7590-01-P

NUCLEAR REGULATORY COMMISSION

STP NUCLEAR OPERATING COMPANY

SOUTH TEXAS PROJECT NUCLEAR POWER PLANT, UNITS 3 AND 4

DOCKET NOS. 52-012 AND 52-013

[NRC-2010-0343]

EXEMPTION

## 1.0 BACKGROUND

By letters dated February 2, 2010 (Agency wide Documents Access and Management System (ADAMS) Accession Number ML100350219), March 23, 2010 (ADAMS Accession Number ML100880055) and July 21, 2010 (ADAMS Accession Number ML102070274), STP Nuclear Operating Company (STPNOC) submitted a request for an exemption from Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.10: License required; limited work authorization. The U.S. Nuclear Regulatory Commission (NRC or the NRC staff) has reviewed this request for exemption, pursuant to 10 CFR 50.12, as it relates to STPNOC's application for combined licenses (COLs) for South Texas Project (STP) Units 3 and 4, which is currently under review by the NRC staff. This exemption would authorize STPNOC to install two crane foundation retaining walls (CFRWs) prior to issuance of the COLs. Granting this exemption would not constitute a commitment by the NRC to issue COLs for STP Units 3 and 4. STPNOC would install the CFRWs assuming the risk that its COL application may later be denied.

## 2.0 REQUEST/ACTION

The proposed action, as described in STPNOC's request for an exemption to 10 CFR 50.10, would allow STPNOC to install two CFRWs (one for Unit 3 and one for Unit 4), prior to issuance of COLs. According to STPNOC, the CFRWs are non-safety related, and have no adverse interactions with any structures, systems, or components as identified in 50.10. STPNOC states that the CFRWs are required to facilitate excavation activities by retaining soil next to the excavations of the Reactor Building, Control Building and Turbine Building Foundations, while allowing the crane areas to be at grade and near the buildings. Installation of the CFRWs would include the following activities:

- Performing a full-depth and-width slurry excavation,
- Placing of reinforcement in the slurry trench,
- Displacing the slurry with concrete from the bottom up, and
- Installing tiebacks and whalers to stabilize the CFRWs, as excavation for permanent plant structures proceeds.

As construction of the permanent plant structures proceeds, the CFRWs would be abandoned in place following crane use. After abandonment, the CFRWs would have no function during operation of STP Units 3 and 4.

In its exemption request, STPNOC stated that the proposed exemption is needed because installation of the CFRWs must occur before excavation for permanent plant structures, and compliance with the requirements for a limited work authorization as indicated in 10 CFR 50.10 would result in undue hardship or other costs that are significantly in excess of those contemplated during the development of 10 CFR 50.10. According to the exemption request, installation of the CFRWs is needed to allow STPNOC to complete certain on-site activities in parallel with the licensing process, so that it can begin construction promptly upon issuance of COLs.

## 3.0 DISCUSSION

Pursuant to 10 CFR 50.12(a) the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR 50.10 when (1) the exemption authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present.

### Authorized by Law

This exemption would authorize the applicant to install two CFRWs (one for Unit 3 and one for Unit 4) prior to issuance of COLs. As stated above, 10 CFR 50.12(a) allows the NRC to grant exemptions from the requirements of 10 CFR 50.10. The NRC staff has determined that granting of the applicant's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

### No Undue Risk to Public Health and Safety

The underlying purpose of 10 CFR 50.10 is to define clearly the licensing requirements for a limited work authorization (LWA). In determining that the proposed exemption would not pose an undue risk to public health and safety and that the applicant could be exempted from the LWA, for the limited purpose of the installation of the CFRWs, the NRC staff evaluated the exemption in the areas of Geotechnical Engineering, Structural Engineering and Hydrology.

***Geotechnical Engineering***

The NRC staff evaluated STPNOC's exemption request using the criteria in NUREG-0800, Standard Review Plan (SRP), Chapter 2.5.4, "Stability of Subsurface Materials and Foundations".

The specific criteria that apply include:

1. RG 1.132, "Site Investigations for Foundations of Nuclear Power Plants."
2. RG 1.138 "Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants."

In this exemption request, the applicant addressed the above criteria. The applicant evaluated the static and dynamic effects the CFRWs could have on safety-related structures, systems, or components (SSC's) identified by 10 CFR 50.10(a)(1)(i) through (vii). These SSCs included: (1) Reactor Building, (2) Control Building, (3) Ultimate Heat Sink and Reactor Service Water Pump House, (4) Turbine Building, (4) Service Building. (5) Diesel Generator Fuel Oil Storage Vault and Tunnel, (6) Reactor Service water Piping Tunnel, and (7) Fire Protection Pump House. This evaluation included soil-structure interaction (SSI) analysis for SSCs. In addition, the applicant's stability evaluation included a static a dynamic bearing capacity and settlement analysis. The applicant concluded that the construction of the CFRWs has no adverse influence on the static and dynamic stability of any of the SSCs listed above.

The staff evaluated the applicant's static and seismic stability analysis of the SSCs identified in 10 CFR 50.10(a)(1). Specifically, the staff evaluated the applicant's SSI analysis as well as the settlement, bearing capacity and dynamic lateral earth pressure effects the CFRWs could have on the aforementioned SSCs. The staff's detailed evaluation is provided below.

*Dynamic Lateral Earth Pressures*

The staff reviewed the soil properties, presented in Revision 3 of the Final Safety Analysis Report (FSAR) Appendix 3H, Table 3H6.2, used as input for the SSI analysis. The applicant assumed a mean, upper and lower bound for the shear and compression wave velocities, and a constant value for unit weight. Poisson's ratio is assumed to vary above and below the water table. The accuracy of these assumed values will be verified in future testing, but the NRC staff concludes that because of the significant margin in the computed lateral earth pressures shown in Figure 2.5 of the attachment, Appendix A, "Crane Foundation Retaining Wall Evaluation Summary", the staff has reasonable assurance that variations in the soil properties of soil backfill properly compacted to 95 percent modified Proctor would not be significant enough to cause exceedence of the lateral pressures assumed in the design of the wall. Hence, the staff concludes that, the resulting static and dynamic earth pressures will be bounded by the lateral earth pressures used in design.

*Bearing Capacity*

The applicant stated that the presence of the wall will not affect the static bearing capacity. The staff concludes that the presence of the CFRWs and the retained natural ground behind the wall will provide additional resistance to a bearing capacity failure in the direction of the wall due to the surcharge provided by the natural ground behind the wall, and the strength of the reinforced concrete wall. The applicant stated that dynamic bearing capacity is not affected by the presence of the wall once the backfill is in place, and the staff concurs with this assessment.

*Settlement*

The applicant considers the settlement due to the wall and retained natural soils to be insignificant. The staff concludes that the weight of the wall versus the weight of the natural soil that it is replacing is minor and the stresses induced by the additional weight of the wall and any additional downward force caused by the battered anchors is minor due to the 3 foot width of the footing. Stresses induced by the linear wall footing can be ignored for the following reasons: (1) the foundations soils below the wall are over-consolidated and any settlement will occur rapidly, prior to the construction of adjacent structures, and (2) the additional vertical stresses due to the 3 ft. wide footing would contribute insignificant additional stress within the zone of influence created by structures placed in close proximity to the wall. Regarding the change in the pattern of stress distribution on the East side of the Reactor Building due to the presence of the wall, the applicant stated that those stresses would be increased, but the settlement due to those increased stresses would be offset by the reduction in stress due to backfill placement above the foundation level due to friction between the wall and the backfill. The staff believes that the presence of the wall will also minimize heave during excavation, and that will therefore reduce the magnitude of re-settlement upon reloading. Additional settlement that may be caused by additional loading due to the pattern of stress distribution on the east side of the Reactor Building due to the presence of the wall will be offset by reduced vertical stresses as indicated by the applicant, and also due to reduced re-settlement that results from less heave because of the presence of the wall. The staff therefore concludes that settlement caused by the presence of the wall is not significant.

***Structural Engineering***

In 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2 requires that the design basis shall reflect appropriate considerations of the most severe earthquakes that have been

historically reported for a site and the surrounding area. 10 CFR Part 50, Appendix S further delineates the earthquake engineering criteria for seismic evaluation of nuclear power plants. Pursuant to Appendix S, the evaluation of SSCs required to withstand the effects of the safe-shutdown earthquake (SSE) ground motion must take into account soil-structure interaction (SSI) effects. Using the guidance of SRP Section 3.7.2 in part, the NRC staff performed a review of the applicant's exemption request to ensure that leaving the CFRWs in place after the plant is constructed does not adversely affect the seismic design basis of safety related structures required to withstand effects of the SSE in the vicinity of the CFRWs.

In this exemption request, the applicant has addressed the above regulations as to the potential effect of the CFRWs on seismic response of the applicable SSCs. The applicant evaluated the potential dynamic effects of the CFRWs on SSC's, which are identified by 10 CFR 50.10(a)(1)(i) through (vii). These SSCs included: (1) Reactor Building, (2) Control Building, (3) Ultimate Heat Sink and Reactor Service Water Pump House, (4) Turbine Building, (4) Service Building, (5) Diesel Generator Fuel Oil Storage Vault and Tunnel, (6) Reactor Service water Piping Tunnel, and (7) Fire Protection Pump House. The CFRWs occupies a very small volume relative to the overall soil mass and represents a small increase in overall weight as compared to the replaced soil. As such, the applicant stated that the CFRWs are expected to have negligible interaction on the other nearby heavy structures such as Reactor Building (RB) or Control Building (CB).

In order to demonstrate that there is no adverse seismic interaction of the CFRWs on SSCs, the applicant performed a SSI analysis of the Reactor and Control Buildings for the STP Units 3 and 4 site-specific conditions, including site-specific SSE and the soil parameters described in Revision 3 of the STP Units 3 and 4 Combined License Final Safety Analysis Report (FSAR) Section 3.7.1 and Appendices 3A and 3C, except that a 2D model was used instead of a

3D model. The SSI analyses were performed with and without the CFRWs using the computer program SASSI2000 as described in FSAR Appendix 3C.8. Based on the analyses results and an assessment of the configuration and locations of the SSCs (listed above) as compared to the location of the CFRWs, the applicant concluded that the construction of the CFRWs has no adverse interactions with SSC's listed above.

The staff evaluated the applicant's SSI analysis of the Reactor and Control Buildings with and without the CFRWs as well as the applicant's engineering evaluation for the other SSCs for any potential effects of the CFRWs on SSCs. The staff based its review on the applicable regulations and SRP guidance for SSI analysis as well as the following engineering principles: (1) much lighter CFRWs will not significantly affect the dynamic response of nearby massive buildings (such as RB, CB, TB, etc), (b) the influence of a heavy structure on the SSE input of the other nearby lighter structure exceeds any influence from much lighter CFRWs, and (c) CFRWs will not influence the dynamic response of heavy or light structures located at a significant distance away from the CFRWs. The seismic input response spectrum used in the RB and CB SSI analysis envelops the site specific Foundation Input Response Spectra (FIRS). The input response spectrum also envelops a broad band spectrum anchored at 0.1g in the horizontal direction as required by Appendix S to 10 CFR Part 50, "Earthquake Engineering Criteria for Nuclear Power Plants." In addition, the staff verified consistency of the analytical model and the site soil parameters used in the exemption request and the COL application. The staff's detailed evaluation is provided below.

*Reactor Building and Control Building*

The RB and CB are part of the Advanced Boiling Water Reactor (ABWR) design certification. The CFRWs are located approximately 15 feet from the exterior wall of the RB and about 80 feet from the exterior wall of the CB. The applicant performed 2-D SSI analyses of the

RB and CB, with and without the CFRWs, to assess the potential impact of the crane wall installation on the seismic response of the RB and CB for the site-specific conditions, including site-specific SSE and soil properties. The staff needed more information about the analytical models to conclude that impact of the seismic interaction of CFRWs has been appropriately accounted for in SSI analysis of RB and CB. The staff, in a request for additional information (RAI 1) dated May 24, 2010 (ADAMS Accession Number ML101400240), asked the applicant to provide this needed information.

In response to the staff's request for additional information, RAI 1, the applicant stated that there were some inconsistencies in the mass and stiffness properties of the 2-D SSI analytical models used in the analysis described in the response to the RAI 03.07.01-24 (U7-C-STP-NRC-100083) and the original exemption request of March 23, 2010. However, the conclusions of these analyses remain the same. In the revised exemption request of July 21, 2010 (U7-C-STP-NRC-100147), the applicant described the updated analytical models used in the reanalysis. The results including the dynamic lateral soil pressure obtained from the SSI analysis for the RB and CB, with and without CFRWs for the mean in-situ soil parameters are reported in Appendices A and B of the exemption request (U7-C-STP-NRC-100143) which concluded that CFRWs does not have significant effect on the response of the RB and CB.

The staff reviewed the analytical model and comparative analysis results with and without the CFRWs as described in Appendix A and B of the exemption request of July 21, 2010. The comparison of in-structure response spectra (ISRS) is provided in Figures 2.1 through 2.4 for the RB and in Figures 2.6 through 2.7 for the CB. For the RB, the ISRS with and without the CFRWs were compared at four locations: bottom of base mat, reactor pressure vessel/main steam nozzle, top of the reinforced concrete containment vessel, and top of the RB. For the CB, the ISRS with and without the CFRWs were compared at the top of the base mat

and the top of the CB. Tables 2.1 and 2.2 of the July 21, 2010 exemption request compare the maximum forces and moments at the above four for the RB and two locations for the CB, respectively, for the RB and CB with and without the CFRWs. These comparisons demonstrate that the CFRWs do not have a significant effect on the seismic response, ISRS, and maximum forces for the RB and the CB. This determination is also consistent with the expectation that lighter nearby structures like the CFRWs will have a minimal influence on the seismic response of nearby heavy structures like RB, CB, and TB.

While the inertia of the CFRWs are not expected to affect the seismic response of the nearby heavy structures, the stiff CFRWs can act as a barrier to reflect the seismic waves and could affect seismic lateral soil pressure on the adjacent building walls. The applicant addressed this issue by comparing the lateral soil pressures on the RB and CB walls obtained from the site-specific SSI analysis, with and without the CFRWs as shown in Figures 2.5 and 2.8. As expected, the lateral seismic soil pressure increased due to the presence of the CFRWs. However, the increase was not significant enough to affect the design pressures for the RB and CB walls. The RB and CB exterior walls are designed for the larger of: (1) the pressure provided in the ABWR Design Control Document (DCD) Tier 2 Figure 3H.1-11 and (2) the pressure obtained from the alternate modified Ostadan method described in the COLA Part 2, Tier 2, Section 2.5S.4.10.5.2. Therefore, the staff agrees with the applicant's conclusion that the increase in soil pressure due to the presence of CFRWs will be bounded by the design seismic soil pressure.

*Ultimate Heat Sink and Reactor Service Water Pump House*

The Ultimate Heat Sink (UHS) and Reactor Service Water Pump House (RSWPH) are large Category I structures. Its smallest separation distance from the CFRWs is 60 feet. Based upon the results of the RB and CB SSI analysis, the applicant stated that the CFRWs do not

have a significant effect on the response of the UHS and RSWPH. The staff reviewed the configuration of the UHS and RSWPH as well as the STP Units 3 & 4 site layout in reference to the CFRWs. Staff noted that these structures are massive and are not located in close proximity of the CFRWs. Therefore, based on the review of these structures, their locations in relation to the CFRWs, and the comparative SSI analysis performed in support of the RB and CB, the staff agrees with the applicant's conclusion that CFRWs do not have a significant effect on the seismic design of the UHS and RSWPH.

*Turbine Building*

The Turbine Building (TB) is a large structure. The CFRWs are installed approximately 15 feet from the exterior wall of the TB. The applicant stated that because CFRWs are a much smaller structure, its influence on the seismic response of large TB is expected to be insignificant. The staff reviewed the configuration of the TB as well as their site layout in reference to the CFRWs. The staff noted that similarly to the RB, the TB is also a heavy structure as compared to the CFRWs. Therefore, the staff concludes that the installation of CFRWs does not have a significant effect on the seismic response of the TB.

*Service Building*

The Service Building (SB) is a non-Seismic Category I structure designed for the SSE, and meets the Seismic Category II/I interaction requirements. The horizontal separation distance of the SB from the CFRWs is approximately 15 feet. The SSE input for the II/I evaluation is determined based on the influence of the CB (which is a heavy structure near the SB) on the lighter nearby SB structure. The influence of the CB on the SSE input and design of the SB far exceeds any influence from the much lighter CFRWs structure.

The applicant stated that the influence of the nearby heavier CB structure is considered for determining the SSE input for the SB. Based on the configuration of the CB and the CFRWs, the staff agrees with the applicant that influence of the nearby CB on the SSE input and design of the SB will be much more significant than any influence on the seismic response of the SB from the much lighter CFRWs.

*Diesel Generator Fuel Oil Storage Vault and Tunnel*

The applicant stated that the Diesel Generator Fuel Oil Storage Vault and Tunnel are designed for the SSE input considering the influence of a heavy structure (i.e., RB) on the lighter nearby structures (Diesel Generator Fuel Oil Storage Vault and Tunnel). The influence of the RB on the SSE input and design of the Diesel generator Fuel Oil Storage Vault and Tunnel far exceeds any influence from much lighter CFRWs. As such, the applicant stated that the presence of the CFRWs has no influence on the design of the Diesel Generator Fuel Oil Storage Vault and Tunnel.

The design calls for three Diesel Generator Fuel Oil Storage Vaults and the associated tunnels per unit surrounded by the RB and RSWPH. Based on the configuration of the RB, RSWPH, and the CFRWs, the staff agrees with the applicant that influence of the nearby massive RB on the SSE input and design of the Diesel Generator Fuel Oil Storage Vault and Tunnel will be much more significant than any influence from the much lighter CFRWs.

*Reactor Service Water Piping Tunnel*

The applicant stated that the *Reactor Service Water (*RSW) Piping Tunnel is located more than 250 feet away from the CFRWs. At this location, the applicant stated that the CFRWs have no effect on the RSW Piping Tunnel.

The staff reviewed the site layout of the RSW Piping Tunnel and determined that there will be no seismic interaction from the CFRWs to influence the seismic input to RSW Piping Tunnel.

*Fire Protection Pump House*

The Fire Protection Pump House is located more than 300 feet away from the CFRWs. At this location, the applicant stated that the CFRWs have no effect on the Fire Protection Pump House. Because of sufficient separation distance (more than 300 feet), the staff agrees with the applicant's conclusion that the seismic input for the Fire Protection Pump House is not affected by the CFRWs.

The staff concludes that leaving the CFRWs in place after the plant is constructed does not adversely affect the seismic design basis of safety related structures required to withstand the effects of the SSE in the vicinity of the CFRWs. This conclusion is based on the analysis and engineering evaluation performed by the applicant and the review performed by the staff as discussed in this report on the above SSCs as defined in 10 CFR 50.10(a)(1).

The staff also concludes that applicant has met the relevant requirements of GDC 2 and 10 CFR Part 50, Appendix S by appropriately considering the most severe earthquake and site parameters as seismic input in performing the comparative SSI analysis with and without the CFRWs.

***Hydrology***

STPNOC stated that the CFRWs will not affect the safe operation of STP Units 3 and 4 or have a reasonable nexus to safety. NRC staff reviewed the impacts of proposed action

on safety-related groundwater issues as they relate to the SSCs as defined in 10 CFR 50.10 (a)(1).

First, in regard to groundwater use, the STPNOC COLA proposed a Deep Aquifer well to provide make up water for the Ultimate Heat Sink (UHS). However, the make-up water for the UHS is not safety-related and thus there are no safety-related impacts.

Second, ABWR DC requires a maximum groundwater level of two feet below the plant grade. The applicant stated in FSAR 2.4.12 that the estimated maximum groundwater level is about 28 feet Mean Sea Level (MSL). STPNOC is now re-evaluating the maximum groundwater level using a detailed groundwater model. However, NRC staff expects that the maximum groundwater level with the CFRWs will remain significantly below the plant grade of 34 ft MSL.

Third, in terms of the groundwater contamination, STPNOC is now re-evaluating the impacts of CFRWs on the groundwater pathways. However, NRC staff expects that the CFRWs will create a longer pathway and travel time that will result in less severe radiological consequences.

Finally, the CFRWs will not have an adverse impact on the safety-related groundwater issues at STP Units 1 and 2 because there is a sufficient separation distance between the proposed and existing units.

The staff concludes that the installation of the CFRWs for Units 3 and 4 will not affect the safe operation of STP Units 3 and 4 or have a reasonable nexus to safety related to groundwater at the STP site.

Consistent with Common Defense and Security

The proposed exemption would allow the applicant to install CFRWs as a preconstruction activity without the authorization provided in a construction permit, combined license or a Limited Work Authorization (LWA). This exemption from 10 CFR 50.10 is for the sole purpose of the installation the CFRWs and has no relation to security issues. Therefore, the common defense and security is not impacted by this exemption.

Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(iii) is present whenever "compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation as adopted, or that are significantly in excess of those incurred by others similarly situated." The underlying purpose of 10 CFR 50.10 is to define clearly the licensing requirements for a LWA. The applicant has demonstrated and the NRC staff has confirmed that the influence of the CFRWs on interactions with the SSCs will have a negligible nexus to safety. The applicant also cites undue hardship or other costs as a special circumstance that would warrant granting this exemption. The applicant has provided two potentially viable alternate construction plans to avoid delay in their schedule: 1) redesign the CFRWs to make it more practical to remove prior to fuel load and 2) increase the size of the excavation and locate the crane in the excavation. STPNOC states that both options will increase the construction cost by $22 million and $260 million respectively. Therefore, since the underlying purpose of 10 CFR 50.10 is still being achieved concerning the safety of the SSCs during construction activities and the applicant has

demonstrated an undue hardship, the special circumstance required by 10 CFR 50.12(a)(2)(iii) for the granting of an exemption from 10 CFR 50.10 exists.

The applicant has also provided information on this proposed action pursuant to 10 CFR 50.12(b) which states any person may request an exemption permitting the conduct of activities prior to the issuance of the construction permit prohibited by 10 CFR 50.10. The balancing factors for granting such an exemption are evaluated in the environmental assessment (EA) that is attached to this package. The ADAMS Accession number for this associated EA is ML101580541.

## 4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a) and 10 CFR 50.12 (b), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants South Texas Project Nuclear Operating Company an exemption from the requirements in 10 CFR 50.10 for the installation of the CFRWs for Units 3 and 4.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (75 FR 67784).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 5th day of November 2010

FOR THE COMMISSION

**/RA/**

David B. Matthews, Director
Division of New Reactor Licensing
Office of New Reactors