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UniStar
NUCLEAR ENERGY

10 CFR 50.4
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May 29, 2009

UN#09-257

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI No. 58, Seismic Design Parameters
RAI No. 63, Seismic Subsystem Analysis
RAI No. 65, Seismic System Analysis
RAI No. 112, Seismic Design Parameters

References:

1) John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No. 58 SEB2 1966.doc (PUBLIC)" email dated February 17, 2009

2) John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No. 63 SEB2 1973.doc (PUBLIC)" email dated February 18, 2009

3) John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No. 65 SEB2 1971.doc (PUBLIC)" email dated February 18, 2009

4) John Rycyna (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No. 112 SEB2 2574.doc (PUBLIC)" email dated April 30, 2009

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5) UniStar Nuclear Energy Letter UN#09-210, from Greg Gibson (UniStar Nuclear Energy) to Document Control Desk, U.S. NRC, Transmittal of Schedule for Seismic Analysis and Geotechnical Schedules, dated April 22, 2009

6) UniStar Nuclear Energy Letter UN#09-228, from Greg Gibson (UniStar Nuclear Energy) to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 58, Seismic Design Parameters, RAI No. 63, Seismic Subsystem Analysis, RAI No. 65, Seismic System Analysis, dated May 1, 2009

The purpose of this letter is to respond to the requests for additional information (RAIs) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated February 17, 2009 (Reference 1), February 18, 2009 (References 2 and 3), and April 30, 2009 (Reference 4). These RAIs address Seismic Design and Analysis, as discussed in Section 3.7 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the CCNPP Unit 3 Combined License Application (COLA), Revision 4.

References 1, 2, 3, and 4 requested UniStar Nuclear Energy to respond within 30 days. Reference 5 provided a response schedule for RAIs 58, 63, 65 and 112. Reference 6 responded to some of the RAI questions associated with RAIs 58, 63, 65 and provided a revised response schedule. The enclosure to this letter provides an updated summary of the scheduled dates for responses to RAI questions associated with RAIs 58, 63, 65, and 112.

There are no regulatory commitments identified in this letter.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Michael J. Yox at (410) 495-2436.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 29, 2009

Greg Gibson

Enclosure: Response Summary for Requests for Additional Information, RAI No. 58, Seismic Design Parameters, RAI No. 63, Seismic Subsystem Analysis, RAI No. 65, Seismic System Analysis, and RAI No. 112, Seismic Design Parameters Calvert Cliffs Nuclear Power Plant Unit 3

cc: John Rycyna, NRC Project Manager, U.S. EPR COL Application
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/td/jmm

Enclosure

**Response Summary for Requests for Additional Information,
RAI No. 58, Seismic Design Parameters,
RAI No. 63, Seismic Subsystem Analysis,
RAI No. 65, Seismic System Analysis, and
RAI No. 112, Seismic Design Parameters
Calvert Cliffs Nuclear Power Plant Unit 3**

Response Summary for Requests for Additional Information

RAI Set 58 Question	Description of RAI Item	Response Date
03.07.01-1	Justify assumptions of rigid basemat in SSI analysis of Nuclear Island including lower bound soil properties (where shear wave velocity is less than 1000 fps)	September 15, 2009
	Identify impact on the SSI analysis results and on the design of the foundation mat and supported superstructure.	September 15, 2009
03.07.01-2	Provide a figure in the FSAR to depict SSI model of Nuclear Island including the model of subgrade.	July 15, 2009
	State whether or not embedment effects were considered in this analysis and, if not, what is the justification for not including them and what impact could this have on the analysis results.	September 15, 2009
	Describe the properties of the structural backfill and how the fill was modeled in the SSI analysis.	July 15, 2009
	As the groundwater table is close to the bottom of the base mat, how are groundwater effects treated in the SSI confirmatory analysis.	July 15, 2009
	Identify computer codes to perform SSI analysis of NI; provide description of codes, extent of application and basis for validation.	July 15, 2009
	Provide similar information on computer codes used in the generation of FIRS for each Category I structure.	July 15, 2009
	Provide similar information on computer codes used in seismic analysis in Section 3.7.1,3.7.2, and 3.7.3.	July 15, 2009
03.07.01-3	For EPGB and ESWB, provide methodology to calculate FIRS at grade elevation computed from the GMRS which were determined at an and applicable elevation 41 ft below grade.	August 29, 2009
	Describe computer codes, soil column model, and the basis for the shear, wave velocity of the structural backfill that supports both the EPGB and ESWB and the impact of this backfill on the development of the FIRS.	December 29, 2009

Response Summary for Requests for Additional Information

RAI Set 58 Question	Description of RAI Item	Response Date
	Provide in the FSAR the spectra at the foundation level of each structure meeting Appendix S requirements.	December 29, 2009
	Provide in the FSAR a comparison of the FIRS at the foundation level of each structure meeting the requirements of Appendix S to the CSDRS provided in the U.S. EPR FSAR.	December 29, 2009
	Provide the basis for not performing confirmatory analysis for the EPGB and ESWB similar to that for NI.	July 29, 2009
03.07.01-4	In FSAR Section 3.7.1.1.1, on page 3.0-32, it discusses the design response spectrum used to analyze the Ultimate Heat Sink (UHS) Makeup Water Intake Structure. The spectral comparison between the European Utility Requirements (EUR) soft soil spectrum scaled to 0.15 g, the RG 1.60 spectrum scaled to 0.1 g, and the ground motion response spectra (GMRS) shown in Fig. 3.7-38 indicates that the RG 1.60 spectrum and GMRS exceed the EUR spectrum at frequencies below 0.7 and 0.4, respectively. What is the corresponding comparison of displacements and velocities for these spectrum motions, and if the EUR displacements are exceeded, how will this be addressed in the design of piping and other appurtenances connected to these buildings including the design of buried utilities?	July 15, 2009
03.07.01-5	For Ultimate Heat Sink Electrical Building, provide and include in the RAI response FSAR the horizontal and vertical spectra depicting design spectra and applicable envelope.	August 29, 2009
	Provide in the FSAR a reconciliation of the design response spectrum with the horizontal foundation input response spectra (FIRS) for this structure which meets the minimum requirements of 10 CFR Part 50, Appendix S.	December 29, 2009
	Include a description of how the FIRS are developed including the soil model, soil properties, backfill properties, computer programs and analysis assumptions.	December 29, 2009
03.07.01-6	Provide in the FSAR how the design response spectrum and assumed soil properties used in the analysis of the UHS MWIS will be reconciled with the FIRS that meets the requirements of Appendix S and the final soil properties determined from the site final geotechnical studies.	September 14, 2009
	Include in the FSAR a comparison of the FIRS with the design response spectra used in the analysis.	December 29, 2009

Response Summary for Requests for Additional Information

RAI Set 58 Question	Description of RAI Item	Response Date
	Include a description of how the FIRS are developed including the soil model, soil properties, computer programs, and analysis assumptions.	December 29, 2009
03.07.01-7	Provide in the FSAR a discussion of the site-specific spectra that were considered for buried utilities.	December 29, 2009
	Provide justification for the use of the EUR soft soil spectrum including possible displacement and velocity differences that may exist with the use of this spectrum as opposed to using a site specific spectrum.	December 29, 2009
	Provide a comparison of the EUR soft soil spectrum with appropriate site specific spectra that are applicable to buried utilities.	December 29, 2009
03.07.01-8	See UniStar Nuclear Energy letter dated May 1, 2009	Response submitted
03.07.01-9	FSAR Section 3.7.1.1.1, page 3.0-32 characterizes the geotechnical data as preliminary. In general, noted throughout FSAR Section 3.7 there are issues that are to be resolved in the final detailed design. It is not clear how the site-specific structures will meet the requirements of GDC 2. Provide a table that lists the items to be resolved in the final detailed design, how the items will be closed, and how these are to be incorporated into the final version of the FSAR.	June 12, 2009
03.07.01-10	State explicitly or by reference design ground motion time histories for RAI partial Nuclear Island, EPGB and ESWB structures.	September 15, 2009
	What are the site specific design ground motions and their bases that apply to these structures? Provide this information in Section 3.7.1.1.2 of the FSAR.	December 29, 2009

Response Summary for Requests for Additional Information

RAI Set 63 Question	Description of RAI Item	Response Date
03.07.03-1	For the analysis of buried utilities, provide the following information: • Describe any computer codes used for the analysis and their application to the analysis and design of buried utilities. • Provide the soil properties used in the analysis and explain how differences in soil properties were accommodated in the analysis. • Provide the design codes and acceptance criteria for each category of buried utilities. • Describe the missile protection provided for safety-related buried utilities. • Describe how ground water effects were considered in the analysis. • For utility runs that are both above and below ground, describe how above ground inertial effects were combined with below ground seismic wave effects. • Describe how the wave velocities were determined for calculating the maximum axial strain. • Provide the basis for determining the maximum friction force per unit length of pipe.	July 15, 2009
	For the analysis of buried utilities, provide the following information: Describe how the building anchor point displacements were determined and how these were combined with seismic wave effects and soil loads	December 15, 2009

Response Summary for Requests for Additional Information

RAI Set 65 Question	Description of RAI Item	Response Date
03.07.02-1	See UniStar Nuclear Energy letter dated May 1, 2009	Response submitted
03.07.02-2	In FSAR Section 3.7.2.1.4 (Equivalent Static Load Method of Analysis) on page 3.0-35, it states that the equivalent static load method is used for the UHS EB by applying 0.5 g acceleration in all directions. Assuming the zero period acceleration (ZPA) of the design input ground motion is .35 g, provide the justification for the amplification of ground acceleration used for this structure, i.e. .5/.35, or 1.43. In addition, an assumption is made that the walls and slabs are stiff. This is used as the basis for assuming there is no additional amplification of the seismic response of the structure due to local flexibility of the structural elements. While it may be true the in-plane stiffness of the walls and slabs exceed 33 Hz, it may not be true that this is the case for their out-of-plane response. Provide the results of an analysis that demonstrates that the out-of-plane response for walls and slabs exceeds 33 Hz. Include in this analysis technical consideration of whether the walls and slabs are cracked or uncracked under the applied design loads.	June 12, 2009
03.07.02-3	Describe how the Ultimate Heat Sink Electrical Building displacements are calculated which are needed as inputs for the analysis of buried conduit, duct banks, and piping that interface with this structure.	June 12, 2009
03.07.02-4	Provide results of SSI analysis for Ultimate Heat Sink Electrical Building that meet the acceptance criteria 4.A.vii of SRP 3.7.1 and acceptance criteria 4 of SRP 3.7.2 using subgrade model of final soil and backfill properties or justify alternative.	December 29, 2009
	Include SSSI effects from UHS MWIS.	December 29, 2009
	Reconcile with the results of assumed seismic response and ISRS.	December 29, 2009

Response Summary for Requests for Additional Information

RAI Set 65 Question	Description of RAI Item	Response Date
03.07.02-5	In FSAR Section 3.7.2.3.2 (Seismic Category I Structures - Not on Nuclear Island Common Base Mat) on page 3.0-36, it describes the finite element model used in the analysis of the Ultimate Heat Sink (UHS) Makeup Water Intake Structure (MWIS). • SRP 3.7.2, SRP Acceptance Criteria 3.C.ii. states the element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results. Describe any sensitivity studies that were implemented in determining the mesh size for the UHS MWIS, and if no sensitivity study was performed provide justification for not doing so. • SRP 3.7.2, SRP Acceptance Criteria 3.D. states that in addition to the structural mass, a floor load of 244.64 kg/m2 (50 pounds/ft^2) should be included to represent miscellaneous dead weights and a mass equivalent to 25 percent of the floor design live load and 75 percent of the roof design snow load should be included in the model. Describe how this acceptance criterion has been addressed in the model of the UHS MWIS, and if no additional mass was added provide the justification for not doing so.	June 12, 2009
03.07.02-6	Describe how the SSI analysis for Ultimate Heat Sink Makeup Water Intake Structure (UHS MWIS) performed meets the acceptance criteria and 4.A.vii of SRP 3.7.1 or justify alternative.	December 29, 2009
	Provide a figure depicting the soil-structure model used for the seismic analysis.	December 29, 2009
	Provide the basis for the assumed soil properties and profile used to calculate the frequency independent impedance functions.	August 15, 2009
	Provide the method and formulas used to calculate the values of the soil springs under the foundation as well as the lateral soil springs that represent the embedment effects.	August 15, 2009
	State whether the soil properties used in the analysis are strain dependent or simply the low strain values. If these are low strain values, justify their use and quantify the impact of not using strain dependent properties on the results of the analysis. If the soil properties are strain dependent, describe how the final soil properties are determined in the analysis.	August 15, 2009

Response Summary for Requests for Additional Information

RAI Set 65 **Question**	**Description of RAI Item**	**Response Date**
	For large values of Poisson's ratio, the dynamic stiffness and damping are frequency dependent. Provide justification for assuming that the impedance functions of the supporting foundation are frequency independent.	August 15, 2009
	Confirm that the control motion is applied at the base of the soil structure analysis model.	August 15, 2009
	Provide a reconciliation of the final soil properties and the foundation input response spectra (FIRS) that are based on these properties with the seismic analysis results described in the FSAR.	December 29, 2009
03.07.02-7	In FSAR Section 3.7.1.1 (pg 3.0-29), it indicates that the Category I makeup water intake structure (MWIS) is founded below sea level. The description of the soil-structure-interaction (SSI) analysis for this structure does not describe how the ground water effects were included in the analysis. Describe how the SSI calculations included these effects, and if they did not, provide justification for not doing so and address the impact.	June 12, 2009
03.07.02-8	FSAR Section 3.7.2.3.2 states that the Ultimate Heat Sink Makeup Water Intake Structure is analyzed in GTSTRUDL. It further states that the walls "are not anticipated" to crack. Provide the basis for this statement including numerical results for typical concrete sections using the applicable wall design loads.	June 12, 2009
03.07.02-9	See UniStar Nuclear Energy letter dated March 19, 2009	Response submitted
03.07.02-10	See UniStar Nuclear Energy letter dated May 1, 2009	Response submitted

Response Summary for Requests for Additional Information

RAI Set 65 Question	Description of RAI Item	Response Date
03.07.02-11	In FSAR Section 3.7.2.4 on page 3.0-37, it states that the convective frequencies associated with sloshing effects occur in the range where the scaled down European Utility Requirements (EUR) spectra do not exceed either the CCNPP Unit 3 spectra (zero period acceleration (ZPA) of 0.067 g) or Regulatory Guide 1.60 spectra scaled to a ZPA of 0.10 g. It goes on to say that due to the lower acceleration levels at the convective frequencies and the lower convective water mass, the convective forces are anticipated to be minimal with respect to the impulsive forces. If the foundation input response spectra (FIRS) for this structure are the scaled down EUR spectra, explain why this is an appropriate response spectra for this site when the low frequency input is less than that of the ground motion response spectra (GMRS) which has a ZPA of .067 g. What is the basis for the calculation of the convective water mass? Why was this mass not included in the analysis of the UHS MWIS? How will the difference in input response spectra be resolved in determining the proper convective design loads for the structure?	June 12, 2009
03.07.02-12	Provide results of a structure-to-structure interaction analysis between UHS MWIS and EB.	December 29, 2009
03.07.02-13	In FSAR Section 3.7.2.6 (Three Components of Earthquake Motion) on page 3.0-40, it states for the Ultimate Heat Sink (UHS) Electrical Building that due to building symmetry cross-coupling is determined to be negligible. As no dynamic analysis was performed for this structure, what is the justification for this statement?	June 12, 2009
03.07.02-14	See UniStar Nuclear Energy letter dated May 1, 2009	Response submitted
03.07.02-15	In FSAR Section 3.7.2.6 on page 3.0-40, it states that for the Ultimate Heat Sink (UHS) Makeup Water Intake Structure (MWIS), three statistically independent time histories are applied for each of the six soil cases to determine accelerations at select locations. Describe how the accelerations obtained from this dynamic analysis are applied to the static model to obtain forces and moments for structural design and provide examples of how the three components of earthquake motion are combined and compare the results to those of the 100-40-40 rule presented in RG 1.92, Revision 2. The use of an equivalent static approach to determine forces and moments in the structure may not be conservative as dynamically computed forces and moments will retain the appropriate sign from the analysis and the static approach will not. How will this be addressed in the development of loads used in the design of the structure?	July 15, 2009
03.07.02-16	See UniStar Nuclear Energy letter dated March 19, 2009	Response submitted

Response Summary for Requests for Additional Information

<table>
<tr><th>RAI Set 65

Question</th><th>Description of RAI Item</th><th>Response Date</th></tr>
<tr><td>03.07.02-17</td><td>The interaction of non-seismic Category I structures with Seismic Category I systems is described in FSAR Section 3.7.2.8. In this section on page 3.0-41, it states that fire protection SSCs are categorized as either Seismic Category II-SSE, meaning the SSC must remain functional during and after a Safe Shutdown Earthquake (SSE), or Seismic Category II, meaning the SSC must remain intact after an SSE without deleterious interaction with a Seismic Category I or Seismic Category II-SSE SSC. In the U.S. EPR FSAR on page 3.7-95, it states that Seismic Category II is designed to the same criteria as Seismic Category I structures. In SRP 3.7.2, SRP Acceptance Criteria 8, which addresses the interaction of non-Category I structures with Category I SSCs, it states that when non-Category I structures are designed to prevent failure under SSE conditions; the margin of safety shall be equivalent to that of the Seismic Category I structure.

• Describe how this margin of safety is achieved for the Seismic Category II-SSE and Seismic Category II portions of the fire protection system. Include in your response the seismic inputs, loading combinations, codes and acceptance criteria. What are the differences in the method of design for these two seismic categories?

• Describe the basis and provide figures in the FSAR of the design response spectra used to analyze above ground seismic Category II and seismic Category II-SSE fire protection SSCs including the fire protection tanks.

• What are the methods of analysis and acceptance criteria for both the buried and above ground portions of the fire protection system that are Seismic Category II-SSE that will ensure that these portions of the system will remain functional following an SSE event?

• What are the modeling and analysis methods used for the fire protection tanks and to what extent do the fire protection tanks meet the acceptance criteria of SRP 3.7.3, SRP Acceptance Criteria 14.A. thru J? When the tank analysis does not meet the acceptance criteria; provide the technical justification for not doing so.</td><td>June 12, 2009</td></tr>
<tr><td rowspan="2">03.07.02-18</td><td>Clarify the seismic classification of fire protection tank and building.</td><td>July 29, 2009</td></tr>
<tr><td>Reconcile the U.S. EPR seismic analysis for NAB with the site-specific soil properties and foundation input response spectra (FIRS)</td><td>September 15, 2009</td></tr>
</table>

Response Summary for Requests for Additional Information

RAI Set 65 **Question**	**Description of RAI Item**	**Response Date**
	Demonstrate in the FSAR that the displacement of this structure relative to the nuclear island common basemat structure is enveloped by the results of the U.S. EPR analysis.	September 15, 2009
03.07.02-19	In FSAR Section 3.7.2.8 on page 3.0-42 it states that the conventional seismic switchgear building, conventional seismic grids systems control building, the conventional seismic circulating water intake structure and the Seismic Category II retaining wall surrounding the CCNPP Unit 3 intake channel could potentially interact with Seismic Category I SSCs. For each of the above structures, describe in the FSAR how the seismic interaction acceptance criteria of SRP 3.7.2, SRP Acceptance Criteria 8 are met, or justify an alternative. If they are intended to meet criterion B, provide the technical basis for the determination that the collapse of the non-Category I structure is acceptable. For criterion C, confirm that the structure will be analyzed and designed to have a margin of safety equivalent to that of a Category I structure and state how this will be accomplished.	June 12, 2009
03.07.02-20	In FSAR Section 3.7.2.8 on page 3.0-42, it states that the existing non-seismic bulkhead could potentially interact with the Ultimate Heat Sink (UHS) Makeup Water Intake Structure and UHS Electrical Building. Identify and describe the methods used to determine that this structure will not have any unacceptable interaction with either of the Seismic Category I structures?	June 12, 2009
03.07.02-21	See UniStar Nuclear Energy letter dated May 1, 2009	Response submitted
03.07.02-22	See UniStar Nuclear Energy letter dated March 19, 2009	Response submitted
03.07.02-23	At the end of FSAR Section 3.7.2.15, on page 3.0-44, there is a description of a comparison of an analysis result using ANSYS to solve the complex eigen-value solution of the non-classical damping formulation with an analysis result using GT STRUDL to solve the real eigen-value solution of the classical damping formulation in which the off-diagonal terms of the damping matrix are neglected. It is not clear from the discussion which of the damping methods was used in the seismic analysis of the Ultimate Heat Sink (UHS) Makeup Water Intake Structure (MWIS). In addition, no comparison of the results using the two methods cited has been provided. Provide the method used to account for damping in the seismic analysis of the UHS MWIS and provide in the FSAR the results of the study comparing the non-classical damping formulation with the classical damping formulation.	June 12, 2009

Response Summary for Requests for Additional Information

RAI Set 65 Question	Description of RAI Item	Response Date
03.07.02-24	Per COLA item 3.7-1, address that the seismic response of the nuclear island common base mat structures, seismic Category II structures, the Nuclear Auxiliary Building and the Radioactive Waste Processing Building is within the parameters of Section 3.7 of U.S. EPR FSAR.	September 15, 2009
	Provide a summary for each structure, either directly or by reference, September 15, which describes how the COL item is met.	September 15, 2009
03.07.02-25	See UniStar Nuclear Energy letter dated May 1, 2009	Response submitted
03.07.02-26	SRP 3.7.2, SRP Acceptance Criteria 14 states that the determination of seismic overturning moments and sliding forces should include three components of input motion and conservative consideration of the simultaneous action of the vertical and horizontal seismic forces. How overturning moments and sliding forces are determined has not been provided in either FSAR Section 3.7.2, 3.8.5 or in Section 3E.4. The applicant is requested to provide this information in Section 3.7.2 and describe how this information is used in determining the overturning and sliding stability of the Ultimate Heat Sink (UHS) Makeup Water Intake Structure and UHS Electrical Building.	June 12, 2009

Response Summary for Requests for Additional Information

RAI Set 112 Question	Description of RAI Item	Response Date
03.07.01-11	Provide a definition of site SSE and explain how it meets regulation requirements.	September 15, 2009
	Consistent with the site SSE, provide the FIRS in the free field at the foundation level of each structure meeting the requirements of Appendix S, and describe how each is determined.	September 15, 2009 (NI) December 15, 2009 (EPGB, ESWB)
	For the U.S. EPR Certified Design structures, provide a comparison of the results of the site seismic analyses using the FIRS input motion defined at the foundation level of each structure, with the analyses results documented in the U.S. EPR FSAR.	September 15, 2009 (NI) December 29, 2009 (EPGB, ESWB)
	For the EPGB and ESWB, describe how the effect of structure-soil-structure interaction has been accounted for in the analysis of these buildings.	December 29, 2009 (EPGB, ESWB)