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
Pending Review of Formal Response		between tendon gallery and NI basemat (3.8.5-19)			
• **Resolved Pending Review of Formal Response**	No	• Design of Seismic Category I foundations – information on issues related to aggressive environments, dewatering systems, and waterproofing of Seismic Category I foundations (3.8.5-20)	• The DC was assumed to be in a non-aggressive environment. We would not be designing the structure to the worst condition • The potential for an aggressive environment will be evaluated in accordance with ACI/ASME as requested and FSAR Section 3.8 will be revised to comply with the RAI • The requirement for waterproofing is identified in FSAR Section 3.4 and it is required for all below grade Cat 1 structures • Design water level is 3.3 feet below the surface (no partially saturated soils) • Textural reference/inference to a dewatering system is to be removed from the FSAR Section 3.8 • Reference to a protective membrane will be removed from FSAR Section 3.8	N/A	N/A
• **Resolved Pending Review of Formal Response**	No	• Design of Seismic Category I foundations – information on issues related to aggressive environments, dewatering systems, and waterproofing of Seismic Category I foundations (3.8.5-21)	N/A.	N/A	N/A
• Path Forward, AREVA Action	No	• Design of EPGB and ESWB foundations – Maximum bearing pressures, settlements, sliding and overturning evaluations for EPGB and ESWB foundations (3.8.5-29, 5-31)	• 3.8.5-29: AREVA indicated that for gravity loads, they will utilize three soil cases covering the entire range of soil conditions along with the elliptical spring distribution. For the seismic dynamic cases the soil pressures are determined from the SASSI analyses. AREVA will clarify in the RAI response that the large Ko value corresponds to the hard rock case 5a which has a shear wave velocity of 13,123 ft/sec. • 3.8.5-31: RAI response will address/provide the following info: 1. The dynamic soil bearing pressures for all SC I structures are based on the SASSI analyses, therefore, this item is addressed. 2. AREVA will provide a description as requested in item 2 in the follow-up RAI. For the overturning capacity, AREVA will include the dynamic effects. 3. AREVA will consider two options to define the minimum coefficient of friction corresponding to mu = 0.5 or 0.7. Need to provide information to demonstrate what is required for each of the sliding slip planes (e.g., soil shear strength, concrete mudmat to soil, mudmat to membrane, basemat to mudmat) and include key requirements into FSAR. 4. For ESWB: Seismic – (a) use ASCE 4-98 to define seismic soil pressure distribution on walls using maximum accelerations from SASSI. (b) For the sliding stability/ overturning, data for wall pressure distribution is not currently available. Shear and normal forces/soil pressures at the bottom of the basemat are available from SASSI. (c) AREVA to address whether the seismic soil pressure distribution used for design of the walls are bounded by	N/A	**3.8.5-29:** **Bearing pressure bounded by the NI, for EPGB hand calculations are used for the dynamic bearing pressure.** **3.8.5-31:** **1. For EPGB hand calculations are used for the dynamic bearing pressure.** **4. c) Wood method used for seismic soil pressure distribution for the design of the walls.**

AREVA Path To Closure NRC Audit April 26-30, 2010 - FSAR Sections 3.7.1, 3.7.2, and 3.7.3; and Sections 3.8.1 through 3.8.5

BIN[1]	NEW RAI[2]	AUDIT SUBJECT	PATH TO CLOSURE	CLARIFICATION	ALTERNATE APPROACH
			the pressures arising from the applicable dynamic seismic time history analysis of the structure (e.g., SASSI). For the last item regarding consistency of sliding resistance at base and at side soil, the sliding stability analysis is appropriate because AREVA did not take advantage of the passive soil resistance of the side soil. For EPGB is surface mounted foundation, therefore, no wall pressures.		

[1] Disposition of Audit Items (RAI)

1. Path forward identified
   a. Agreed NRC action
   b. *Proposed AREVA action*
2. Resolved pending review of formal response **(includes final responses submitted after April 2010)**
3. Resolution path unclear
4. Not discussed

[2] New or Follow-up RAI for resolving this item or providing agreed upon response