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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

February 1, 2012

UN#12-010

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 308, Foundations

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI No. 308 SEB2 5748" email dated May 23, 2011

2) UniStar Nuclear Energy Letter UN#11-290, from Mark T. Finley to Document Control Desk, U.S. NRC, Updated RAI Closure Plan, dated November 30, 2011

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated May 23, 2011 (Reference 1). This RAI addresses Foundations, as discussed in Section 03.08.05 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 7.

The enclosure provides our response to RAI No. 308, Question 03.08.05-8 related to the foundation of the Nuclear Island and includes COLA markups. Note that COLA markups to FSAR Section 2.5.4.10.2 will be later supplemented with the Response to RAI 308 Question 03.08.05-09, scheduled for submittal by November 5, 2012, (Reference 2) once the foundation analysis of the Essential Service Water Buildings (ESWBs) is finalized. The response to RAI No. 308, Question 03.08.05-8, also includes a COLA markup which deletes reference to the Emergency Power Generating Building (EPGB) and the ESWB in the Maximum Settlement row

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of FSAR Table 2.0-1. The EPGB and the ESWB will be re-inserted into FSAR Table 2.0-1 as part of the RAI 308 Question 03.08.05-09 response.

Our response does not include any new regulatory commitments. This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 369-1907, or Mr. Wayne A. Massie at (410) 369-1910.

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

Executed on February 1, 2012

Mark T. Finley

Enclosure: Response to NRC Request for Additional Information RAI No. 308, Question 03.08.05-8, Foundations, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn-Willingham, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Patricia Holahan, Acting Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
David Lew, Deputy Regional Administrator, NRC Region I (w/o enclosure)

MTF/AJF/mdf

Enclosure

Response to NRC Request for Additional Information
RAI No. 308, Question 03.08.05-8, Foundations
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 308

Question 03.08.05-8

03.08.05-8

SRP Acceptance Criteria 3.8.5.II.4 discusses information on the design and analysis procedures for Seismic Category I foundations, including the consideration of settlement. In RAI number 03.08.05-2, the staff requested that the applicant provide additional information on the site-specific settlement analysis for the Nuclear Island (NI) common basemat structure, since Rev. 3 of the CCNPP Unit 3 FSAR indicated that the site-specific differential settlements of the NI foundation basemat exceed the EPR differential settlement limit.

The staff reviewed the RAI response to Question 03.08.05-2 provided in UniStar Letter UN#11-085 dated February 22, 2011 (ML110560307). The RAI response addressed most of the staff's original questions. However, the staff notes that the issue of differential settlements of Seismic Category I structures is still under discussion as part of the U.S. EPR Design Certification (DC) review, and the most recent draft RAI response submittal for Question 03.08.05-22 by AREVA provides updated information on settlement evaluations of Seismic Category I structures. Therefore, the staff requests that the applicant, after the official publication of the new COL items proposed by the AREVA draft submittal, explain how the new and updated COL Items regarding settlements of the NI common basemat structure will be addressed. Confirm also that the same U.S. EPR models, methodology, and procedures will be used for the site-specific analysis. Also explain what site-specific conditions will be considered and how the site-specific soil case is compared to the soil cases considered in U.S. EPR's settlement evaluation for the NI common basemat structure. The staff needs the information to be able to conclude in the SER that there is reasonable assurance that the foundation design of the Seismic Category I structure is consistent with SRP Acceptance Criteria 3.8.5.II.4, and has been adequately addressed in the CCNPP Unit 3 FSAR.

Response

A site specific assessment of the predicted settlement across the basemat of Seismic Category I structures during and post construction has been performed as required by U.S. EPR FSAR Tier 2 Table 1.8-2, COL Item 2.5-12. The predicted settlement of the Nuclear Island (NI) Common Basemat is used to evaluate the CCNPP Unit 3 settlement as described in U.S. EPR FSAR Tier 2 Table 1.8-2, COL Items 2.5-7 and 3.8-18.

CCNPP Unit 3 uses the same construction sequence, models, methodology and procedures as described in U.S. EPR FSAR, Revision 3, Tier 2 Sections 3.8.5.4.1 and 3.8.5.4.2 to evaluate the predicted settlement.

The CCNPP Unit 3 predicted settlement profiles are the same as the differential settlement contour plots included in the U.S. EPR FSAR Tier 2, Figures 3.8-122 through 3.8-134, due to the soil spring data inputs being identical. The U.S. EPR FSAR analyzes the CCNPP Unit 3 site-specific conditions as the representative soft soil case and incorporates the CCNPP Unit 3 basemat displacements into the U.S. EPR design. Therefore, the CCNPP Unit 3 predicted settlement profiles for the NI Common Basemat are enveloped by the U.S. EPR FSAR settlement profiles. Comparison directly to a specific soil profile in the U.S. EPR is not necessary.

Site-specific considerations which account for short and long term effects of settlement include the effects of dewatering, excavation, foundation material preparation, umbilical connections, sequence of placing the basemat, and site-specific construction sequence of the superstructure. These considerations conform to the requirements specified in U.S. EPR FSAR Tier 2, Table 1.8-2, COL item 2.5-12 and CCNPP Unit 3 FSAR Section 2.5.4.10.2.

CCNPP Unit 3 COLA FSAR Sections 3.8.5.4.1 and 3.8.5.4.2 state that no departures or supplements are made from the U.S. EPR FSAR.

The U.S. EPR Tier 2 Table 1.8-2 COL Item 3.8-18 requires that the resulting angular distortion of the CCNPP Unit 3 site-specific settlement analysis be compared to the U.S. EPR Design Certification settlement analysis to determine the adequacy of the CCNPP Unit 3 basemat displacements. As discussed previously, this is not necessary as site-specific soil spring data for CCNPP Unit 3 is the same as that which was used in the U.S. EPR FSAR site-specific settlement analysis.

Since the input data for the settlement analysis is the same for both the U.S. EPR FSAR and for CCNPP Unit 3, the resulting angular distortion values and displacement contour plots of the basemat are the same. The U.S. EPR design envelops the site-specific soil data of CCNPP Unit 3. No further analysis or comparison needs to be made for the CCNPP Unit 3 NI basemat regarding soil settlement.

COLA Impact

FSAR Table 1.8-2 is being updated with the revision of COL Item 2.5-7 as follows:

Table 1.8-2—FSAR Sections that Address COL Items

Item No	Description	Section
...	...	...
2.5-6	A COL applicant that references the U.S. EPR design certification will present site-specific information about the properties and stability of soils and rocks that may affect the nuclear power plant facilities under both static and dynamic conditions, including the vibratory ground motions associated with the CSDRS and the site specific SSE.	2.5.4
2.5-7	A COL applicant that references the U.S. EPR design certification will verify that the predicted ~~differential~~tilt settlement value of 1/2 in per 50 ft in any direction across the foundation basemat of a Seismic Category I structure is not exceeded. Settlement values larger than this may be demonstrated acceptable by performing additional site-specific evaluations.	2.5.4.10.2
...	...	...

FSAR Table 1.8-2 is being updated with the addition of COL Items 2.5-12 and 3.8-18 as follows:

Table 1.8-2—FSAR Sections that Address COL Items

Item No	Description	Section
...	...	...
2.5-12	A COL applicant that references the U.S. EPR design certification will provide an assessment of predicted settlement values across the basemat of Seismic Category I structures during and post construction. The assessment will address both short term (elastic) and long term (heave and consolidation) settlement effects with the site specific soil parameters, including the soil loading effects from adjacent structures.	2.5.4.10.2
3.1-1	A COL applicant that references the U.S. EPR design certification will identify the site-specific QA Program Plan that demonstrates compliance with GDC-1.	3.1.1.1.1
...	...	...
3.8-18	A COL applicant that references the U.S. EPR design certification will compare the NI common basemat site-specific predicted angular distortion to the angular distortion in the relative differential settlement contours in U.S. EPR FSAR Figure 3.8-124 through Figure 3.8-134, using methods described in U.S. Army Engineering Manual 1110-1-1904. The comparison is made throughout the basemat in both the east-west and north-south directions. If the predicted angular distortion of the NI common basemat structure is less than the angular distortion shown for each of the construction steps, the site is considered acceptable. Otherwise, further analysis will be required to demonstrate that the structural design is adequate.	3.8.5.5.1
3.9-1	A COL applicant that references the U.S. EPR design certification will submit the results from the vibration assessment program for the U.S. EPR RPV internals, and piping systems specified in U.S. EPR FSAR Tier 2, Section 3.9.2.1, in accordance with RG 1.20.	3.9.2.4
...	...	...

CCNPP Unit 3 COLA FSAR Table 2.0-1 will be revised as shown in a future revision of the COLA:

	U.S. EPR FSAR Design Parameter Value	**CCNPP Unit 3 Site Characteristic Value**
...	...	...
Slope Failure Potential	No slope failure potential is considered in the design of safety-related SSCs for U.S. EPR design certification.	No slope failure potential that would adversely affect the safety of the proposed CCNPP Unit 3 (See Section 2.5.5)
~~Maximum Differential Settlement (across the basemat)~~	~~1/2 inch in 50 feet in any direction~~	~~1/2-1 inch in 50 ft for common Basemat. (note a) (See Sections 2.5.4 and 3.8.5.5.1)~~ ~~> 1/2 inch in 50 ft for both EPGB and ESWB (note a) (See Sections 2.5.4, 3.8.5.5.2, and 3.8.5.5.3)~~
Maximum Settlement (across the basemat) - Differential Settlement - Tilt Settlement	U.S. EPR FSAR Figures 3.8-124 through 3.8-136 ½ inch in 50 feet in any direction	See Section 3.8.5.5.1 for NI. Less than ½ inch in 50 feet in any direction of NI Common Basemat. See Section 2.5.4.10.2
Maximum Ground Water	3.3 ft below grade	Approximately 30 feet below grade (See Section 2.4.12.5)
...	...	...

Notes:

a. ~~Value is a departure from a design parameter and is listed in Part 7 of the COL Application. Justification is provided in Chapter 3~~Not used.

COLA FSAR Section 2.5.4.10.2 will be revised as follows:

2.5.4.10.2 Settlement

The U.S. EPR FSAR includes the following COL Items in Section 2.5.4.10.2:

> A COL Applicant that references the U.S. EPR design certification will provide an assessment of predicted settlement values across the basemat of Seismic Category I structures during and post construction. The assessment will address both short term (elastic) and long term (heave and consolidation) settlement effects with the site specific soil parameters, including the soil loading effects from adjacent structures.
>
> A COL applicant that references the U.S. EPR design certification will verify that the ~~differential~~tilt settlement value of 1/2 inch per 50 ft in any direction across the foundation basemat of a Seismic Category I structure is not exceeded. Settlement values larger than this may be demonstrated acceptable by performing additional site specific evaluations.

~~This~~These COL Items ~~is~~are addressed as follows:

...

Conclusions – Settlement Analysis

...

The U.S. EPR FSAR Section 2.5.4.10.2 identifies ~~differential~~tilt settlement as a required parameter to be enveloped, defined as "½ inch per 50 ft in any direction across the foundation basemat of a Seismic Category I structure" and that "values larger than this may be demonstrated acceptable by performing additional site specific evaluations."

The estimated ~~differential~~tilt settlements for ESWB 1 and ESWB 2 do not meet the U.S. EPR FSAR requirement of ½ inch per 50 ft (or 1/1,200) and EPGB 1 is at ½ inch per 50 ft (see Table 2.5-69); however, additional site specific evaluations will be performed to demonstrate their acceptability, as follows.

To verify that foundations perform according to estimates, and to provide an ability to make corrections, if needed, major structure foundations are monitored for rate of movement during and after construction.

Foundations are designed to safely tolerate the anticipated total and differential settlements. Additionally, engineering measures are incorporated into design for control of differential movements between adjacent structures, piping, and appurtenances sensitive to movement, consistent with settlement estimates. This includes the development and implementation of a monitoring plan that supplies and requires evaluation of information throughout construction and post-construction on ground heave, settlement, pore water pressure, foundation pressure, building tilt, and other necessary data. This information provides a basis for comparison with design conditions and for projections of future performance.

The estimated differential settlements represent departures from the U.S. EPR FSAR requirements. Additional discussion of the acceptability of these estimated differential settlements is provided in Section 3.8.5.

COLA FSAR Section 3.8.5.5.1 will be revised as follows:

3.8.5.5.1 Nuclear Island Common Basemat Structure Foundation Basemat

The U.S. EPR FSAR included the following COL Item in Section 3.8.5.5.1:

A COL Applicant that references the U.S. EPR design certification will compare the NI common basemat site-specific predicted angular distortion to the angular distortion in the relative differential settlement contours in Figure 3.8-124 through U.S. EPR FSAR Figure 3.8-134, using methods described in U.S. Army Engineering Manual 1110-1-1904. The comparison is made through the basemat in both the east-west and north-south directions. If the predicted angular distortion of the basemat of the NI common basemat structure is less than the angular distortion shown for each of the construction steps, the site is considered acceptable. Otherwise, further analysis will be required to demonstrate that the structural design is adequate.

The COL Item is addressed as follows:

{The Calvert Cliffs Unit 3 site-specific soil spring values are the same as the values used in the U.S. EPR Standard Plant settlement analysis. Due to these input values being the same as well as the construction sequence, models, methodologies, and procedures, the predicted angular distortion of the NI common basemat structure is the same for both CCNPP Unit 3 and the U.S. EPR Standard Plant.}

~~{The following departure is taken from U.S. EPR FSAR Section 3.8.5.5.1.~~

~~The standard design of Seismic Category I foundations for the U.S. EPR is based on a maximum differential settlement of ½ inch in 50 ft in any direction across the foundation. These standard design values are specified in the U.S. EPR FSAR Sections 2.5.4.10.2 and 3.8.5.5.1, and tabulated in U.S. EPR FSAR Tier 1 Table 5.0-1. The expected site-specific values for settlement of the CCNPP Unit 3 NI Common basemat foundation are in the range of 1/600 (1 inch in 50 ft) to 1/1200 (½ inch in 50 ft) as stated in Section 2.5.4.~~

~~To account for the Calvert Cliffs site-specific expected differential settlement values, an evaluation of differential settlements up to 1 inch in 50 ft was performed. A static analysis was performed of the foundation structures assuming this site-specific differential settlement value. The static analysis was performed using the same finite element model developed by AREVA for the standard plant differential settlement criteria of ½ inch in 50 ft. The finite element model is analyzed using the QA verified software ANSYS V10.0 SP1.~~

~~The evaluation consisted of a static finite element analysis of the foundation structures which considered the effects of the higher expected displacement (tilt) on the foundation bearing pressures and basemat stress due to structural eccentricities resulting from a uniform rotation of the foundation mat along the axis of the NI Common basemat. The evaluation assumed no changes in the soil stiffness or increased flexure due to differential settlement consistent with the design analysis for the standard U.S. EPR design. The evaluation considered Soil Case~~

~~SC15, from the U.S. EPR FSAR standard design, which represented the softest soil condition used in the U.S. EPR standard plant design and exhibits the largest differential displacements of the basemat.~~

~~The displacement is defined per length of the structure, 1 inch in 50 ft. The displacement of the NI common basemat is greatest along the North/South axis at the Fuel Building (FB) and least along this axis at Safeguard Building 2 and 3 (SB 2/3). Therefore, the NI model is rotated around the X-axis (West/East axis). The overall length of the NI basemat from the North end to the South end is approximately 344 ft (105 m). Since an initial settlement of 1 inch in 50 ft is considered, the NI structure has an initial displacement of approximately 7.0 inches (17.8 cm), or approximately 0.1 degrees.~~

~~Results from the evaluation indicate there is negligible difference in both the soil bearing pressures and the stresses in the concrete basemat structure when the NI is subjected to an initial settlement of 1 inch in 50 ft as compared to an initial settlement of ½ inch in 50 ft established in the U.S. EPR standard plant.~~

~~There is a negligible difference in both the bearing pressures and the stresses in the basemat when the NI is subjected to structural eccentricities associated with a 7 inch (17.8 cm) basemat differential displacement representing a settlement value of 1 inch in 50 ft. Therefore, the site-specific departure in differential settlement values is structurally acceptable.}~~

CCNPP Unit 3 COLA Part 7, Departures and Exemption Requests Section 1.1.1 and 1.2.1 will be revised as shown in a future revision of the COLA:

1.1.1 MAXIMUM ~~DIFFERENTIAL~~TILT SETTLEMENT (ACROSS THE BASEMAT)

Affected U.S. EPR FSAR Sections: Tier 1 Table 5.0-1, Tier 2 Table 2.1-1, Tier 2 Section 2.5.4.10.2

Summary of Departure:

The U.S. EPR FSAR identifies a maximum ~~differential~~tilt settlement of 1/2 inch in 50 feet (i.e., 1/1200) in any direction across the basemat. The estimated settlement values for ~~the Nuclear Island common basemat,~~ Emergency Generating Building foundations~~,~~ and Essential Service Water System Cooling Tower foundations exceed the U.S. EPR FSAR value.

Extent/Scope of Departure:

This Departure is identified in CCNPP Unit 3 FSAR Table 2.0-1 and Section 2.5.4.10.2.

Departure Justification:

~~The estimated site-specific values for settlement of the CCNPP Unit 3 Nuclear Island common basemat foundation are in the range of 1/600 (1 inch in 50 feet) to 1/1200 (1/2 inch in 50 feet) as stated in FSAR Section 2.5.4.10.2.~~

~~As described in FSAR Section 3.8.5.5.1, to account for the Calvert Cliffs site-specific expected differential settlement values, an evaluation of differential settlements up to 1/600 (1 inch in 50 feet) was performed. The evaluation consisted of a static finite element analysis of the foundation structures which considered the effects of the higher expected displacement (tilt) on the foundation bearing pressures and basemat stress due to structural eccentricities resulting from a uniform rotation of the foundation mat along the axis of the nuclear island common basemat. The evaluation assumed no changes in the soil stiffness or increased flexure due to differential settlement consistent with the design analysis for the standard U.S. EPR design. The evaluation considered Soil Case SC15, from the U.S. EPR FSAR standard design, which represented the softest soil condition used in the U.S. EPR standard plant design and exhibits the largest differential displacements of the basemat. Results from the evaluation indicate there is negligible difference in both the soil bearing pressures and the stresses in the concrete basemat structure when the Nuclear Island is subjected to an initial settlement of 1/600 (1 inch in 50 feet) as compared to the U.S. EPR standard plant analysis results that were based on an initial settlement of 1/1200 (1/2 inch in 50 feet). Therefore, the site specific departure in differential settlement values is structurally acceptable.~~

The estimated site-specific ~~differential~~tilt settlement for the Emergency Power Generating Buildings and Essential Service Water System Cooling Towers (based on a fully flexible basemat) are 1/1166 and 1/845 (approximately ½ and ¾ inch in 50 ft), respectively, as stated in FSAR Section 2.5.4.10.2.

As described in Sections FSAR 3.8.5.5.2 and 3.8.5.5.3, finite element analyses were performed for the Emergency Power Generating Buildings and Essential Service Water System Cooling Towers using soil springs representing the CCNPP Unit 3 site. For each structure, the ~~differential~~tilt settlement within the confines of the building periphery is shown to be substantially less than the 1/1200 (1/2 inch in 50 feet) requirement of the U.S. EPR FSAR.

The variation of the finite element analysis ~~differential~~tilt settlement with the estimated ~~differential~~tilt settlements of Section 2.5.4.10.2 is attributed to the conventional geotechnical treatment of the foundation as a flexible plate, a condition much more conservative than the actual heavily stiffened (by deep reinforced concrete walls) 6'-0" thick reinforced concrete Emergency Power Generating Building and Essential Service Water System Cooling Tower basemats.

Finite element analyses were also performed to evaluate the effects of overall Emergency Power Generating Building and Essential Service Water System Cooling Tower tilts of L/550 and L/600, respectively, where L is the least basemat dimension. For these analyses:

- Spring stiffnesses are adjusted to achieve a tilt of L/550,

- The elliptical distribution of soil springs is maintained,
- Soil spring stiffnesses along the basemat centerline (perpendicular to the direction of tilt) are retained, and
- Adjustment is made to all other springs as a function of the distance from the basemat centerline to the edges.

Bending moments from these finite element analyses confirm that an uncracked condition of the Emergency Power Generating Building and Essential Service Water System Cooling Tower basemats is maintained.

Departure Evaluation:

This Departure, associated with the maximum ~~differential~~tilt settlement of ~~the Nuclear Island common basemat,~~ the Emergency Power Generating Building foundations~~,~~ and Essential Service Water System Cooling Tower foundations, has been evaluated and determined to not adversely affect the safety function of these structures. Accordingly, the Departure does not:

1. Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the plant-specific FSAR;
2. Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety and previously evaluated in the plant-specific FSAR;
3. Result in more than a minimal increase in the consequences of an accident previously evaluated in the plant-specific FSAR;
4. Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the plant-specific FSAR;
5. Create a possibility for an accident of a different type than any evaluated previously in the plant-specific FSAR;
6. Create a possibility for a malfunction of an SSC important to safety with a different result than any evaluated previously in the plant-specific FSAR;
7. Result in a design basis limit for a fission product barrier as described in the plant-specific FSAR being exceeded or altered;
8. Result in a departure from a method of evaluation described in the plant-specific; or
9. FSAR used in establishing the design bases or in the safety analyses.

This Departure does not affect resolution of a severe accident issue identified in the plant-specific FSAR.

Therefore, this Departure has no safety significance.

and

1.2.1 MAXIMUM ~~DIFFERENTIAL~~TILT SETTLEMENT (ACROSS THE BASEMAT)

Applicable Regulation: 10 CFR Part 52

The U.S. EPR FSAR Tier 1 Table 5.0-1, Tier 2 Table 2.1-1, and Tier 2 Section 2.5.4.10.2 identify a maximum ~~differential~~tilt settlement of ½ inch in 50 feet (i.e., 1/1200) in any direction across the basemat. The estimated settlement values for ~~the Nuclear Island common basemat,~~ Emergency Generating Building foundations~~,~~ and Essential Service Water System Cooling Tower foundations exceed the U.S. EPR FSAR value.

Pursuant to 10 CFR 52.7 and 10 CFR 52.93, Calvert Cliffs 3 Nuclear Project, LLC, and UniStar Nuclear Operating Services, LLC, request an exemption from compliance with the U.S. EPR FSAR Tier 1 and 2 requirements associated with the maximum ~~differential~~tilt settlement.

Discussion:

~~The estimated site-specific values for settlement of the CCNPP Unit 3 Nuclear Island common basemat foundation are in the range of 1/600 (1 inch in 50 feet) to 1/1200 (½ inch in 50 feet) as stated in FSAR Section 2.5.4.10.2.~~

~~As described in FSAR Section 3.8.5.5.1, an evaluation of differential settlements up to 1/600 (1 inch in 50 feet) was performed. The evaluation consisted of a static finite element analysis of the foundation structures which considered the effects of the higher expected displacement (tilt) on the foundation bearing pressures and basemat stress due to structural eccentricities resulting from a uniform rotation of the foundation mat along the axis of the nuclear island common basemat. The evaluation assumed no changes in the soil stiffness or increased flexure due to differential settlement consistent with the design analysis for the standard U.S. EPR design. The evaluation considered Soil Case SC15, from the U.S. EPR FSAR standard design, which represented the softest soil condition used in the U.S. EPR standard plant design and exhibits the largest differential displacements of the basemat. Results from the evaluation indicate there is negligible difference in both the soil bearing pressures and the stresses in the concrete basemat structure when the Nuclear Island is subjected to an initial settlement of 1/600 (1 inch in 50 feet) as compared to the U.S. EPR standard plant analysis results that were based on an initial settlement of 1/1200 (½ inch in 50 feet). Therefore, the site specific departure in differential settlement values is structurally acceptable.~~

The estimated site-specific ~~differential~~tilt settlement for the Emergency Power Generating Buildings and Essential Service Water System Cooling Towers (based on a fully flexible basemat) are 1/1166 and 1/845 (approximately ½ inch and ¾ inch in 50 ft), respectively, as stated in FSAR Section 2.5.4.10.2.

As described in Sections FSAR 3.8.5.5.2 and 3.8.5.5.3, finite element analyses were performed for the Emergency Power Generating Buildings and Essential Service Water System Cooling Towers using soil springs representing the CCNPP Unit 3 site. For each structure, the ~~differential~~tilt settlement within the confines of the building periphery is shown to be substantially less than the 1/1200 (½ inch in 50 feet) requirement of the U.S. EPR FSAR.

The variation of the finite element analysis ~~differential~~tilt settlement with the estimated ~~differential~~tilt settlements of Section 2.5.4.10.2 is attributed to the conventional geotechnical treatment of the foundation as a flexible plate, a condition much more conservative than the actual heavily stiffened (by deep reinforced concrete walls) 6'-0" thick reinforced concrete Emergency Power Generating Building and Essential Service Water System Cooling Tower basemats.

Finite element analyses were also performed to evaluate the effects of overall Emergency Power Generating Building and Essential Service Water System Cooling Tower tilts of L/550 and L/600, respectively, where L is the least basemat dimension. For these analyses:

- Spring stiffnesses are adjusted to achieve a tilt of L/550,
- The elliptical distribution of soil springs is maintained,
- Soil spring stiffnesses along the basemat centerline (perpendicular to the direction of tilt) are retained, and
- Adjustment is made to all other springs as a function of the distance from the basemat centerline to the edges.

Bending moments from these finite element analyses confirm that an uncracked condition of the Emergency Power Generating Building and Essential Service Water System Cooling Tower basemats is maintained.

This change associated with the maximum ~~differential~~tilt settlement of ~~the Nuclear Island common basemat, the~~ Emergency Power Generating Building foundations~~,~~ and Essential Service Water System Cooling Tower foundations, has been evaluated and determined to not adversely affect the safety function of these structures. Therefore, this change will not result in a significant decrease in the level of safety otherwise provided by the design described in the U.S. EPR FSAR.

The exemption is not inconsistent with the Atomic Energy Act or any other statute. As such, the requested exemption is authorized by law.

This change does not result in a departure from the design and does not require a change in the design described in the U.S. EPR FSAR. In addition, the change has been evaluated and determined to not adversely affect the safety function of the associated structures. Therefore, the requested exemption will not present an undue risk to the public health and safety.

The change does not relate to security and does not otherwise pertain to the common defense and security. Therefore, the requested exemption will not endanger the common defense and security.

The special circumstance necessitating the request for exemption is that the CCNPP Unit 3 ~~Nuclear Island common basemat, the~~ Emergency Power Generating Building foundations~~,~~ and Essential Service Water System Cooling Tower foundations estimated settlement values exceed the U.S. EPR FSAR value. However, the CCNPP Unit 3 specific maximum ~~differential~~tilt settlement of

~~the Nuclear Island common basemat,~~ the Emergency Power Generating Building foundations~~,~~ and Essential Service Water System Cooling Tower foundations, has been evaluated and determined to not adversely affect the safety function of these structures. As such, application of the regulation for this particular circumstance would not serve the underlying purpose of the rule and is not required to achieve the underlying purpose of the rule.

This requested exemption does not require a change in the design described in the U.S. EPR FSAR. Therefore, this exemption will not result in any loss of standardization.

For these reasons, Calvert Cliffs 3 Nuclear Project, LLC, and UniStar Nuclear Operating Services, LLC, request approval of the requested exemption from compliance with the U.S. EPR FSAR Tier 1 and 2 requirements associated with maximum ~~differential~~tilt settlement.