Nuclear Operating Company

South Texas Project Electric Generating Station 4000 Avenue F – Suite A Bay City, Texas 77414

September 14, 2010
U7-C-STP-NRC-100210

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville MD 20852-2738

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

Reference:
1. Letter, Scott Head to Document Control Desk, "Response to Request for Additional Information," dated September 2, 2010, U7-C-STP-NRC-100201.
2. Letter, Scott Head to Document Control Desk, "Response to Request for Additional Information," dated May 27, 2010, U7-C-STP-NRC-100119, (ML101530608).
3. Letter, Scott Head to Document Control Desk, "Response to Request for Additional Information," dated January 4, 2010, U7-C-STP-NRC-100001, (ML100060691).

This letter supersedes the previous responses to Request for Additional Information (RAI) 19.01-31 provided in References 1 through 3. Attachment 1 to this letter addresses the following RAI:

19.01-31, Revision 2 Response

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 is one new commitment, COM 19.4-1, included as Attachment 2 to this letter.

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

STI 32748035

D091

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

Executed on 9/14/10

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

dws

Attachment:

1. RAI 19.01-31, Revision 2 Response
2. Summary of Commitment COM 19.4-1

cc: w/o attachment except*
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RAI 19.01-31

QUESTION

The staff has reviewed the applicant's response to RAI 19-18 and 19-20 and has additional questions. The shared fire water system design departure impacts the shutdown and full power hurricane risk assessment for the site. In accordance with 10CFR Part 52.79(d)(1), the staff requests that the applicant provide:

(a) The shutdown and full power hurricane core damage frequency (CDF) and large early release frequency (LERF).

(b) (b) A description of the dominant sequences contributing to the shutdown and full power hurricane CDF and LERF estimates.

(c) The list of SSCs that were identified as risk significant for the Reliability Assurance Program with the supporting Fussell-Vesely (FV) and Risk Achievement Worth (RAW) for component basic events, human error probabilities, and common cause failures.

REVISION 2 RESPONSE

The Revised Supplemental Response to Request for Additional Information (RAI) 19.01-31 provided in Letter U7-C-STP-NRC-100201, dated September 2, 2010, the Supplemental Response to RAI 19.01-31 provided in Letter U7-C-STP-NRC-100119, dated May 27, 2010 (ML101530608), and the original response to RAI 19.01-31 provided in letter U7-C-STP-NRC-100001, dated January 4, 2010 (ML100060691), are replaced in their entirety by the revised response provided below.

Background Information

STP Units 1 and 2 have developed an Abnormal Procedure for responding to Natural or Destructive Phenomena, including hurricanes. This site procedure is discussed below because it presents the general considerations STP Units 3 and 4 will implement in order to respond to a hurricane that approaches the STP site.

Prior to hurricane arrival, the site (STP 1&2) implements hurricane mitigation strategies to put the units in a safe stable shutdown configuration in accordance with the Abnormal Procedure for Natural or Destructive Phenomena Guidelines, 0POP04-ZO-0002. Starting approximately 36 hours prior to landfall (Hurricane Watch), the site starts making preparations for a controlled shutdown of all units. Preparations include topping off water supplies, fuel oil supplies, and other consumable inventories, site cleanup, staging of equipment such as portable fire equipment, fire brigade supplies, and ensuring the equipment necessary to establish and maintain safe shutdown is Operable. When a Hurricane Warning is received (landfall predicted within 24 hours) additional personnel are ensured to be available for the duration of the storm (the storm

crew), monitoring of the grid status in coordination with the Transmission Distribution Service Provider (TDSP) is established, the equipment necessary to establish and maintain safe shutdown is verified to be Operable, and predicted landfall between Corpus Christie and Galveston is confirmed. At twelve hours prior to landfall, the additional personnel move on-site for the duration of the storm. Two hurricane shutdown timelines are developed at least 8 hours prior to predicted landfall, one for wind speeds at the site greater than 73 mph and the other for greater than 96 mph. The determination of which timeline to follow is made by the Plant Manager after discussing with the TDSP the effect of taking the units offline prior to 73 mph on site. All exterior doors and hatches are verified closed or secured at least 4 hours prior to the projected arrival of winds in excess of 73 mph, and personnel move into Category I structures. At least 2 hours prior to wind speeds in excess of 73 mph (96 mph) the units are shutdown and cooled down to Mode 3. When expected time of winds in excess of 73 mph is less than 2 hours, one emergency diesel generator (EDG) in each unit is started and loaded onto its safety bus, and the bus disconnected from offsite power. If an unstable electrical grid develops or is predicted by the TDSP, the remaining diesel generators are started and loaded on their safety buses and the buses are disconnected from offsite power. This procedure is consistent with NUMARC 87-00, Rev. 1, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Initiative 2, Procedures, and Section 2.11, Hurricane Preparations.

The specific shutdown requirements for STP Units 3&4 will be similar to the requirements established for STP Units 1&2 and are required as part of the abnormal procedure development described in Section 13.5.3.4.7, Abnormal Operating Procedures, and will satisfy the NUMARC 87-00 Guidelines.

The basic wind speed for Extreme Wind for STP Units 3&4 is 134 mph (3 second gust) (Response to RAI 03.03.01-1, U7-C-STP-NRC-090111, Attachment 10, Table 2.0-2, ML092430131). This design wind speed is applied to the combustion turbine generator structure (Table 1C-3; U7-CTG-M-SPEC-CTG-5002), the fire pump house (FSAR Subsection 19.9.21), and the 345kV switchyard (FSAR Subsection 8.2.1.2.1). The return period of the 3 second gust wind is one in a hundred years (FSAR Subsection Ref. 2.3S.10, ASCE Standard ASCE/SEI-7-02, Minimum Design Loads for Buildings and Other Structures, Revision of ASCE 7-98, American Society of Civil Engineers (ASCE) and Structural Engineering Institute, January 2002; FSAR Subsection 3.3-4, Ref 3.3-4, International Code Council, 2006 International Building Code). This is assumed to be the loss of offsite power initiating event frequency for this assessment

Quantitative Assessment

A quantitative assessment was performed to satisfy the requirements of 10CFR52.79(d)(1) for the effect of a hurricane on STP Units 3&4. Failure data for the assessment was taken from the emergency diesel generator analysis contained in the STP 1&2 PRA, Revision 6. The STP 1&2 EDG system failure results are slightly higher than the STP 3&4 EDG only failure results, primarily due to the inclusion of other EDG support equipment (ventilation fans) and the generator output breaker in the STP 1&2 system model. The electric power arrangement for STP 1 & 2 is similar to the arrangement for STP 3 & 4 and is summarized below.

	STP 1 and 2	**STP 3 and 4**
Number of emergency diesel generators/Required	3/1	3/1
Independent trains	Yes	Yes
Room Ventilation	Included in EDG model	Included as a basic event
Output Breaker	Included in EDG model	Included as a basic event
Common Cause – start, run 1st hour, run to 24 hours, output breaker, ventilation fan	Included – MGL method for all active components	Included – Beta Factor for diesel
Modeling	RISKMAN (large fault tree, large event tree)	CAFTA (linked fault tree)

Two simple event trees were constructed and evaluated in EXCEL and are presented below. In the first case, the Combustion Turbine Generators (CTGs) for Units 3 and 4 are included in the model with a conditional failure likelihood of 0.5 given extreme high winds on the site, the second model does not credit operation of the CTGs, i.e., guaranteed to be failed. If the CTG for a Unit is successful, no further questions are asked in the event trees. If the CTG for a Unit fails, the EDGs for the Unit are challenged. The STP 1&2 PRA EDG model used for this assessment includes the EDG failure modes start, run for the first hour, and run for 23 hours, the EDG ventilation system start and run for 24 hours, and the EDG output breaker to its Class 1E bus. One EDG is assumed to be running and loaded on its Class 1E bus in accordance with the Abnormal Procedure described above, which removes the start and run for the first hour failure modes for that EDG, and the ventilation fan start and breaker close failure modes for the same EDG. No planned maintenance or testing would be in progress prior to or during a hurricane that affects the site. The appropriate Multiple Greek Letter (MGL) common cause parameters were adjusted to remove one train from the start (diesel and ventilation fan), run the first hour (diesel), and close (output breaker) MGL sets. Repair of a failed EDG within the first 24 hours is not credited in this assessment, although two complete storm crews are on-site standing by to repair failed equipment. After the PRA assumed mission time of 24 hours, significant resources are available to repair equipment and restore offsite power. The data development is provided below.

Data Development

MAS_REV6

Top Event	SF Name	SF Value	Split Fraction Description
DGX	G1A	6.0541E-02	TRAIN A DIESEL GENERATOR
DGX	G1B	6.0541E-02	TRAIN B DIESEL GENERATOR
DGX	G1C	6.0541E-02	TRAIN C DIESEL GENERATOR
DGX	G2AB	4.0736E-03	TRAINS A AND B DIESEL GENERATORS
DGX	G2AC	4.0736E-03	TRAINS A AND C DIESEL GENERATORS
DGX	G2BC	4.0736E-03	TRAINS B AND C DIESEL GENERATORS
DGX	G3ABC	4.2184E-04	TRAINS A, B, AND C DIESEL GENERATORS
	DG3(cc)	8.6204E-05	CCF EDG FTR (3)
	Fan3cc)	6.4035E-06	CCF FAN FTR (3)

Data Variables

ZTFN2S	Small Fan - Fail to Start, [STP_REV6]	1.91E-03
ZTDGS1	EDG - Fail to Load and Run for 1 Hour, [STP_REV6]	1.09E-03
ZTDGSS	EDG - Fail to Start, [STP_REV6]	2.44E-03
ZTCB1C	Circuit Breaker, >= 4160V Breaker - Fail to Close, STP 94 Update	1.06E-03

The Master Frequency File (MFF) information is from the STP 1 & 2 PRA Zero Maintenance Master Frequency File MAS_REV6. The data is from the STP 1 & 2 PRA Model STP_REV6.

MFF Split Fraction G1B is modified by deleting the basic events representing ventilation fan start, diesel generator start, diesel generator load and run for 1 hour, and output breaker close based on the procedure requirement to start and load one diesel generator on its respective bus prior to hurricane arrival on site.

$$G1B^{*} = G1B - (ZTFN1S + ZTDGS1 + ZTDGSS + ZTCB1C) = 5.40E\text{-}02$$

Failure of all diesel generators given a hurricane (for a 24 hour mission time) is represented by:

$$G3ABC^{*} = G2AC \times G1B^{*} + DG3(cc) + Fan3(cc) = 3.06E\text{-}04$$

$G3ABC^{*}$ is used in the simplified event tree quantification included in this RAI response for the hurricane assessment.

In the quantitative assessment, other systems, such as Reactor Core Isolation Cooling (RCIC), which are available to provide core cooling in the ABWR, are not included. RCIC is designed to operate for at least eight hours after a Station Blackout, which would provide additional time to provide inventory makeup from the AC Independent Water Addition (ACIWA) function of the fire protection system or recover offsite power following a loss of the offsite grid. No recovery of the offsite grid is included in this quantitative assessment.

The ACIWA function is included in the final calculation of core damage frequency for each Unit, as the basis for this Request for Additional Information is the departure for the shared fire water system, STP DEP 1.1-2. The value assigned for the ACIWA function, 0.01, as described in Section 19.10.7 of the Standard Safety Analysis Report (SSAR), is controlled by operator action after a plant transient, and is conservatively assigned. SSAR Appendix 19D.7.4.1 suggests a value of 0.001 for the operator action to initiate the ACIWA function after a seismic event with successful operation of RCIC for eight hours in a station blackout scenario. The dual unit core damage sequence does not credit the operation of the ACIWA.

The containments for STP 3&4 are expected to remain in the state they were in prior to the arrival of the hurricane. If the plants are operating, the containments will remain inerted during a forced shutdown due to a hurricane in anticipation of restoring the units to operation after the hurricane has passed. If one of the Units were shutdown for refueling prior to the arrival of a hurricane, the containment would be deinerted to support refueling operations and would remain deinerted for the duration of the hurricane event.

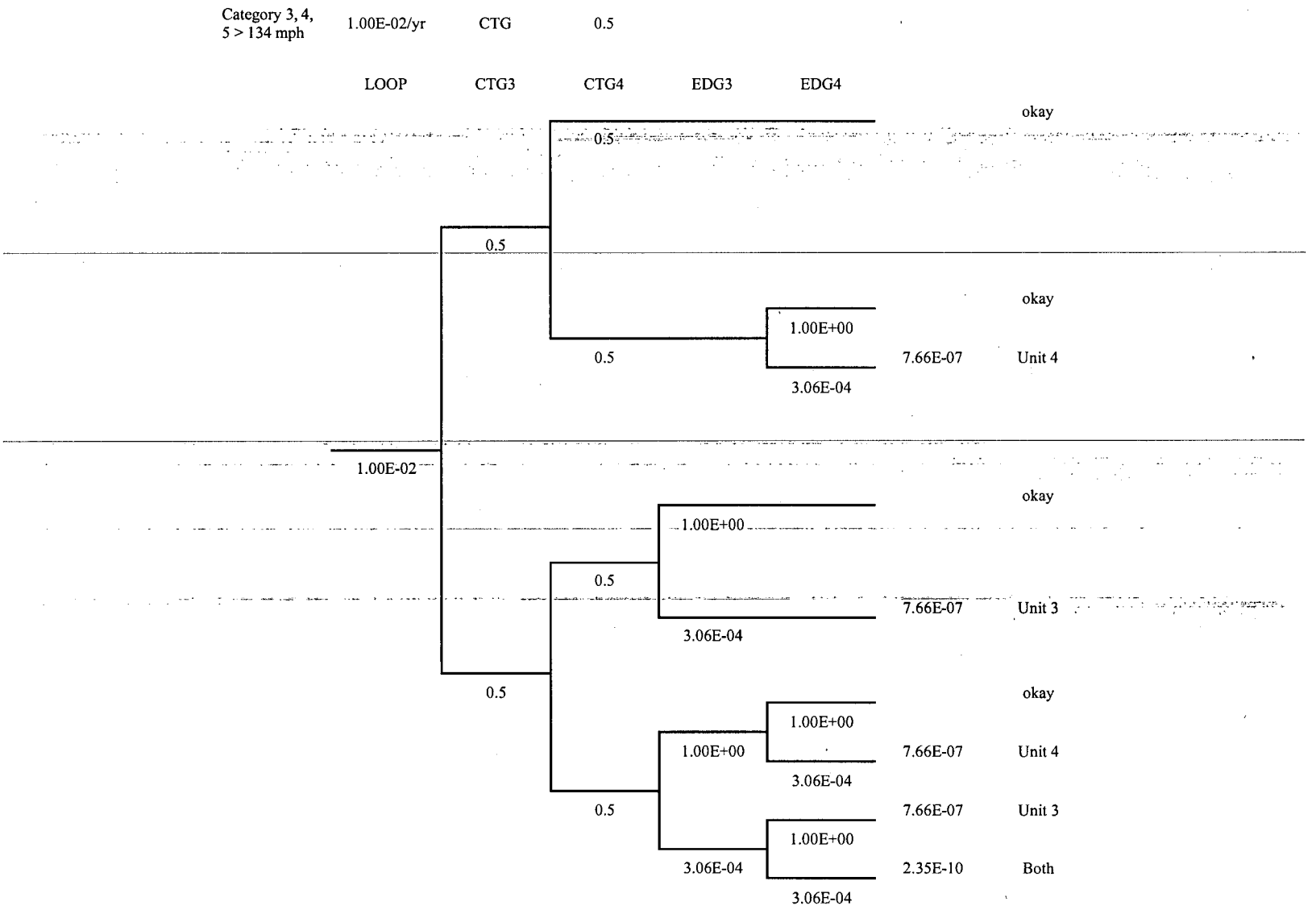
Results of the Quantitative Assessment

Using the simplified events trees below, the core damage frequency with credit for the ACIWA function with and without credit for the CTGs are:

	CTG = 0.5	CTG = 1.0
Unit 3	1.5E-08	3.1E-08
Unit 4	1.5E-08	3.1E-08

Crediting the operation of RCIC for eight hours after the station blackout following a hurricane potentially reduces the failure likelihood for the ACIWA function from 0.01 to 0.001 as suggested in Appendix 19D.7.4.1 of the SSAR for the seismically induced station blackout. This would serve to further reduce the core damage frequency calculated in this assessment for the effect of hurricanes on STP Units 3 and 4. No evaluation of Large Release Frequency is necessary with quantitative results this low.

Hurricane Evaluation – CTG at 0.5

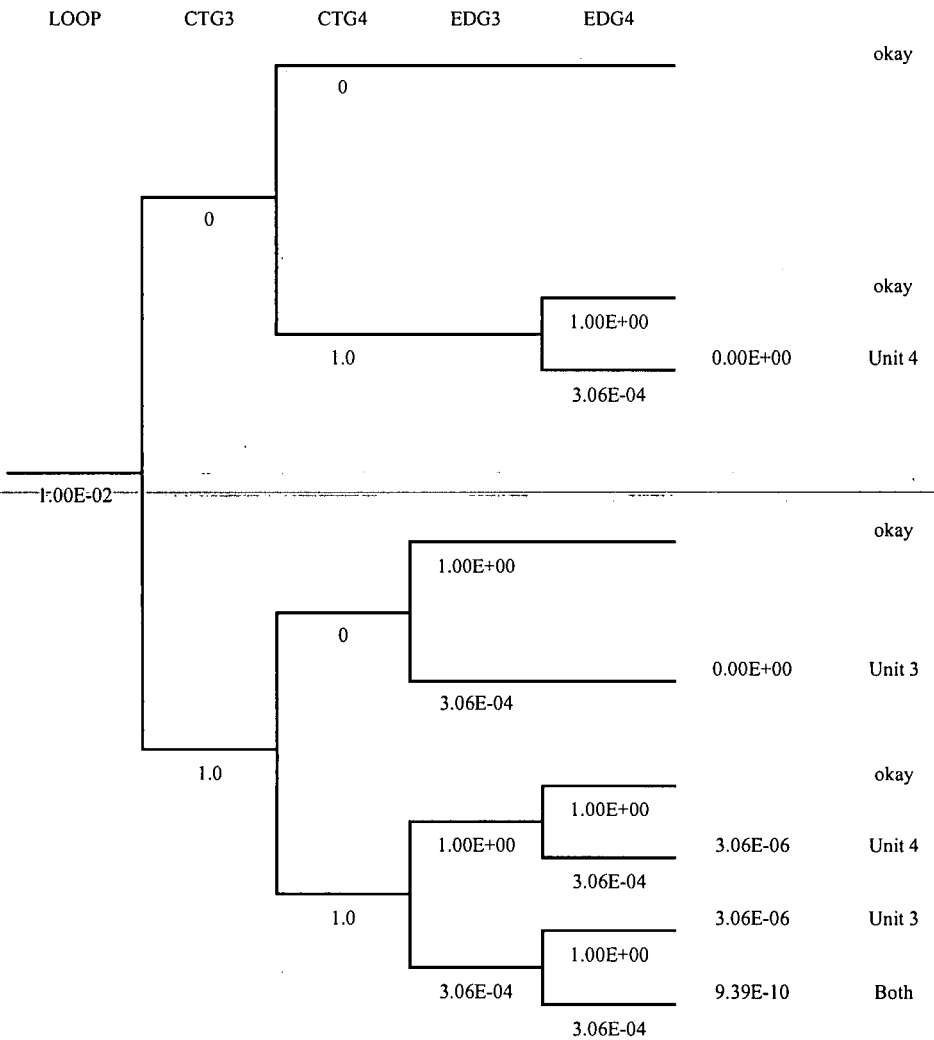


*ACIWA (.01)

Unit 3	1.10E-06	1.10E-08
Unit 4	1.10E-06	1.10E-08
Both	2.35E-10	

Hurricane Evaluation – CTG at 1.0

Category 3, 4, 5 > 134 mph	1.00E-02/yr	CTG	1.0



		*ACIWA (.01)
Unit 3	3.06E-06	3.06E-08
Unit 4	3.06E-06	3.06E-08
Both	9.39E-10	

Changes to FSAR Section 19.4 that reflect information contained in the Supplemental Response are provided below. These changes will be included in the next COLA revision after NRC acceptance of the COLA changes.

The following paragraph is added to FSAR Subsection 19.4.6, ABWR Shutdown Risk.

The following site-specific supplement addresses the results of a quantitative assessment of hurricanes at the STP 3&4 site.

Because the STP site is located in close proximity to the Gulf of Mexico, a quantitative assessment of hurricanes was performed to satisfy the requirements of 10CFR52.79(d)(1). The quantitative assessment demonstrated that the risk from hurricanes at the STP site do not significantly affect the shutdown risk analysis or the external events analysis described in the DCD.

The assessment was developed assuming that the characteristics of the specific hurricane shutdown requirements for STP Units 3&4 will be similar to the requirements established for STP Units 1&2. Specifically, the abnormal operating procedure will require:

- Action shall be initiated to place the units in Mode 3 (Hot Shutdown) at least two hours prior to wind speed in excess of 73 mph (or 96 mph as determined by discussions with the Transmission Distribution Service Provider (TDSP)). The applicability for this requirement is for units in Modes 1 and 2. Units in Modes 3, 4, or 5 will be maintained in Modes 3, 4, or 5.
- One emergency diesel generator in each unit is started and loaded onto its safety bus and the bus disconnected from offsite power at least two hours prior to the arrival on-site of winds in excess of 73 mph.
- If an unstable electrical grid develops or is predicted by the TDSP, the remaining diesel generators are started and loaded on their safety buses and the buses disconnected from offsite power.
- If applicable for the current unit Mode, RCIC will be verified to be available to provide core cooling in the event of a Station Blackout.
- If the containment is inerted at the time of the hurricane warning, it will remain inerted during a forced shutdown due to a hurricane in anticipation of restoring the units to operation after the hurricane has passed.

The specific shutdown requirements for STP Units 3&4 are required as part of the abnormal operating procedure development described in Section 13.5.3.4.7, Abnormal Operating Procedures, and will satisfy the NUMARC 87-00 Guidelines (Ref. 19.4-15). (COM 19.4-1).

In addition, FSAR Subsection 19.4.7, References, will be supplemented as shown below.

19.4-15. NUMARC 87-00, Rev. 1, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Initiative 2, Procedures, and Section 2.11, Hurricane Preparations.

SUMMARY OF COMMITMENT COM 19.4-1

Commitment	Description	Completion Date
COM 19.4-1 CR 10-15528 Action 2	Develop an STP 3&4 abnormal operating procedure for severe weather that is consistent with NUMARC 87-00, Rev. 1, Guidelines and the Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Initiative 2, Procedures, and Section 2.11, Hurricane Preparations. A hurricane abnormal operating procedure for STP Units 3&4 will be developed and will contain specific requirements as follows: • Action shall be initiated to place the units in Mode 3 (Hot Shutdown) at least two hours prior to wind speed in excess of 73 mph (or 96 mph as determined by discussions with the Transmission Distribution Service Provider (TDSP)). The applicability for this requirement is for units in Modes 1 and 2. Units in Modes 3, 4, or 5 will be maintained in Modes 3, 4, or 5. • One emergency diesel generator in each unit is started and loaded onto its safety bus and the bus disconnected from offsite power at least two hours prior to the arrival on-site of winds in excess of 73 mph. • If an unstable electrical grid develops or is predicted by the TDSP, the remaining diesel generators are started and loaded on their safety buses and the buses disconnected from offsite power. • If applicable for the current unit Mode, RCIC will be verified to be available to provide core cooling in the event of a Station Blackout. • If the containment is inerted at the time of the hurricane warning, it will remain inerted during a forced shutdown due to a hurricane in anticipation of restoring the units to operation after the hurricane has passed. The specific shutdown requirements for STP Units 3&4 are required as part of the abnormal operating procedure development described in Section 13.5.3.4.7, Abnormal Operating Procedures, and will satisfy the NUMARC 87-00 Guidelines.	Prior to fuel load