

## PMSTPCOL PEmails

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**From:** Foster, Rocky  
**Sent:** Monday, May 18, 2009 12:53 PM  
**To:** Stillwell, Daniel  
**Cc:** STPCOL  
**Subject:** Draft Chapter 19 RAIs-Publically Available  
**Attachments:** Draft RAI 2801.pdf; Draft RAI 2754.pdf

Bill,

Attached are the first two sets of RAIs for Chapter 19 of the STP COLA. Please review and provide me with feedback on need for clarification, or if I can formally issue them to STP as is.

Thanks,

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Request for Additional Information No. 2801 Revision 2

South Texas Project Units 3 and 4  
South Texas Project Nuclear Operating Co  
Docket No. 52-012 and 52-013

SRP Section: 19.01 - Determining the Technical Adequacy of Probabilistic Risk Assessment Results for  
Risk-Informed  
Application Section: 19.0

QUESTIONS for PRA Licensing, Operations Support and Maintenance Branch 2 (ESBWR/ABWR  
Projects) (SPLB)

19.01-\*\*\*

Section 19.3.1.1 of the STP FSAR, Revision 2, in support of meeting the requirement of 10 CFR 52.79(a)(46) pertaining to the plant-specific probabilistic risk assessment (PRA), states the following: "In order to verify that the Subsection 19D.3 remains bounding for the STP 3 & 4, loss of offsite power and power recovery data from NUREG/CR-6890 (Reference 19.3-8) was also evaluated. Industry composite data in NUREG/CR 6890 was used, which conservatively bounds the experience for the STP site. This evaluation verified that the overall risk impact of grid events at STP is bounded by the original Subsection 19D analysis."

The staff requests that the applicant describe the quantitative information used to determine that the risk impact of loss of offsite power events at STP is bounded by the analysis in Subsection 19D of the referenced Design Control Document (DCD). Also, describe the impact of the plant-specific loss of offsite power and power recovery data on the DCD PRA results and insights.

19.01-\*\*\*

In Section 19R.4.4 ("Control Building") of the STP FSAR, Revision 2, the set of assumptions for the "worst case" control building flood is presented twice with each having a different assumption for pipe length between the ultimate heat sink and the RCW/RSW room. The staff requests that the applicant clarify in the STP FSAR the assumptions for the "worst case" control building flood.

19.01-\*\*\*

Section 19R.4.6 ("RSW Pump House") of the STP FSAR, Revision 2, states "The results of this 'worst case' RSW pump house flood are: (1) A leak occurs in the RSW pump room and the lower level sensor alarms at 0.4 meters." The results for this "worst case" RSW pump house flood appears to be incomplete. The staff requests that the applicant provide additional information on the results for this "worst case" RSW pump house flood (e.g., With no operator action, the water level continues to rise and reaches the high level sensor. The RSW pumps in the leaking division are tripped and redundant supply isolation valves are automatically isolated at 1.5 meters.).

19.01-\*\*\*

The departures that were considered in the internal events PRA (e.g., STD DEP T1 2.4-3, STD DEP T1 3.4-1, STD DEP 8.3-1, STP DEP 9.2-5, and STD DEP 19.3-1) can impact the plant-specific probabilistic risk assessment (PRA) for reactor building flooding in Section 19R.5 ("Probabilistic Flood Assessment") of the STP FSAR, Revision 2. For example, these departures can impact the failure probabilities associated with the top events for bringing reactor to safe shutdown condition in the reactor building flooding event trees (refer to Figures 19R-11 to 19R-13 in the ABWR Standard Safety Analysis Report). Also, Section 19R.5 did not provide the plant-specific core damage frequency (CDF) for reactor building flooding. 10 CFR 52.79(a)(46) states that a combined license (COL) application must contain an FSAR that includes a description of the plant-specific PRA and its results. In addition, Regulatory Guide 1.206, Section C.I.19, Appendix A explains what the results should include (e.g., CDF, significant core damage sequences, importance measures, and etc.).

Therefore, the staff requests the applicant provide the plant-specific CDF value for internal flooding of reactor building, and describe the risk impact that the departures have on these PRA results (also provide necessary quantitative information that supports this description).

19.01-\*\*\*

Departure STD DEP 10.4-2 increased the number of circulating water pumps to four. This can impact the plant-specific probabilistic risk assessment (PRA) for turbine building flooding in Section 19R.5.3 ("Turbine Building") of the STP FSAR, Revision 2. For example, this departure can impact the failure probabilities associated with top events "PTRIP" and "VCLOSE" in the turbine building flooding event tree (refer to Figure 19R-8 "Turbine Building Flooding, High PCHS" in the ABWR Standard Safety Analysis Report). In addition, the departures that were considered in the internal events PRA (e.g., STD DEP T1 2.4-3, STD DEP T1 3.4-1, STD DEP 8.3-1, STP DEP 9.2-5, and STD DEP 19.3-1) can impact the failure probabilities associated with the top event for bringing reactor to safe shutdown condition in the turbine building flooding event tree. Also, Section 19R.5.3 did not provide the plant-specific core damage frequency (CDF) for turbine building flooding. 10 CFR 52.79(a)(46) states that a combined license (COL) application must contain an FSAR that includes a description of the plant-specific PRA and its results. In addition, Regulatory Guide 1.206, Section C.I.19, Appendix A explains what the results should include (e.g., CDF, significant core damage sequences, importance measures, and etc.).

Therefore, the staff requests the applicant provide the plant-specific CDF value for internal flooding of turbine building, and describe the risk impact that the departures have on these PRA results (also provide necessary quantitative information that supports this description).

19.01-\*\*\*

Departure STD DEP 9.2-5 increased the RSW flow rate per pump from 1800 m<sup>3</sup>/h to 3290 m<sup>3</sup>/h and increased RSW pipe sizes. This can impact the plant-specific probabilistic risk assessment (PRA) for control building flooding in Section 19R.5.4 ("Control Building") of the STP FSAR, Revision 2. For example, this departure can impact the timing associated with operator actions in top events "OPACT1", "OPACT2" and "OPACT3" in the event tree for control building flooding due to RSW line break (refer to Figure 19R-9 "RSW Control Building Flood" in the ABWR Standard Safety Analysis Report). In addition, the departures that were considered in the internal events PRA (e.g., STD DEP T1 2.4-3, STD DEP T1 3.4-1, STD DEP 8.3-1, STP DEP 9.2-5, and STD DEP 19.3-1) can impact the failure probabilities associated with the top events for bringing reactor to safe shutdown condition in the control building flooding event trees. Also, Section 19R.5.4 did not provide the plant-specific core damage frequency (CDF) for control building flooding due to RSW line and fire water system breaks. 10 CFR 52.79(a)(46) states that a combined license (COL) application must contain an FSAR that includes a description of the plant-specific PRA and its results. In addition, Regulatory Guide 1.206, Section C.I.19, Appendix A explains what the results should include (e.g., CDF, significant core damage sequences, importance measures, and etc.).

Therefore, the staff requests the applicant provide the plant-specific CDF values for internal flooding of control building due to RSW line and fire water system breaks, and describe the risk impact that the departures have on these PRA results (also provide necessary quantitative information that supports this description).

19.01-\*\*\*

Section 19R.5.6 ("RSW Pump House") of the STP FSAR, Revision 2, states "Unisolated breaks in the fire water system could cause inter-divisional flooding since the RSW divisional separation splits the RSW pump house into three, watertight compartments." However, Section 19R of the STP FSAR does not provide or describe a probabilistic risk assessment (PRA) for internal flooding due to unisolated breaks in the fire water system in the RSW pump house. The staff requests the applicant describe in the STP FSAR the PRA internal flooding analysis for this scenario, or justify why it should not be included.

19.01-\*\*\*

Section 19R.5.6.1 ("RSW Line Breaks") of the STP FSAR, Revision 2, qualitatively describes the plant-specific probabilistic risk assessment (PRA) for internal flooding due to reactor service water (RSW) line breaks in the RSW pump house. 10 CFR 52.79(a)(46) states that a combined license (COL) application must contain an FSAR that includes a description of the plant-specific PRA and its results. In addition, Regulatory Guide 1.206, Section C.I.19, Appendix A explains what the results should include (e.g., core damage frequency, CDF, significant core damage sequences, importance measures, and etc.).

Therefore, the staff requests the applicant provide the following information associated with the plant-specific risk for internal flooding due to RSW line breaks in the RSW pump house:

- Total CDF for this internal flooding event,

- PRA significant accident sequences and their mean CDFs,
- Initiating event frequency estimation and its basis, and
- Top event failure probabilities and their basis.

Also, for this internal flooding event, explain where the PRA assumes the worst case pipe break to occur (e.g., pipe break occurs downstream of the RSW pump discharge motor-operated valve, pipe break occurs upstream of the RSW pump discharge motor-operated valve).

19.01-\*\*\*

The reference numbers provided in Section 19R.7 ("External Flooding Evaluation") of the STP FSAR, Revision 2, do not correspond to the references in Section 19R.8 ("References"). The staff requests the applicant correct this inconsistency in the STP FSAR.

19.01-\*\*\*

Section 19R.7 ("External Flooding Evaluation") of the STP FSAR, Revision 2, qualitatively describes the plant-specific probabilistic risk assessment (PRA) for external flooding due to Main Cooling Reservoir (MCR) breach. 10 CFR 52.79(a)(46) states that a combined license (COL) application must contain an FSAR that includes a description of the plant-specific PRA and its results. In addition, Regulatory Guide 1.206, Section C.I.19, Appendix A explains what the results should include (e.g., core damage frequency, CDF, significant core damage sequences, importance measures, and etc.).

Therefore, the staff requests the applicant provide the following information associated with the plant-specific risk for external flooding due to MCR breach:

- Total CDF for this external flooding event,
- PRA significant accident sequences and their mean CDFs,
- Initiating event frequency for MCR failures that could impact STP Units 3&4 and the basis for this frequency,
- Top event failure probabilities and their basis, and
- Failure probability for operator action to close control room watertight access door and the basis for this failure probability.

Also, confirm the staff's interpretation that the watertight control room access door is normally closed (except for intermittent ingress and egress), but the MCR external flooding PRA conservatively assumes this door to be open prior to MCR breach.

19.01-\*\*\*

Section 19R.7 ("External Flooding Evaluation") of the STP FSAR, Revision 2, qualitatively describes the plant-specific probabilistic risk assessment (PRA) for external flooding due to multiple, concurrent upstream dam (MCUD) failures. 10 CFR 52.79(a)(46) states that a combined license (COL) application must contain an FSAR that includes a description of the plant-specific PRA and its results. In addition,

Regulatory Guide 1.206, Section C.I.19, Appendix A explains what the results should include (e.g., core damage frequency, CDF, significant core damage sequences, importance measures, and etc.).

Therefore, the staff requests the applicant provide the following information associated with the plant-specific risk for external flooding due to MCUD failures:

- Total CDF for this external flooding event,
- PRA significant accident sequences and their mean CDFs,
- Initiating event frequency for MCUD failures and the basis for this frequency, and
- Top event failure probabilities and their basis.

Also, Section 19R.7.3 ("Quantification of External Flooding Initiating Event Frequency") of the STP FSAR, Revision 2, states "The frequency of multiple, concurrent upstream dam breaks considers the failure of three dams, the S. W. Freese, Buchanan, and Mansfield Dams. ... Downstream of the S. W. Freese Dam is the Buchanan Dam. It is assumed that failure of the Buchanan Dam is dependent on the failure of the S. W. Freese Dam. Table 19R-4 gives values for common cause factors. Although not considered a common cause failure in the traditional sense, the second and third dam failures are analyzed using the common cause factors from Table 19R-4. Using the Beta factor from Table 19-4, failure of the Buchanan Dam, given failure of the S. W. Freese Dam is calculated. Failure of the third dam, the Mansfield Dam, given failure of the first two dams, is calculated using the Gamma factor given in Table 19R-4. The frequency of multiple concurrent dam failures considered as external flooding initiating events is calculated to be very low." The uncertainty associated with the MCUD initiating event frequency could be large. It may be more appropriate to conservatively assume that the Beta or Gamma factors are 1.0. The staff requests the applicant provide the basis for the assumption of analyzing the second and third dam failures using the common cause factors from Table 19R-4.

19.01-\*\*\*

The third paragraph of Section 19K.11.1 of the ABWR DCD ("Component Inspections and Maintenance") states "Multiplexers which provide multiple signals to several systems are identified by the Level 1 analysis as high importance components. Safety system multiplexers have a built-in self test that checks circuits frequently. In addition, one of four multiplexers can be bypassed and tested during plant operation without loss of system function. ..." Section 19K.11.1 of the STP FSAR, Revision 2, does not appear to address this statement for departure STD DEP T1 3.4-1 ("Safety-Related I&C Architecture"). The staff requests that the applicant address the above comment and revise Section 19K.11.1 of the STP FSAR as necessary.

Request for Additional Information No. 2754 Revision 0

South Texas Project Units 3 and 4  
South Texas Project Nuclear Operating Co  
Docket No. 52-012 and 52-013  
SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation  
Application Section: Chapter 19

QUESTIONS for PRA Licensing, Operations Support and Maintenance Branch 2 (ESBWR/ABWR Projects) (SPLB)

19-\*\*\*

In ABWR DCD Section 19.3.2.1, it is stated that "...The accident event progression for each of the accident classes was analyzed using the MAAP code...". Please clarify if the same version of the MAAP code was utilized by the STP to produce the accident progression results for STP 3&4. If a different version of the MAAP code was used:

- (a) Please explain the implication of these differences on the ABWR containment failure probability and the large release frequency.
- (b) Please provide comparisons of key event times (e.g. core uncovering, core relocation to lower head, vessel failure, drywell floodler activation, containment failure), and additional figures-of-merits (e.g., melt mass, melt composition, melt temperature, water mass in lower drywell, containment pressure and temperature, etc.) at the times of these key events. Discuss these differences in terms of their quantitative impacts on the calculated loads and the probability of containment failure due to various severe accident challenges, including direct containment heating, ex-vessel steam explosions, and basemat/pedestal penetration. Provide a discussion of the MAAP results for STP 3&4 for radial ablation of the pedestal, and whether or not they affect the conclusions previously drawn from the MAAP3B-ABWR code results. In particular, please verify that the MAAP results for STP 3&4 continue to suggest that using a 1.5 m layer of basaltic concrete as sacrificial material would avert containment liner failure for approximately 24 hours after core damage for the more likely severe accident challenges. Finally, discuss any implications pertaining to developing the technical basis for accident management procedures.

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The submittal incorporates by reference the information in Appendix 19D of the reference DCD (which in turn points to the SSAR) with no departures or supplements. The SSAR section contains quantified CETs (as of Amendment 33) with numerical estimates of phenomenology-based event outcomes. This latter document was developed circa 1990s. To assure that there are no significant increases in large release frequency (LRF) or conditional containment failure probability (CCFP), on the basis of the differences in the results calculated by STP, please describe any significant changes and report any differences in the estimates of the LRF or CCFP. If there are



indeed significant changes, please discuss them in the context of any phenomenological modeling improvements in the version of the MAAP computer code utilized by STP. In addition, please provide the results of CET quantification.

19-\*\*\*

Contributions to LRF and CCFP from severe accidents during low power or shutdown operations were not included in the ABWR SSAR or in the STP 3 & 4 FSAR. More recent design certification PRAs have shown that such scenarios are significant and sometimes dominant contributors to LRF and CCFP. Please discuss the impacts on LRF and the overall CCFP from low power and shutdown scenarios for STP 3 & 4. In addition, please explain whether or not the deletion of the Flammability Control System, including the recombiners, from the STP 3 & 4 design, affects the consideration of hydrogen combustion during the startup/shutdown periods when the containment may not be inerted.

19-\*\*\*

FSAR Section 19E.3 provides the consequence analysis results, incorporating by reference the information contained in the ABWR DCD Section 19E.3. In this section, the accident consequences for nine cases were re-evaluated based on the STP site-specific parameters. However, the listed source terms are limited to three release groups (i.e., noble gas, iodine and cesium). The applicant indicated that, the remaining five groups have negligible releases. However, the assessment of severe accident mitigation alternatives (SAMA) requires consideration of the impacts of these releases. Please provide a complete list of release fractions for all cases evaluated. In addition, please discuss how the addition of the missing released nuclides would affect the SAMA evaluations in the Environmental Report.

19-\*\*\*

In developing the technical basis for accident management procedures for STP 3 & 4, it will be necessary to identify departures from Revision 2 of the BWROG Accident Management Guidelines and capture the severe accident-related insights from the ABWR SSAR and the STP PRA. This is necessary to address potential changes in the emergency procedure guidelines (EPGs) and severe accident guidelines (SAGs), particularly with respect to strategies for flooding the containment by using the drywell flooders, or from the AC-independent water addition (ACIWA) system sprays. It will be necessary, for example, to avoid inadvertent operation of these features in order to assure that there is not a pool of water in the lower drywell into which molten core debris could pour during a severe accident and cause a large steam explosion. Please describe the necessary changes to the BWROG EPGs and SAGs, as applied to the STP 3 & 4 ABWRs, to ensure sound severe accident mitigation strategies and procedures.

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The staff requests the following information to support its confirmatory assessment activities:

- (a) The parameter file for the MAAP version used by the STP for units 3 and 4, and the scenario-specific input files prepared by the STP.
- (b) The site-specific MACCS input deck, including the ABWR-specific core inventory.