



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

May 13, 2010  
U7-C-STP-NRC-100108

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
One White Flint North  
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Rockville, MD 20852-2738

South Texas Project  
Units 3 and 4  
Docket Nos. 52-012 and 52-013  
Revised Response to Request for Additional Information

- References:
1. Letter, Scott Head to Document Control Desk, "Response to Request for Additional Information," dated August 20, 2009. U7-C-STP-NRC-090105 (ML092370556)
  2. Letter, Scott Head to Document Control Desk, "Supplemental Response to Request for Additional Information," dated April 14, 2010. U7-C-STP-NRC-100083 (ML101090143)

The Attachments herein provide revised responses to NRC staff questions included in Request for Additional Information (RAI) letter numbers 157, 297, and 299 related to Combined License Application (COLA) Part 2, Tier 2, Sections 3.7 and 3.8. References 1 and 2 above provided the original or previous revisions to the responses which are revised by the attached responses to the following RAI questions:

03.07.01-2  
03.08.04-25  
03.08.05-2

When a change to the COLA is indicated, it will be incorporated into the next routine revision of the COLA following NRC acceptance of the RAI response.

There are no commitments in this letter.

If you have any questions regarding this response, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

DO91  
NRO

STI 32676391

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

Executed on 5/13/10



Scott Head  
Manager, Regulatory Affairs  
South Texas Project Units 3 & 4

jep

Attachments:

1. RAI 03.07.01-2, Revision 1
2. RAI 03.08.04-25, Revision 2
3. RAI 03.08.05-2, Revision 2

cc: w/o attachment except\*  
(paper copy)

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**RAI 03.07.01-2, Revision 1****QUESTION:**

10 CFR 50 Appendix S specifies that the Safe Shutdown Earthquake (SSE) Ground Motion for the site is characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface. As such, site-specific SSE ground motion should be established as free-field ground motion response spectra together with site-specific design time histories. Per guidance of SRP Acceptance Criteria 3.7.1 II.1.A & B, the applicant is requested to provide the following in the FSAR:

1. Site-specific SSE design response spectra for all applicable damping values (include specific figures), used for seismic reconciliation with the standard plant results as well as for site-specific seismic analysis and design of applicable site-specific structures (Ultimate Heat Sink, and Reactor Service Water (RSW) Piping Tunnel.)
2. Site-specific statistically independent three components of SSE design time histories and their bases that apply for the site-specific analysis.
3. Site-specific Operating Basis Earthquake (OBE) to be used for setting up the seismic instrumentation (FSAR Section 3.7.4).

**REVISED RESPONSE:**

The original response to this RAI was submitted with STPNOC letter U7-C-STP-NRC-090105, dated August 20, 2009. This revised response corrects some of the Reactor and Control Building characteristic dimensions provided in the RAI, and incorporated in COLA Rev. 3, Section 3A.17.

COLA Rev. 3, Section 3A.17 will be revised as shown on the following page.

**3A.17 Supporting Media for Seismic Category 1 Structures**

Soil conditions at the STP 3 & 4 site are described in Subsection 2.5S.4. The soil at the site extends down several thousand feet and consists of alternating layers of clay, silt, and sand.

The approximate characteristic dimensions of the RB and CB are summarized below:

<b>Structure</b>	<b>Embedment Depth to Bottom of Basemat (ft)</b>	<b>Maximum Height from Bottom of Basemat (ft)</b>	<b>Base Dimensions (ft)</b>
Reactor Building	84	208	188 x 198 186 x 196
Control Building	76	114 111	185 x 80 184 x 79

**RAI 03.08.04-25, Revision 2****QUESTION:****Follow-up to Question 03.08.04-15 (RAI 3323)**

The applicant's response to Question 03.08.04-15 provides a conceptual design for the interface connection between the Reactor Service Water (RSW) Piping Tunnels and the RSW Pump Houses and the Control Buildings. The applicant states that the interface design will be finalized during detailed design. The response does not include any information regarding size, dimension, and material for the interface, or calculated data to support the displacement capacity requirement of the joint. Therefore, the applicant is requested to provide detailed information to demonstrate that the design joint has enough deformation capacity to accommodate the deformation demand that is obtained from analysis to confirm that the tunnel interface will maintain integrity, and confirm that loads due to interaction of the tunnel and the building are appropriately included in the design. The applicant is also requested to include in the FSAR critical design information pertaining to the design of the interface, e.g., separation gap, calculated differential displacement, material and stiffness properties of the interface material, etc. Please also address potential degradation of the interface material due to groundwater, in-service inspection of the interface material, and measures against potential in-leakage of groundwater.

**REVISED RESPONSE (Revision 2):**

Revision 1 of the response to this RAI was submitted with STPNOC letter U7-C-STP-NRC-100083, dated April 14, 2010. Due to discovery of a discrepancy within the calculations, the response is revised to report the corrected results. Also corrected is the table number for the new COLA table. The revised portion of the response is marked with a revision bar.

The joint is designed to accommodate the expected relative building movements without transmitting significant forces. The separation gap between the Reactor Service Water (RSW) Piping Tunnels and the RSW Pump Houses and the Control Buildings, as well as the Diesel Generator Fuel Oil Storage Vaults and the Diesel Generator Fuel Oil Tunnels, will be at least 50% larger than the absolute sum of the calculated displacement due to seismic movements and long term settlement. The material used as flexible filler will be able to be compressed to approximately 1/3 of its thickness (based on 50% margin or a commensurate value if a margin larger than 50% is provided) without subjecting the building to more than a negligible force relative to the resistance capacity of the building.

The joint material will be a polyurethane foam impregnated with a waterproof sealing compound, or a similar material. Typical vendor data indicates that the material tensile strength is about 21 psi. Vendor testing for this material in a 5 inch joint compressed to 50% movement has a 7 psi compressive stress in the compressed condition. Considering the negligible strength and

limited area of the sealing material compared to strength (minimum compressive strength ( $f'_c$ ) of 4000 psi) and massive size of the tunnels and abutting structures the effect on interaction between structures, if any, is negligible.

To minimize the movements due to settlement, the complete installation of the details will not occur until after the short term settlement is substantially complete.

The values for the required and provided separation gaps due to seismic movements plus long term settlement are provided in the attached COLA mark-up.

Because of the low rate with which groundwater can flow through the detail if it were to fail in any particular location, in-leakage of groundwater is a housekeeping issue and not a safety concern. Even a degraded flexible filler material acts as a sieve to slow the flow of groundwater into the building/tunnel. Constant exposure to groundwater may deteriorate the waterproofing material. However, the detail provided (Figure 03-08-04-15A) with the response to RAI 03.08.04-15 (see letter U7-C-STP-NRC-090160, dated October 5, 2009) allows the waterproofing material to be replaced if it becomes degraded or for inspections as required.

The COLA will be revised as shown on the following pages as a result of this response.

COLA Part 2, Tier 2, will be revised to add a new Section 3H.6.8 and new Table 3H.6-15, as shown below.

1. Add the following new subsection 3H.6.8 and revise the subsection number for References.

**3H.6.8 Seismic Gaps at the Interface of Site-Specific Seismic Category I Structures and the Adjoining Structures**

The joints (i.e. separation gaps) at the interface of site-specific seismic category I structures (Reactor Service Water Tunnels and Diesel Generator Fuel Oil Storage Vaults) with the adjoining structures (Control Buildings, Reactor Service Water Pump Houses, and Diesel Generator Fuel Oil Tunnels) are designed to accommodate the expected movements without transmitting significant forces. These separation gaps are sized at least 50% larger than the absolute sum of the maximum calculated displacements due to seismic movements and long term settlement. The joint material used as flexible filler will be polyurethane foam impregnated with a waterproofing sealing compound, or a similar material, capable of being compressed to 1/3 of its thickness without subjecting the structures to more than a negligible pressure of about seven psi.

Table 3H.6.15 provides summary of the required and provided gaps at the interface of site-specific seismic category I structures with adjoining structures.

**3H.6.8 3H.6.9 References**

2. Add new Table 3H.6-15 shown below

**Table 3H.6-15: Required and Provided Gaps at the Interface of Site-Specific Seismic Category I Structures and the Adjoining Structures**

Interfacing Structures	Required and Provided Gaps (inches)	
	Required Gap	Provided Gap
RSW Piping Tunnels and Control Building	4.41	4.5
RSW Pump House and RSW Piping Tunnel A	3.51	4.5
RSW Pump House and RSW Piping Tunnel B	4.44	4.5
RSW Pump House and RSW Piping Tunnel C	2.59	4.5
Diesel Generator Fuel Oil Storage Vault (DGFO SV) No. 1 and its Diesel Generator Fuel Oil Tunnel	1.44	2.0
Diesel Generator Fuel Oil Storage Vault (DGFO SV) No. 2 and its Diesel Generator Fuel Oil Tunnel	1.62	2.0
Diesel Generator Fuel Oil Storage Vault (DGFO SV) No. 3 and its Diesel Generator Fuel Oil Tunnel	1.38	2.0

**RAI 03.08.05-2, Revision 2****QUESTION:****Follow-up to Question 03.08.05-1 (RAI 3324)**

The applicant's response to RAI 03.08.05-1 states that "the differential settlements will be determined based on detailed settlement calculations considering the time rate of settlements and construction sequence. Additional information on settlements is provided in the response to RAI 02.05.04-30 (see letter U7-C-STP-NRC-090146 dated September 21, 2009)."

Although the applicant's response to RAI 02.05.04-30 provides general information on the settlement study, the applicant did not provide any information regarding magnitudes of the differential settlements considered for design of site-specific seismic category I structures, and how the differential settlements were included in the analysis of these structures. Therefore, the applicant is requested to clearly describe the magnitudes of differential settlements considered for design of site-specific seismic category I structures, and also explain how differential settlements were accounted for in the analysis of these structures. This information is needed so the staff can conclude that the design of site-specific seismic category I structures has appropriately considered the differential settlements.

Also, the applicant stated in its response that information pertaining to analysis and design results including the coefficient of friction used for sliding evaluation, calculated factors of safety for static and dynamic bearing pressures, lateral pressure on foundation walls, and design details of foundation walls and mat will be provided in a supplemental response to RAI 03.07.01-13 by December 31, 2009. The applicant is requested to either include the above information in its response, or include the information in the December supplemental response, and update the FSAR with relevant information, as appropriate.

**REVISED RESPONSE:**

Revision 1 of the response to this RAI was submitted with STPNOC letter U7-C-STP-NRC-100083, dated April 14, 2010. Due to discovery of a discrepancy within the calculations, the response is revised to report the corrected results. The revised portion of the response is marked with a revision bar.

There are three different effects of settlements which need to be considered in design of structures. Each of these effects is discussed in the following paragraphs.

**a. Rigid Body Angular Distortions/Tilts**

COLA Part 2, Tier 2, Section 2.5S.4.10 presents conservatively calculated angular distortions/tilts based on conservatively estimated differential settlements of each structure. The calculation assumed a perfectly flexible structure with no applied reduction due to buoyancy or

structural rigidity. As explained in the response to RAI 03.08.05-3, the calculated tilt values are acceptable and no additional consideration is needed in the design of structures for these tilt values.

#### b. Differential Settlement due to Flexibility of Structure/Basemat and Supporting Soil

Settlements due to flexibility of structure/basemat and supporting soil induce stresses within the structure. In the analysis and design of the site-specific seismic category I structures, this effect is accounted for through the use of Finite Element Analysis (FEA) in conjunction with foundation soil springs. FEA representation of the structure accounts for the flexibility of structure/basemat, and the soil springs with their stiffness based on subgrade modulus, which is a function of the foundation settlement, account for the flexibility of the supporting soil medium. The information on the analysis and design of the site-specific structures provided in Supplement 2 to the response to RAI 03.07.01-13 (see STPNOC letter U7-C-STP-NRC-090230, dated December 30, 2009) is based on the FEA that includes the foundation soil springs, and thus incorporates the effect of this differential settlement.

#### c. Differential Settlement between Buildings

Differential settlements due to structural backfill, loading of other structures and consolidation of clay layers result in differential settlements between the buildings and angular distortions/tilts. These differential settlements and angular distortions/tilts will impact the design of commodities and tunnels running between the buildings and the seismic gaps among the adjacent buildings. The magnitude of these impacts will be minimized by delaying final connections to a time when the majority of the differential settlements and angular distortions/tilts have already taken place. The timing for the final connection of such commodities and tunnels will be established based on time-rate of settlement analyses described in the response to RAI 02.05.04-30 (see STPNOC letter U7-C-STP-NRC-090146 dated September 21, 2009).

The total movement for design of commodities and tunnels running between buildings and seismic gaps of the adjacent buildings are determined considering the differential settlements and angular distortions/tilts from the time-rate of settlement analysis and any additional movement during a seismic event.

Based on the results of time-rate of settlement analyses, the differential movements for the design of commodities running between the site-specific seismic category I structures (RSW Piping Tunnels and Diesel Generator Fuel Oil Storage Vaults) and the adjoining structures (Control Buildings, RSW Pump Houses, and Diesel Generator Fuel Oil Tunnels) are as shown in the attached Table 03.08.05-2a. The gap information between the site-specific Seismic Category I structures and the adjoining structures is provided in the revised response to RAI 03.08.04-25, being submitted concurrently with this letter.

The information on the analysis and design of the site-specific structures has been provided in Supplement 2 to the response to RAI 03.07.01-13 (see STPNOC letter U7-C-STP-NRC-090230, dated December 30, 2009).

No COLA revision is required as a result of this response.

**Table 03.08.05-02a:**

**Differential Movements for Design of Commodities Running between Site-Specific Seismic Category I Structures and Adjoining Structures**

Location	Differential Movement (inches)		
	North-South	East-West	Vertical
RSW Piping Tunnels and Control Building (for RSW Piping)	2.15	1.51	1.44
RSW Pump House and RSW Piping Tunnel A (for RSW Piping)	1.35	1.03	1.33
RSW Pump House and RSW Piping Tunnel B (for RSW Piping)	1.35	1.03	1.08
RSW Pump House and RSW Piping Tunnel C (for RSW Piping)	1.35	1.03	1.52
Diesel Generator Fuel Oil Storage Vault (DGFOSV) No. 1 and its Diesel Generator Fuel Oil Tunnel (for Fuel Oil Piping)	1.00	2.05	1.11
Diesel Generator Fuel Oil Storage Vault (DGFOSV) No. 2 and its Diesel Generator Fuel Oil Tunnel (for Fuel Oil Piping)	1.13	1.83	1.26
Diesel Generator Fuel Oil Storage Vault (DGFOSV) No. 3 and its Diesel Generator Fuel Oil Tunnel (for Fuel Oil Piping)	1.86	1.11	1.20