19.4 External Event Analysis and Shutdown Risk Analysis

The information in this section of the reference ABWR DCD, including all subsections, is incorporated by reference with the following departures and supplements.

STD DEP T1 2.15-1

STP DEP 19R-1

STD DEP Admin

19.4.3.2.1 Structural Fragility

STD DEP T1 2.15-1

~~*The radwaste building does not contain safety-related equipment and its failure will not lead to core damage. Consequently, an estimate of the radwaste buiilding fragility is not required.*~~

19.4.3.4 Results of the Analysis

The following site-specific supplement addresses additional results of the analysis.

The STP 3 & 4 site-specific geology is bounded by the reference ABWR DCD seismic design.

19.4.4 Fire Protection Probabilistic Risk Assessment

The following site-specific supplement addresses additional results of the analysis.

The ABWR FIVE analysis was reviewed as discussed in Appendix 19M, based on the proposed plant departures and STP 3 & 4 site-specific characteristics. The existing ABWR FIVE results are considered bounding for the STP ABWR.

19.4.5 ABWR Probabilistic Flooding Analysis

The ABWR probabilistic flooding assessment considered internal flooding and external flooding events. The results of the internal and external flooding assessments are discussed below.

STD DEP Admin

STP DEP 19R-1

~~*The results of the ABWR Probabilistic Internal Flooding Analysis show that the turbine, control, and reactor buildings are the only structures that required evaluations for potential flooding. The other buildings do not contain any equipment that could be used for safe shutdown or potential flooding would not result in a plant transient.*~~

The following site-specific supplement addresses probabilistic flooding analysis of the relocated Reactor Service Water pump house.

The results of the ABWR Probabilistic Internal Flooding Analysis show that the turbine, control, and reactor buildings and the Reactor Service Water pump house, are the only structures that required evaluations for potential flooding. The other buildings do not contain any equipment that could be used for safe shutdown or potential flooding would not result in a plant transient.

Flooding in the turbine building could result in a turbine trip due to loss of circulating water or feedwater. Automatic pump trips and valve closure on high water level should terminate the flooding. But if these were to fail, a non-watertight door at grade level in the turbine building should allow water to exit the building. If this door retained water, watertight doors would prevent water entering the control and reactor buildings. The core damage frequency (CDF) for turbine building flooding is extremely small.

The worst case flood in the control building is a break in the reactor service water system (RSW) which is an unlimited source. Floor drains and other openings in the floor would direct all flood water to the first floor where the reactor building cooling water (RCW) rooms are located. The RCW rooms contain sump pumps. Water level sensors in the RCW rooms should actuate alarms in the control room and send signals to trip the RSW pumps and close isolation valves in the RSW system. If these sensors were to fail, watertight doors on each room should limit flood damage to only one of the three RCW divisions. Breaks in the fire water system could result in interdivisional flooding in the upper floors but floor drains would limit water height to below installed equipment for the first hour. To prevent damage to safety-related equipment after this time requires operator actions to limit the depth of water. The CDF for control building flooding is extremely small.

The RSW pump house is contiguous with the Ultimate Heat Sink (UHS), and is separated into three divisions each with two levels, the pump room at elevation (-)18 feet nominal, and the Electrical and HVAC room at elevation14 feet nominal. Each division is separated from the other divisions by watertight, three-hour fire rated doors at both elevations (RSW Interface Requirements, Subsection 2.11.9 (2)). The normal operating level in the UHS basin is 63 feet 3 inches to 71 feet, or approximately 37 feet above site grade (nominally 34 feet). For each RSW division, the RSW supply line from the Ultimate Heat Sink (UHS) splits in the RSW pump house to provide water to both RSW pumps. The RSW pump discharge combines into a single supply line to the Control Building. RSW return from the Control Building passes through the RSW pump rooms and returns to the UHS above the normal operating level. Flooding in the RSW pump house could occur from failure of the supply line from the UHS, or from failure in the RSW return line to the UHS. The RSW pump rooms contain sump pumps and water level sensors that function to mitigate the effects of small breaks or leaks from the RSW lines in the RSW pump room. If the sensors were to fail, watertight doors on each room and level should limit flood damage to only one of the three RSW divisions. Large breaks in the supply lines from the UHS are unisolable before the pump discharge isolation motor-operated valve (MOV). Breaks after the pump discharge MOV and in the RSW return line to the UHS are isolable with the pump discharge MOV, which closes automatically on high level in the RSW pump room. Unisolable breaks in the RSW supply piping will result in draining the UHS to El. 50’ through the ventilation intake ducts in the top of the RSW pump house. Breaks in the fire water system could

result in interdivisional flooding in the upper floors of the RSW pump house, but floor drains would limit water height to below installed equipment for the first hour. To prevent damage to safety-related equipment after this time requires operator actions to limit the depth of water. The CDF for internal flooding in the RSW pump house is very small.

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 at beyond design basis wind speed was performed to satisfy the requirements of 10CFR52.79(d)(1). The quantitative assessment demonstrated that the risk from hurricanes at the STP site does not significantly affect the shutdown risk analysis or the external events analysis described in the DCD, and was performed independent of the PRA, assuming the abnormal operating procedures for hurricane preparations for STP Units 3&4 will contain all of the specific requirements listed below.

Completion of these specific requirements in the abnormal operating procedures to address hurricane preparations would assure that:

(1) The risk from hurricanes for STP Units 3&4 remains below the Commission Goals, discussed in the SRM to SECY-90-016, for core damage frequency (CDF) and large release frequency (LRF):

- CDF less than the goal of one-in-ten-thousand, or 1.0E-4 per reactor year.
- LRF less than the goal of one-in-one-million, or 1.0E-6 per reactor year.

(2) The STP Units 3&4 design has levels of defense-in-depth by providing a balance between prevention of core damage and consequences mitigation.

Changes to the specific bulleted requirements listed below require an assessment of the quantitative risk of hurricanes at beyond design basis wind speed and a comparison with the full-scope assessment (all modes, internal and external events model), as assurance that the Commission Goals, stated in (1) above, would continue to be met, and that changes to the licensing basis would meet the key principles contained in Regulatory Guide 1.174.

The specific requirements below will be included in the abnormal operating procedures to address hurricane preparations:

- Action shall be initiated to place the units in Mode 3 (Hot Shutdown) at least two hours prior to sustained wind speeds 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 sustained 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.
- The portable diesel-driven fire pump will be staged in an on site Seismic Category I structure prior to the arrival on site of sustained winds in excess of 73 mph.
- 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 above bulleted requirements will be included in the abnormal operating procedures as described in the procedure development plan required 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).

19.4.7 References

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.

19.4-16 Staff Requirements Memorandum (SRM) on SECY-90-016, "Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements," June 26, 1990.

19.4-17 Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Bases," May 2011.