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

February 20, 2017
NOC-AE-16003421
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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Supplemental Information – Final Integrated Plan

References:
1. Letter from G.T. Powell, STPNOC, to NRC Document Control Desk, "Notification of Full Compliance with Order EA-12-049 for Mitigation Strategies for Beyond Design Basis External Events and Update for Order EA-12-051 for Reliable Spent Fuel Pool Instrumentation", February 17, 2016 (NOC-AE-15003311)(ML16067A088)
2. NRC Order Number EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events", March 12, 2012 (ML12054A735)

In Reference 1, South Texas Project Nuclear Operating Company (STPNOC) provided the report of full compliance with the Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, pursuant to NRC Order EA-12-049 (Reference 2). The compliance letter included the STPNOC Final Integrated Plan (FIP) as an Enclosure. The purpose of this letter is to provide supplemental information supporting the FIP.

Following the submittal of the FIP, the NRC staff continued their audit of the STPNOC Mitigating Strategies for Beyond-Design Basis Events (FLEX). During the audit, the NRC staff identified several items that required clarification or additional information to resolve. Many items were resolved during phone conferences and email discussions based on previously submitted information. However, some information requested by the NRC was either not described in the FIP or resulted in a change to the FLEX strategies.

The supplemental information described in Attachment 1 to this letter will be integrated into the FIP following completion of calculation and procedure revisions. Planned changes to the FIP are listed in Attachment 2. The revised FIP will be issued prior to the performance of the NRC Temporary Instruction (TI) 2515/191 inspection at STP.

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There are no commitments in this letter.

If there are any questions regarding this letter, please contact Wendy Brost at (361) 972-8516 or me at (361) 972-7344.

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

Executed on February 20, 2017
Date

James Connolly
Site Vice President

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Attachments:
1. Supplemental Information Regarding FLEX Mitigating Strategies
2. Description of Planned Changes to the Final Integrated Plan

cc:
(Paper Copy)

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Attachment 1

Supplemental Information Regarding FLEX Mitigating Strategies

The NRC staff audit of the STPNOC Mitigating Strategies for Beyond-Design Basis Events (FLEX) identified several items that required clarification or additional information to resolve. The items from the audit requiring change to the FIP are summarized below with a reference to the source of the NRC question and a summary of the response provided by STPNOC. A table describing the planned changes to the FIP is included in Attachment 2.

The STPNOC FIP will be updated to reflect the supplemental information in this Attachment prior to the performance of the NRC Temporary Instruction (TI) 2515/191 inspection at STP. This action is being tracked in the condition reporting process.

Assumption Regarding Re-Closure of RCP Seal Leak-Off Line Relief Valve (Reference 1, Item 1)

The original FLEX strategy for RCS makeup assumes re-closure of the #1 RCP seal leak-off line relief valve. This valve could cycle during two-phase flow conditions for more than 10 hours. The basis for assuming the valve would reliably close was questioned.

STPNOC has reasonable assurance that the valve would close even though the RCP seal leak-off line relief valve is not specifically qualified for two-phase flow. To add additional conservatism, STPNOC will revise the appropriate calculations to reflect the relief valve remaining open for the duration of the event. The STPNOC FLEX strategies will still include lowering the RCS pressure below the relief valve setpoint for the relief valve to close.

Potential Increased Leakage through Reactor Coolant Pump (RCP) Seals Caused by Hydrothermal Corrosion (Reference 1, Item 2)

The silicon-nitride seal faceplates for the RCP seals are susceptible to a temperature-dependent hydrothermal corrosion effect and the time and target temperature of the Reactor Coolant System (RCS) cooldown impacts the seal leakage rate. Depending on the degree of hydrothermal corrosion of the seal faceplates, the resulting RCS leakage could be greater than STPNOC had considered in the FLEX thermal-hydraulic analyses and calculations.

In order to mitigate the potential increase in RCP seal leakage due to hydrothermal corrosion, STPNOC is revising the current FLEX cooldown strategy timeline to ensure that the RCS cold leg temperature is below 360°F within 10 hours following the start of the Extended Loss of AC Power (ELAP) event. The associated calculation revisions will require changes to procedures and other documents as well as training on these changes. These tasks will be completed before the TI 2515/191 inspection is conducted at STP.

STPNOC reviewed the FLEX timeline, staffing studies and procedure time validations and determined that the staffing timeline can be revised to support initiating the cooldown earlier in the event such that the RCS cold leg temperature would be below 360°F within 10 hours.

The following actions must be completed within 8 hours to support the cooldown to less than 360°F by 10 hours:

- Start FLEX Diesel Generator (DG),
- Start Positive Displacement Pump (PDP) to borate the RCS,
- Connect Motor Control Center (MCC) cables for repowering equipment,
- Align breakers for Safety Injection (SI) Accumulator isolation,
- Start FLEX Steam Generator (SG) Makeup Pump.

STPNOC verified that completing these actions in this revised timeline would not cause any task conflicts.

Clarifications on Use of Pressurizer Power Operated Relief Valve (PORV) for Depressurization of RCS (Reference 1, Item 3)

Additional clarification and information was requested on STPNOC's use of the pressurizer PORVs as a means for pressure control, specifically procedures for identifying a stuck PORV and available indications.

Use of the pressurizer PORV is integrated into the STPNOC FLEX strategy analyses, procedures and training for depressurization of the RCS. The FLEX procedures ensure that the PORV and block valve is energized prior to their use. The pressurizer PORV is powered from the safety-related DC Switchboard and its block valve receives power from the FLEX DG that powers MCC E1A2(E2A2) from FLEX distribution panel DP1000.

The Emergency Operating Procedure and FLEX procedures provide the requirements for closing the Pressurizer PORV. Operators will be able to monitor pressurizer level, RCS pressure and Reactor Vessel Water Level (RVWL) while the Pressurizer PORV is being used. These indications are used when determining the need for the Pressurizer PORV. If power is not available to these instruments, FLEX procedure FSG20 provides an alternate method for monitoring Qualified Display Processing System (QDPS) Parameters. When the criteria is met per the procedure the Pressurizer PORV will be closed. If the PORV does not close the block valve will be used to isolate the Pressurizer PORV.

Additional Information Regarding Shutdown Margin (Reference 1, Item 4)

Confirmation was requested that the cooldown could be procedurally undertaken prior to completion of boration to ensure xenon-free shutdown margin at the applicable temperature. The reviewers also requested clarification on the available free volume to be filled by FLEX RCS injection.

STPNOC performed a preliminary core boron analyses initiating the second cooldown and startup of the FLEX RCS makeup pump at 8.5 hours instead of 10 hours to ensure the cooldown of the RCS cold leg to 360°F is completed within 10 hours. Assuming the second cooldown starts at 8.5 hours gives an additional 30 mins of margin from when the necessary actions should be completed. The results of the preliminary re-analyses show that by making this timeline change, STPNOC maintains sufficient shutdown margin to the required critical boron concentration. This conclusion will be confirmed when the revised calculation is completed and approved. Revisions to the affected calculations will be completed and the results integrated into affected procedures and documents prior to the TI 2515/191 inspection.

There is a potential for the reactor core to return to criticality following shutdown during an ELAP scenario. This is mainly due to xenon decay and core cooldown. As stated in the STP Nuclear Design Report, after a reactor trip from full power, xenon decay will result in returning to the HFP (hot full power) equilibrium xenon conditions between 18 and 25 hours, depending on the time in core cycle life. Once HFP equilibrium xenon conditions are reached, continued xenon decay will add positive reactivity. Cooldown will also cause positive reactivity insertion due to a negative isothermal temperature coefficient (ITC). Under some circumstances, the combined effect may be sufficient to cause a return to power. Therefore, during the cooldown period, the core boron analysis conservatively assumes no-xenon conditions occur early at 18 hours.

The shutdown margin analysis is performed with and without RCP seal leakage. The results show that the no-leakage case is limiting for shutdown margin analysis, and is checked every refueling cycle in the reload safety evaluation.

The available RCS free volume is 2636 ft^3, which is the sum of the available pressurizer (2100 ft^3) and upper head (536 ft^3) volumes. These values will not change in the calculation revisions being performed to support the FLEX strategy timeline change.

After the re-analysis is completed to show that an early cooldown is acceptable, STPNOC will determine any additional or revised actions that could be required and will make the necessary procedure changes. The changes made by the analysis will be incorporated into the STPNOC FLEX timeline to ensure there are sufficient personnel to execute the FLEX strategies. STPNOC will update the appropriate procedures to address the requirements for mitigating hydrothermal corrosion within 10 hours from the start of the event.

Consequences of Using Raw Water for Supplying SGs (Reference 1, Item 6)

Information was requested on either STPNOC's plans for providing a long-term supply of purified water or the consequences of using raw water for supplying the SGs to satisfy the indefinite coping requirement of Order EA-12-049.

STPNOC does not plan to procure a water purification system for use with the FLEX strategies. If all purified water sources are expended during the ELAP, STPNOC can utilize water from the Essential Cooling Pond (ECP). STPNOC performed a calculation to determine when silt would cover the downcomer inlet tubesheet in the SG when the SGs are being supplied with feed water that contains suspended solids during an ELAP event. The calculation assumed a silt concentration of 44.8 ppm in the ECP based on historical total suspended solids data. The calculation shows that silt would cover the downcomer inlet tubesheet after one year if only one SG was in operation or in 27 years if all four SGs were operating.

Confirmation that Primary or Alternate FLEX SG Makeup Pump is Capable of Providing Flow to SGs if Turbine-Driven Auxiliary Feedwater (TDAFW) Pump is Not Available (Reference 1, Item 8)

Confirmation was requested that either the primary (N) or alternate (N+1) FLEX SG makeup pump is capable of providing flow to the SGs during Phase 2 if steam pressure is not adequate to support continued operation of the TDAFW pump.

STPNOC confirmed that either the primary (N) or alternate (N+1) FLEX SG makeup pump can be used for this purpose – the FIP will be revised to clarify this statement (see change 9 in Attachment 2).

Connectors for FLEX RCS Makeup Pumps (Reference 1, Item 9)

Since the connectors used to join the FLEX RCS makeup pumps to installed piping lack redundancy and diversity, additional information was requested on the design of the connectors and the method for storing and securing them as well as justification that the connectors will function when required.

STPNOC is utilizing 3-inch diameter stainless steel braided hoses with flanged ends as connectors to join the FLEX RCS makeup pumps to installed piping. These hose connectors are designed to accommodate the maximum flow rate, pressure and temperature associated with suction and discharge of the FLEX pumps. The hoses have a welded neck flange on one side and a lap joint flange on the other side to eliminate twisting the hose due to misalignment during installation (Reference 2).

When they are not in use, the hose connectors are stored in non-safety related hose racks (References 3 and 4). The racks are located in Seismic Category 1 areas and are mounted in compliance with Seismic II/I Design Criteria. The hose racks are qualified to withstand a Safe-Shutdown Earthquake (SSE) and the stowed hoses are not physically connected to any plant piping systems until they are needed. These hoses have a robust design which ensures that the hose will not be inadvertently damaged during normal plant activities or during an ELAP event.

Freeze and Missile Protection for FLEX DGs located on MAB Roof (Reference 5)

Information was requested associated with freeze protection for the FLEX DGs pre-staged on the MAB roof due to the record low temperature of 7°F recorded in the area of the STPNOC site in 1989. Additionally, clarification was requested on the criteria used to determine that the structure around the FLEX DGs is adequate for protection against wind borne missiles. Specifically, details were requested on the thickness and material composition of the structure walls.

With respect to freezing temperatures, the DGs have been procured to operate at a low operating temperature of 8°F. Each DG is equipped with an engine block heater to accommodate this 8°F ambient temperature. Per procedure 0PGP03-ZO-0043, "Fuel Monitoring", the fuel oil clouding point begins at 26°F and will gel at a lower temperature. To protect the FLEX DG fuel oil supply and fire protection water lines, portable heaters will be installed when outside air temperatures are predicted to decrease below thresholds established in the STPNOC Cold Weather Guidelines.

The FLEX DGs enclosures are designed to resist hurricane and tornado wind and missiles. The enclosure consists of steel columns, purlins, and roof beams which support a 1-inch and 1.5-inch thick steel plate in most areas and thick missile-resistant grating in some locations on the enclosure roof. Structural design inputs for the FLEX DG enclosure include Regulatory Guide (RG) 1.221 (October 2011) for hurricane wind speed and missile spectrum and RG 1.76, Revision 1 for Tornado Wind Speed and Missile Spectrum.

Controls for Monitoring and Maintenance of Fuel Oil for FLEX Equipment (Reference 6)

Additional information was requested regarding controls for maintenance and monitoring of fuel oil for FLEX equipment.

The FLEX DG fuel is monitored under the STPNOC procedure for the Fuel Oil Monitoring Program, 0PGP03-ZO-0043. The fuel oil for the FLEX tractors and trailer-mounted diesel-driven pumps is included in the Preventative Maintenance (PM) activities performed by STPNOC. The scope of the PMs include checking the fuel oil quality and lubricating and inspecting the equipment.

Attachment 1 References

1. NRC Email from M. Valentín to W.E. Brost, "RE: RE: STP Follow-Up Questions", August 18, 2016 (AE-NOC-17002931)
2. Vendor Drawing, B05615--00016S6, "3" Hose Assembly Series 402M"
3. STPNOC Drawing, 7F021S0001, "Reactor Coolant System Makeup Hose Rack – Train A
4. STPNOC Drawing, 7F021S0004, "Reactor Coolant System Makeup Hose Rack – Train B
5. NRC Email from M. Valentín to W.E. Brost, "STP Protection Against External Hazards", April 28, 2016 (AE-NOC-17002932)
6. NRC Email from M. Valentín to W.E. Brost, "Monitoring and maintenance of fuel oil for FLEX", June 16, 2016 (AE-NOC-17002934)

Attachment 2

Description of Planned Changes to the Final Integrated Plan

#	FIP Section	Description of Change(s)
1	Section 3.2, FLEX Mitigation Strategy Overview Subsection: Narrative Summary of ELAP/LUHS Event Sequence	- Revise note in first paragraph to state while the timeline and analyses were originally based on the RCP seal leakage assumed in Westinghouse Report PWROG-14015-P, the FLEX strategy timeline is being revised to ensure that the RCS cold leg temperature is below 360°F within 10 hours following the start of the event in order to mitigate the potential increase in RCP seal leakage due to hydrothermal corrosion - Note that the RCP seal leak-off line relief valve is not specifically qualified for two-phase flow, so for conservatism, STPNOC will assume that the valve will remain open - Include description of actions that will be required to be completed within 8 hours and a note that the cooldown to 360°F will be completed within 10 hours - Revise time for powering and closing the SI Accumulator isolation valves from 10 hours to 8 hours - Adjust times listed for when the reactor vessel upper head is filled, when the reactor vessel head vents are secured and when pressurizer level is restored based on results of revised analyses/calculations
2	Section 3.2.1, Reactor Core Cooling Strategy	- Revise time for initiating RCS makeup and boron addition from 10 hours to 8 hours
3	Section 3.2.1.1, Phase 1 Strategy	- Adjust minimum time the AFW will be available for RCS decay heat removal based on results of revised analyses/calculations
4	Section 3.2.1.2, Phase 2 Strategy	- Remove statements related to re-seating the RCP seal leak-off line relief valve - Adjust timing for restoration of pressurizer level based on results of revised analyses/calculations
5	Section 3.2.1.2, Phase 2 Strategy Subsection: N+1 Strategy for Phase 2 RCS Fill	- Revise estimated time for starting FLEX DG
6	Section 3.2.1.2, Phase 2 Strategy Subsection: Considerations for Phase 2 RCS Fill Following a Flood Event	- Adjust times that the AFWST will be available for providing water to the SGs, water inventory with the addition of the DA, and inventory in the SGs based on results of revised analyses/calculations
7	Section 3.2.1.3, Phase 3 Strategy	- Add description and reference to STPNOC calculation performed to show the effects of raw water and silting on the SGs

#	FIP Section	Description of Change(s)
8	Section 3.2.2.2, Water Sources Subsection: Auxiliary Feedwater Storage Tank	- Adjust coping time for AFWSTs based on results of revised analyses/calculations
9	Section 3.2.5.1, RCS Response	- Revise conclusions from RETRAN ELAP analysis based on results of revised analyses/calculations - Change statement about the alternate FLEX SG makeup pump to clarify that either the primary or alternate FLEX SG makeup pump can be used to provide flow to the SGs if the TDAFW pump is not available
10	Section 3.2.5.2, Reactor Coolant Pump Seals	- Add note before first paragraph stating the while the timeline and analyses were originally based on the RCP seal leakage assumed in Westinghouse Report PWROG-14015-P, the FLEX strategy timeline is being revised to ensure that the RCS cold leg temperature is below 360°F within 10 hours following the start of the event in order to mitigate the potential increase in RCP seal leakage due to hydrothermal corrosion - Revise times listed for time to RCP seal package uncovery and time to reflux cooling based on results of revised analyses/calculations
11	Section 3.4.1, Phase 1	- Revise results for maximum containment pressure and temperature based on results of revised analyses/calculations
12	Section 3.6.1, Seismic	- Add brief discussion and references to STPNOC and NRC letters regarding the STPNOC Seismic Mitigating Strategy Assessment (MSA)
13	Section 3.6.2, External Flooding	- Add brief discussion and references to STPNOC and NRC letters regarding the STPNOC Flooding MSA
14	Section 3.7, Protection of FLEX Equipment	- Add subsection describing freeze and missile protection for FLEX DGs on MAB roof
15	Section 3.11.1, Ventilation and Habitability	- Revise projected completion times for connecting cables and starting the FLEX DGs based on FLEX strategy timeline change
16	Section 3.14.1, Core Cooling and RCS Inventory Control	- Adjust makeup requirements for Modes 5 and 6 based on results of revised analyses/calculations

#	FIP Section	Description of Change(s)
17	Section 3.15, Sequence of Events	- Change time to power/close SI accumulator valves to ≤ 8 hours - Changes times for initiating RCS makeup, initiating cooldown and placing SG makeup pump in service to 8 hours - Revise times for other listed events beyond 10 hours as necessary based on results of revised analyses/calculations - Revise event noting RCP seal leakage terminates when pressure is below 135 psig to indicate that the relief valve could close once the RCS pressure is reduced to less than 135 psig, but this closure is not credited in the analysis - Add event noting when cooldown to 360°F is achieved then hydrothermal corrosion of the RCP seal face is no longer an issue and has no effect on RCP leakage
18	Section 4, **References**	- Update procedure and calculation revision numbers and identification/retrieval numbers - Add Reference: Revised STPNOC Calculation, 15-FR-010, "SG Boil-Off and Silt Buildup for ELAP Event" - Add Reference: STPNOC Procedure, 0PGP03-ZO-0043, "Fuel Oil Monitoring Program", Revision 11, May 25, 2016 (STI 34306539) - Add Reference: STPNOC Drawing, 7F021S00001, "Reactor Coolant System Makeup Hose Rack – Train A", March 19, 2015 (STI 33884889) - Add Reference: STPNOC Drawing, 7F021S00004, "Reactor Coolant System Makeup Hose Rack – Train B", March 19, 2015 (STI 33970410) - Add Reference: Vendor Drawing, B05615--00016S6, "3" Hose Assembly Series 402M" (STI 34039692) - Add Reference: T. Sato, K. Komeya, et al., "Corrosion of Silicon Nitride Ceramics Under Hydrothermal Conditions", Journal of Materials Science, 1991 - Add Reference: NRC Email from M. Valentín to W.E. Brost, "RE: RE: STP Follow-Up Questions", August 18, 2016 (AE-NOC-17002931)(STI 34431824) - Add Reference: NRC Email from M. Valentín to W.E. Brost, "STP Protection Against External Hazards", April 28, 2016 (AE-NOC-17002932)(STI 34431829) - Add Reference: NRC Email from M. Valentín to W.E. Brost, "Monitoring and maintenance of fuel oil for FLEX", June 16, 2016 (AE-NOC-17002934)(STI 34431845)

#	FIP Section	Description of Change(s)
18	Section 4, **References** *(continued)*	- Add Reference: Letter from A. Capristo, STPNOC, to NRC Document Control Desk, "STP Nuclear Operating Company Flooding Mitigation Strategies Assessment (MSA) Report Submittal", September 29, 2016 (NOC-AE-16003356)(ML16300A208) - Add Reference: Letter from A. Capristo, STPNOC, to NRC Document Control Desk, "Mitigating Strategies Assessment (MSA) Report for the New Seismic Hazard Information – NEI 12-06, Appendix H, Revision 2, H.4.1 Path 1: GMRS ≤SSE", September 29, 2016 (NOC-AE-16003398)(ML16300A267) - Add Reference: Letter from J.F. Uribe, NRC, to G.T. Powell, STPNOC, "South Texas Project, Units 1 and 2 – Flood Hazard Mitigation Strategies Assessment (CAC Nos. MF7977 and MF7978)", November 10, 2016 (AE-NOC-16002919)(ML16308A406) - Add Reference: Letter from F. Vega, NRC, to G.T. Powell, STPNOC, "South Texas Project, Units 1 and 2 – Staff Review of Mitigation Strategies Assessment Report of the Impact of the Reevaluated Seismic Hazard Developed in Response to the March 12, 2012, 50.54(f) Letter (CAC Nos. MF7878 and MF7879)", November 1, 2016 (AE-NOC-16002913)(ML16302A120)