ZIONSOLUTIONS LLC
An EnergySolutions Company

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U.S. Nuclear Regulatory Commission
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Zion Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-39 and DPR-48
NRC Docket Nos. 50-295 and 50-304

Subject: Response to Requests for Additional Information for Questions 3 and 6 and Schedule for Submittal of Remaining Responses

Reference: 1. Request For Additional Information Regarding The Upgraded Fuel Handling Building Crane System As A Single-Failure Proof Crane For Zion Nuclear Power Station, Unit 1 And 2 (Tac Nos. J00433 and J00434), dated December 18, 2012

Zion*Solutions,* LLC (ZS) has reviewed the subject Requests for Additional Information and has attached responses to Questions 3 and 6 to this letter.

Questions 1, 2 and 4 require revision to a contractor document to record the results of additional calculations in order to show that the interaction ratios are less than 1.0. The preliminary calculations have been performed and show that the interaction ratios are less than 1.0. Question 5 also requires an update to a contractor document.

The remaining responses to Questions 1, 2, 4, and 5 will be provided by February 15, 2013.

If you have any questions, please call Mr. Jack Bailey at (224) 789-4138.

Respectfully,

Patrick S. Thurman, Esq.
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cc: John Hickman, USNRC Senior Project Manager
Service List

Attachment 1: Responses to RAIs 3 and 6

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RAI # 3

Question received from, NRC on December 18, 2012:

Section II.3 of Standard Review Plan (SRP) Section 3.7.2 states the following: "If the OBE is set at one-third or less of the SSE, an explicit response or design analysis is not required. If the OBE is set at a value greater than one-third of the SSE, an analysis and design must be performed to demonstrate that the applicable stress, strain, and deformation limits are satisfied." Please, confirm that ZNPS has met the guidance stipulated by SRP 3.7.2, Section II.3, and provide the results and the references confirming that this provision has been satisfied. If ZNPS did not consider the aforementioned SRP criteria, provide the OBE results that were omitted from the analysis.

Response:

The Zion Station Defueled Safety Analysis Report (DSAR) defines only a Design Basis Earthquake for the facility that is currently undergoing decommissioning and the seismic response curves for the facility provided in the DSAR are equivalent to the Safe Shutdown Earthquake (SSE) response used as the original design basis for the facility. There is no Operating Basis Earthquake (OBE) or Safe Shutdown (SSD) identified. This position was accepted by the NRC in its Safety Evaluation Report (SER) (Amendments 180 and 167 respectively for Units 1 and 2). The SER states "The specification also notes that other SSCs are designed to withstand an operational basis earthquake or per applicable codes, and are defined as Seismic Class 2 or 3. These descriptions are not included in the PDTS since safe shutdown, post accident containment isolation, LOCAs, and the ability of the reactor to withstand an earthquake and keep operating are no longer of concern."

Although only one calculation is needed, to conform to the DSAR, for the purpose of performing calculations on the building structure, the contractor to Zion*Solutions*, LLC (ZS) has used the SSE and OBE responses from the Updated Final Safety Analysis Report (UFSAR) and in most cases, the SSE and OBE have been analyzed in accordance with the SRP. However, in some cases, the SSE loads have been evaluated against the OBE working stress allowables, rather than perform both calculations (conservative). If the interaction ratio (IR) for this case was 1.0 or less, then no further analysis was performed. If the IR of the SSE loads vs. OBE working stress allowables was greater than 1.0, then the SSE and OBE cases were both evaluated. Some of this information was previously provided by the results of Enercon Calculation ZION001-CALC-002, Appendix A.

Additional results that differentiate between OBE and SSE load cases related to the building structural analysis are, as requested in the RAI, provided below.

In the case of the crane analysis, per ASME NOG-1-2004 Section 4140, both operating basis earthquake and safe shut down earthquake are defined as extreme environment conditions and for this reason they have the same allowable values. Since operating basis earthquake response spectra are enveloped by safe shut down earthquake response spectra and both events have the

same allowable values, OBE event is enveloped by SSE event and no further evaluation is carried out for an OBE event.

Anchor Bolts:

The capacity of the anchor bolts was evaluated for tension and shear as identified in the first two columns. Reactions were calculated at the column baseplates for both OBE and SSE loads using both working stress and ultimate strength load combinations. The anchor bolts were evaluated against the resultant worst case tension and shear loads.

Anchor Bolts			**Allowable**
Tension	Max. Tension in Single Anchor OBE (Type R Base Plate Configuration)	89.45 kips	129.41 kips
	Max. Tension in Single Anchor SSE (Type R)	104.70 kips	129.41 kips
	Max. Tension in Group of Anchors OB. (Type R)	178.11 kips	229.11 kips
	Max. Tension in Group of Anchors SSE (Type R)	209.28 kips	229.11 kips
Shear	Max. Shear in Single Anchor OBE (Type R)	7.99 kips	68.45 kips
	Max. Shear in Single Anchor SSE (Type T)	51.88 kips	68.45 kips
	Max. Shear in Group of Anchors OBE (Type R)	15.93 kips	161.20 kips
	Max. Shear in Group of Anchors SSE (Type T)	100.26 kips	137.50 kips
Maximum Interaction, Combined Tension and Shear OBE (Type R)		0.879	1.0
Maximum Interaction, Combined Tension and Shear SSE (Type R)		0.928	1.0

Concrete Columns:

The capacity of the concrete columns was evaluated in accordance with the original code of design, ACI 318-63. Enveloped forces from the SSE load combinations were used and verified using working stress design (OBE allowable forces and stresses) as opposed to ultimate strength (SSE allowable forces and stresses). The results are considered bounding for the OBE case. Axial and moment interaction diagrams from the, "Reinforced Concrete Design Handbook, Working Stress Method", Third Edition, ACI Publication SP-3 were used to compare forces to capacity.

Concrete Columns		**Allowable**
Max. Axial Load	711.49 kips	3617 kips
Max. Shear Stress	21.9 psi	70 psi
Max. Bearing Stress	207.3 psi	1000 psi
Max. Moment	18351 kip-in	18951 kip-in

Shear Walls:

The capacity of the concrete shear walls was evaluated for shears, moments, and axial loads as identified in the first column. The most limiting cases of evaluations of SSE Loads compared to working stress allowables are identified in the second and third column. The working stress method of ACI 318-63, the original design code of record, was used to evaluate the walls for the enveloped SSE loads. Where acceptable, this bounds the OBE load case. Isolated cases exist where SSE loads were evaluated using ultimate strength design allowables. In all but one case, where SSE loads are evaluated using ultimate strength allowables, OBE loads were evaluated using working stress allowables.

Shear Walls						
Item	SSE	OBE Allowable (Working Stress)	SSE	SSE Allowable (Ultimate Strength)	OBE	OBE Allowable (Working Stress)
Maximum Out of Plane Conc. Shear Stress	70 psi Shear Wall P7	70 psi	77 psi Shear Wall P4	108 psi	64.8 psi Shear Wall P4	70 psi
Maximum Out of Plane Moment Per 1" Width	28.578 k-in. Shear Wall P8A	34 k-in.	30 k-in. Shear Wall P3	66.15 k-in.	Shear Wall P3**	27 k-in.
Maximum In-Plane Shear Stress	68 psi Shear Wall P10C	70 psi	SSE vs. SSE enveloped by SSE vs. OBE		OBE vs. OBE enveloped by SSE vs. OBE	
Maximum In-Plane Moment	1,073,150 k-in. Shear Wall P3	1,097,317 k-in.	SSE vs. SSE enveloped by SSE vs. OBE		OBE Vs. OBE enveloped by SSE vs. OBE	
Maximum Axial Load Per Ft. of Wall	512 kips* Shear Wall P6	508 kips	314 kips Shear Wall P11	345 kips	230 kips Shear Wall P11	255.36 kips

*This highest interaction ratio of 1.008 is the only interaction ratio greater than unity in this category.

This case is for SSE loads evaluated against ACI 318-63 working stress methods and is therefore considered acceptable. [Note: this is the subject of RAI #4 and will be eliminated by revision to the calculation as part of our forthcoming response]

**SSE Max. Moment - 30 k-in per in./OBE Working Stress Allowable Moment – 27 k-in. per in. (IR= 1.111). Based on the analysis, SSE forces and stresses are larger than OBE, therefore by comparison, the wall is acceptable under OBE conditions.

RAI #6

Question received from, NRC on December 18, 2012:

3. Page 15 of the LAR submittal states the following: "A total of seven bridge locations are modeled including a position to maximize accelerations for evaluation of the crane itself." Please identify the locations chosen and explain why these are most limiting or representative.

Response:

Seven bridge positions were evaluated to provide either the most limiting or representative loads as follows:

Position #1, Maximum Moment:

Bridge centered between column lines R and P (east end of Fuel Handling Building (FHB)). This position provides the maximum positive and negative moment. This center position coincides approximately with the western most crane wheel positioned at 0.2L east of column line R corresponding to the maximum moment influence provided in the original FHB design calculations.

Position #2, Maximum Shear Load:

Center of the western most end truck positioned over column line R with the end truck wheels centered equidistant from the column. This location corresponds to the maximum shear influence provided in the original FHB design calculations.

Position #3, Maximum Axial Load:

Crane centerline (and corresponding hook centerline) positioned over column line R with the end trucks centered equidistant from the column. This location corresponds to the maximum of the combined shears on either side of the column as provided in the original FHB design calculations. This position is bounding for axial loads on the column because the cross sectional area for compressive stress and section modulus for bending stress is smaller than the other built up column section comprised of plate girders.

Position #4, Maximum Load Effects to Column Line W:

Centerline of the western most bridge girder 6'-3 1/2" from column line W, as indicated in P&H drawing 105A3002, Sheet 2, that corresponds to the travel limit for the crane, will provide the maximum force effect to column line W, as well as at the wall along column line 17 at the shield door discontinuity between column lines W and V.

Position #5, Maximum Crane Response:

For the purposes of determining the seismic response of the crane, the bridge located with the crane and hook centered directly over column line V, with both end trucks equidistant from the column line is the bounding response scenario. This is scenario judged bounding because the bridge is positioned over the center of the column and located near the stiffer shear wall boundary condition, the crane will see maximum accelerations based on axial stiffness of the column and lateral stiffness adjacent to Wall W. Stiffer locations of the structure take more energy to dissipate inertial forces causing higher accelerations. This is evident in typical response spectra where there tends to exist a plateau of maximum response correlating to elements or structures that behave in a more rigid fashion (high frequencies and low periods of vibration), such as concrete and masonry structures, as opposed to steel framing systems which vibrate at much longer periods.

Position #6, Maximum Load Effects to Column Line X-17:

For the purposes of determining maximum load to the concrete columns at column line X-17 and S-17 that support the steel columns, the crane will be centered over column line X-17 similar to the way the crane was centered for position 3. This position (Position 6) will be bounding for load effects to both column line X-17 and S-17 since these concrete columns are identical.

Position # 7, Maximum Load Effects to Column Line U-23:

For the purposes of determining maximum load to the concrete column at column line U-23 that supports the steel column, the crane will be centered over column line U-23 similar to the way the crane was centered at Position 3. In addition, longitudinal impact loads will be mirrored since the trolley is positioned along the South extreme end as will the ASME NOG-1 specified boundary conditions. This will fix the North-South translation along column line 23 delivering the maximum force to the column.