CHAPTER 19

PROBABILISTIC RISK ASSESSMENT

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# CHAPTER 19

# PROBABILISTIC RISK ASSESSMENT

## 19.1 INTRODUCTION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

## 19.2 INTERNAL INITIATING EVENTS

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## 19.3 MODELING OF SPECIAL INITIATORS

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## 19.57 INTERNAL FIRE ANALYSIS

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## 19.58 WINDS, FLOODS, AND OTHER EXTERNAL EVENTS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

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### 19.58.3 CONCLUSION

Add the following information at the end of DCD Subsection 19.58.3:

WLS SUP 19.58-1

Table 19.58-201 documents the site-specific external events evaluation that has been performed for WLS Units 1 and 2. This table provides a general explanation of the evaluation and resultant conclusions and provides a reference to applicable sections of the COL where more detailed supporting information (including data used, methods and key assumptions) regarding the specific event is located. Based upon this evaluation, it is concluded that the WLS Units 1 and 2 site is bounded by the High Winds, Floods and Other External Events analysis documented in DCD Section 19.58 and APP-GW-GLR-101 (Reference 201) and no further evaluations are required at the COL application stage.

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### 19.58.4 REFERENCES

201. Westinghouse Electric Company LLC, “AP1000 Probabilistic Risk Assessment Site-Specific Considerations,” Document Number APP-GW-GLR-101, Revision 1, October 2007.

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TABLE 19.58-201 (Sheet 1 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

WLS SUP 19.58-1

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| High Winds | EF0 Tornado | A, C | Y | Cherokee County tornado activity is provided in Table 2.3-204 from 1950 through 2005. The event frequency was determined for each tornado category using the point probability method presented in Subsection 2.3.1.2.2. First, the average impacted area was calculated by averaging the area of each category of tornado activity (events with an area of zero value were conservatively disregarded in determining the average area). Second, the tornado frequency was calculated by dividing the total count of tornado events in each category including those with zero area by the measured duration (56 years). Third, the point probability of a tornado impacting a square mile (site area estimated as 1 $mi^2$) is calculated by taking the product of the average impacted area and the average tornado frequency and dividing by the total area of Cherokee County (392.7 $mi.^2$ per Subsection 2.3.1.2.2). This computation assumes that tornadoes with a zero path length have an area equal to the average area of the category.<br><br>As shown in Table 2.3-204, there are no recorded category EF5 tornados in the region. A conservative event frequency of <1.00E-03 was assigned for EF5 tornado events, consistent with APP-GW-GLR-101 (Reference 201). | 2.13E-05 |
| | EF1 Tornado | A, C | Y | | 3.42E-05 |
| | EF2 Tornado | A, C | Y | | 1.25E-05 |
| | EF3 Tornado | A, C | Y | | 5.17E-05 |
| | EF4 Tornado | A, C | Y | | 5.43E-05 |
| | EF5 Tornado | D | Y | | <1.00E-03 |

TABLE 19.58-201 (Sheet 2 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | These event frequencies are bounded by the limiting initiating event frequencies given in Table 3.0-1 of APP-GW-GLR-101. Therefore, the safety features of the AP1000 are unaffected and the CDFs given in APP-GW-GLR-101 Table 3.0-1 for these events are applicable to WLS Units 1 and 2. | |
| | Cat.1 Hurricane | D | Y | Historical data for tropical weather is archived by the National Coastal Services Center, and dates back to 1851. This data was used to analyze the occurrence of tropical weather traveling directly over Cherokee County, or near enough to Cherokee County to have a substantial impact (distance defined as 100 statute miles radius from plant). The resulting storms have been sorted to remove duplicate values. The event frequency is determined by dividing the measured duration (157 years) by the number of occurrences of tropical weather.<br><br>Figure 6-1B of ASCE/SEI 7-05 shows the basic wind speed for the eastern part of the Gulf of Mexico, including the state of South Carolina. WLS is located in the northwest part of the state beyond the 90 mph contour. Thus, it is concluded that WLS is not located in a Hurricane Prone Region.<br><br>There were no recorded events for Category 3, 4, or 5 hurricanes. However, a conservative event frequency of 1.00E-02 was assigned for these events, consistent with APP-GW-GLR-101 for Category 4 and 5 hurricanes (Reference 201). | 1.27E-02 |
| | Cat.2 Hurricane | A, C | Y | | 1.27E-02 |
| | Cat.3 Hurricane | D | Y | | 1.00E-02 |
| | Cat.4 Hurricane | D | Y | | 1.00E-02 |
| | Cat.5 Hurricane | D | Y | | 1.00E-02 |
| | Extratropical Cyclones | D | Y | | 9.55E-02 |

TABLE 19.58-201 (Sheet 3 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | These event frequencies are bounded by the limiting initiating event frequencies given in Table 3.0-1 of APP-GW-GLR-101. Therefore, the safety features of the AP1000 are unaffected and the CDFs given in APP-GW-GLR-101 Table 3.0-1 for these events are applicable to WLS Units 1 and 2.<br><br>Winds below 74 mph (storms) are not considered to have an adverse impact of WLS Units 1 and 2 as the switchyard and non-safety buildings will be designed to function at a higher wind speed (96 mph). Therefore, no additional PRA considerations are required for winds below hurricane force. | |
| External Flood | External Flood | D | Y | As discussed in Subsections 2.4.2.2 and 2.4.5, specific analysis of Broad River flood levels resulting from surges, seiches, snowmelt, ice effects, flood-waves from landslides, and tsunamis is not required for the Lee Nuclear Station.<br><br>As discussed in Subsection 2.4.4, failure of the on-site reservoirs would not affect the safety-related facilities.<br><br>As discussed in Subsections 2.4.1.2.2.6 and 2.4.3.6, the Probable Maximum Flood (PMF) event on the Make-Up Pond B watershed with the added effects of coincident wind wave activity results in a flood elevation of 584.6 ft. The Lee Nuclear Station safety-related plant elevation is 590 ft. This result shows a margin exceeding 5 ft. between | N/A |

TABLE 19.58-201 (Sheet 4 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | the calculated flood elevation and the point where safety-related SSCs could be impacted.<br><br>As discussed in Subsection 2.4.4.3, the PMF event on the Broad River, including effects of dam failures and the coincident wind wave activity, results in a flood elevation of 582.01 ft. Thus, the Make-Up Pond B event described above remains the bounding event for external flooding and provides reasonable assurance that the plant has adequate protection from external flooding.<br><br>As discussed in Subsection 2.4.4.1, the Make-Up Pond C peak dam failure outflow was combined with the maximum historical flow recorded on the Broad River. The resulting combined peak outflow does not exceed the critical dam failure event for the Broad River watershed, and, even if routed to the Lee Nuclear Station without attenuation, the resulting water surface elevation would not exceed the elevation determined from the critical multiple dam failure scenario coincident with the Broad River watershed PMF. Thus, the consequences of the Make-Up Pond C failure event are bounded and would not adversely affect safety related structures.<br><br>The above discussion and results for "External Floods" are consistent with the evaluation presented in Section 4.0 of APP-GW-GLR-101 (Reference 201), which states that the AP1000 is protected against floods up to the 100 ft level (590 ft msl for Lee Nuclear Station). Therefore, it is | |

TABLE 19.58-201 (Sheet 5 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | concluded that this event frequency is bounded by the CDF of 5.85E-15 events per year given in APP-GW-GLR-101, Section 4.0 and the safety features of the AP1000 are unaffected. | |
| Transportation and Nearby Facility Accidents | Aviation (commercial/ general/ military) | A, B | Y | As discussed in Subsection 3.5.1.6, a calculation performed in accordance with the guidelines of Standard Review Plan (SRP) Section 3.5.1.6, determined the general aviation probability of aircraft accidents that hit safety related structures is less than 1.8E-7 per year. Note, the calculated event frequency is based entirely on the general aviation crash rate, including use of low altitude Airway V54. This event frequency is bounded by the limiting value of 1.21E-6 events/year for small aircraft in APP-GW-GLR-I01.<br><br>As discussed in Subsection 3.5.1.6, no airports having more than 500 $D^2$ movements per year are located within 10 miles of the site, and no airports beyond 10 miles of the site have more than 1000 $D^2$ movements per year. Thus, the aircraft hazard probability does not need to be calculated because it is considered to be less than an order of magnitude of 1.0E-7 per year.<br><br>Subsection 2.2.2.7.2 identifies two high altitude airways used by commercial aircraft in the vicinity of the site. The centerline of the nearer, J208, is located approximately 9 miles from the site. Given the total width of the airway is 8 nautical miles (9.2 statute miles), the nearest edge of the | 1.8E-07 (general aviation)<br><br><1.0E-7 (commercial aircraft) |

TABLE 19.58-201 (Sheet 6 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | airway more than 4 statute miles from the site, which exceeds the screening criterion of 2 statute miles given in SRP 3.5.1.6.<br><br>Based on the above discussion, the commercial aircraft hazard probability is considered to be less than an order of magnitude of 1.0E-7 per year, and the APP-GW-GLR-101 criterion of an impact frequency of less than 1.0E-7 per year is met for the site. Thus, the commercial aircraft hazard for WLS Units 1 and 2 is bounded by the limiting initiating event frequencies given in subsection 5.1 of APP-GW-GLR-101. | |
| | Marine (ship/ barge) | E | N | As discussed in Subsection 2.2.3.1.3.1, the nearby Broad River is not navigable by barges and does not transport commercial traffic. No risk-important events related to marine transportation have been identified for WLS Units 1 and 2. This is consistent with the evaluation provided in Subsection APP-GW-GLR-101. Therefore, because no risk-important consequences were identified in the evaluation, the potential for hazards from these sources are minimal and will not adversely affect safe operations of WLS Units 1 and 2. | N/A |
| | Pipeline (gas/ oil) | B | N | As discussed in Subsection 2.2.3.1.1.2, the releases from postulated rupture of the natural gas pipelines and refined petroleum pipelines within 5 miles of WLS do not pose a credible hazard to the site. As discussed in Subsection 2.2.3.1.2, unconfined vapor clouds with delayed ignition were evaluated for various energetic | N/A |

TABLE 19.58-201 (Sheet 7 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | combustible materials, and determined to not result in any significant damage to the plant.<br><br>Based upon the quantitative consequence evaluations performed, the limiting initiating event is conservatively estimated to be 1.0E-7 events per year. This is consistent with the evaluation provided is Subsection 5.3 of APP-GW-GLR-101. Thus, the pipeline accident hazard for WLS Units 1 and 2 is bounded by the limiting initiating event frequencies given in Subsection 5.3 of APP-GW-GLR-101. | |
| | Railroad | D | N | As discussed in Subsection 2.2.3.1.1.1, the potential hazard resulting from railroad cars was evaluated using the methodology of RG 1.91. The maximum probable cargo based on RG 1.91 was used along with a conservative TNT equivalency, which resulted in a safe standoff distance that was less than the distance from the nearest approach of a railroad line to the site boundary.<br><br>As discussed in Subsection 2.2.3.1.2, unconfined vapor clouds with delayed ignition were also evaluated for various energetic combustible materials, and determined to not result in any significant damage to the plant.<br><br>Based upon the quantitative consequence evaluations performed, no risk-important events related to rail transportation have been identified for WLS Units 1 and 2. This is consistent with the evaluation provided in Subsection 5.4 of APP-GW-GLR-101. Therefore, because | N/A |

TABLE 19.58-201 (Sheet 8 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | | | | no risk-important consequences were identified in the evaluation, the potential for hazards from these sources are minimal and will not adversely affect safe operation WLS Units 1 and 2. | |
| | Truck | D | N | As discussed in Subsection 2.2.3.1.1.1, the potential hazard resulting from trucks was evaluated using the methodology of RG 1.91. The maximum probable cargo based on RG 1.91 was used along with a conservative TNT equivalency, which resulted in a safe standoff distance that was less than the distance from the nearest highway to the site boundary.<br><br>As discussed in Subsection 2.2.3.1.2, unconfined vapor clouds with delayed ignition were also evaluated for various energetic combustible materials, and determined to not result in any significant damage to the plant.<br><br>Based upon the quantitative consequence evaluations performed, no risk-important events related to truck transportation have been identified for WLS Units 1 and 2. This is consistent with the evaluation provided in Subsection 5.4 of APP-GW-GLR-101. Therefore, because no risk-important consequences were identified in the evaluation, the potential for hazards from these sources are minimal and will not adversely affect safe operation of WLS Units 1 and 2. | N/A |

TABLE 19.58-201 (Sheet 9 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | Nearby Facility Accidents | D | Y | Subsection 2.2.3.1.1.3 discusses potential design basis events associated with accidents at nearby facilities. Subsection 2.2.3.2 concludes that the effects of events from these facilities on the safety-related components of the plant are insignificant. Therefore, because no risk-important consequences were identified, the potential for hazards from these sources are minimal and will not adversely affect safe operation of WLS Units 1 & 2. | N/A |
| Other events | A number of external events beyond those evaluated in DCD Subsection 19.58 and APP-GW-GLR-101 (Reference 201) were evaluated for the WLS site. These events are discussed below. | | | Based on the evaluations below, these events do not pose a credible threat to the safe operation of the station. Thus, these events are not considered to be risk-important and it can be concluded that the WLS Units 1 and 2 site is within the bounds of the Floods and Other External Events analysis documented in DCD Section 19.58 and APP-GW-GLR-101 (Reference 201). | |

TABLE 19.58-201 (Sheet 10 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | External Fires | D | Y | Subsection 2.2.3.1.4 discusses external fires and concludes that fires originating from accidents at nearby facilities or transportation routes, and brush and forest fires will not endanger the safe operation of the station. Additionally, this subsection states that fire and smoke from accidents at nearby homes, industrial facilities, transportation routes, or from area forest or brush fires do not jeopardize the safe operation of the plant due to the separation distance from the plant.<br><br>Therefore, because no risk-important consequences were identified, the potential for hazards from external fires is minimal and will not adversely affect safe operation of WLS Units 1 & 2. | N/A |
| | Toxic Chemical Releases | D | Y | Based on the evaluations provided in Subsections 2.2.3.1.3 and 6.4.4.2, release of toxic chemicals from stationary industrial sources and mobile sources in the vicinity of WLS does not pose a credible threat to the control room operators. Based the quantitative consequence evaluations performed, toxic chemical release events at the Lee Nuclear Station are not considered to be risk-important. Therefore, because no risk-important consequences were identified in the evaluation, the potential for hazards from these sources are minimal and will not adversely affect safe operation of WLS Units 1 and 2. | N/A |

TABLE 19.58-201 (Sheet 11 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | On-Site Chemical Storage | D | Y | FSAR Subsection 2.2.3.1.3.2.1, "Stationary Sources," states that there are no site-specific sources of airborne hazardous materials stored on the Lee Nuclear Station site in sufficient quantity to affect control room habitability.<br><br>Based the quantitative consequence evaluations performed on-site chemical storage at the Lee Nuclear Station is not considered to be risk-important. Therefore, because no risk-important consequences were identified in the evaluation, the potential for hazards from these sources are minimal and will not adversely affect safe operation of WLS Units 1 and 2. | N/A |

TABLE 19.58-201 (Sheet 12 of 12)
EXTERNAL EVENT FREQUENCIES FOR WLS

| Category | Event | Evaluation Criteria (See Notes) | Applicable to Site? (Y/N)[1] | Explanation of Applicability Evaluation | Event Frequency (Events/yr) |
|---|---|---|---|---|---|
| | Major Depots and Storage Areas Releases | D | Y | Based on the discussion in Subsection 2.2.2.2.4, none of the listed mines poses a credible threat to the site, because none of the mines uses explosives. Also, there are no military facilities within 5 mi, so no further evaluation is required. Based upon the quantitative consequence evaluations performed, no risk-important events related to major depots and storage areas releases have been identified for WLS Units 1 and 2. Therefore, because no risk-important consequences were identified in the evaluation, the potential for hazards from these sources are minimal and will not adversely affect safe operation WLS Units 1 and 2. | N/A |

Notes:

1. All events that are physically possible are considered to be "applicable" and are discussed. Those events that are physically not possible are considered not applicable to the site.

Evaluation Criteria

A: The initiating event frequency (IEF) is less than the IEF in DCD Tier 2 Section 19.58 or Table 19.58-3 for the event.

B: IEF is less than 1.0E-07.

C: Core damage frequency (CDF) is less than 1.0E-08.

D: A specific event frequency for this event has not been determined. A deterministic quantitative consequence evaluation has been performed that has demonstrated that the event does not adversely impact the safe operation of WLS 1 and 2. Additional details are provided in the "Explanation of Applicability Evaluation" with references to the applicable FSAR Subsections.

E: The event is not physically possible for the site.

More than one screening note may apply to a given type of event.

## 19.59 PRA RESULTS AND INSIGHTS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

### 19.59.10.5 Combined License Information

STD COL 19.59.10-1

A review of the differences between the as-built plant and the design used as the basis for the AP1000 seismic margins analysis will be completed prior to fuel load. A verification walkdown will be performed with the purpose of identifying differences between the as-built plant and the design. Any differences will be evaluated and the seismic margins analysis modified as necessary to account for the plant-specific design, and any design changes or departures from the certified design. A comparison of the as-built SSC high confidence, low probability of failures (HCLPFs) to those assumed in the AP1000 seismic margin evaluation will be performed prior to fuel load. Deviations from the HCLPF values or assumptions in the seismic margin evaluation due to the as-built configuration and final analysis will be evaluated to determine if vulnerabilities have been introduced.

The requirements to which the equipment is to be purchased are included in the equipment specifications. Specifically, the equipment specifications include:

1. Specific minimum seismic requirements consistent with those used to define the Table 19.55-1 HCLPF values. This includes the known frequency range used to define the HCLPF by comparing the required response spectrum (RRS) and test response spectrum (TRS). The range of frequency response that is required for the equipment with its structural support is defined.

2. Hardware enhancements that were determined in previous test programs and/or analysis programs will be implemented.

STD COL 19.59.10-2

A review of the differences between the as-built plant and the design used as the basis for the AP1000 PRA and DCD Table 19.59-18 will be completed prior to fuel load. The plant-specific PRA-based insight differences will be evaluated and the plant-specific PRA model modified as necessary to account for plant-specific design and design changes or departures from the design certification PRA.

As discussed in Subsection 19.58.3, it has been confirmed that the Winds, Floods and Other External Events analysis documented in DCD Section 19.58 is applicable to the site. The site-specific design has been evaluated and is consistent with the AP1000 PRA assumptions. Therefore, Subsection 19.58 of the AP1000 DCD is applicable to this design.

STD COL 19.59.10-3

A review of the differences between the as-built plant and the design used as the basis for the AP1000 internal fire and internal flood analysis will be completed prior to fuel load. Plant-specific internal fire and internal flood analyses will be evaluated and the analyses modified as necessary to account for the plant-specific design, and any design changes of departures from the certified design.

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STD COL 19.59.10-4

The AP1000 Severe Accident Management Guidance (SAMG) from APP-GW-GLR-070, Reference 1 of DCD Section 19.59, is implemented on a site-specific basis. Key elements of the implementation include:

- SAMG based on APP-GW-GLR-070 is provided to Emergency Response Organization (ERO) personnel in assessing plant damage, planning and prioritizing response actions and implementing strategies that delineate actions inside and outside the control room.
- Severe accident management strategies and guidance are interfaced with the Emergency Operating Procedures (EOP's) and Emergency Plan.
- Responsibilities for authorizing and implementing accident management strategies are delineated as part of the Emergency Plan.
- SAMG training is provided for ERO personnel commensurate with their responsibilities defined in the Emergency Plan.

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STD COL 19.59.10-5

A thermal lag assessment of the as-built equipment required to mitigate severe accidents (hydrogen igniters and containment penetrations) will be performed to provide additional assurance that this equipment can perform its severe accident functions during environmental conditions resulting from hydrogen burns associated with severe accidents. This assessment will be performed prior to fuel load and is required only for equipment used for severe accident mitigation that has not been tested at severe accident conditions. The ability of the as-built equipment to perform during severe accident hydrogen burns will be assessed using the environment enveloping method or the test based thermal analysis method discussed in EPRI NP-4354 (DCD Section 19.59, Reference 3).

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Add the following new information after DCD Subsection 19.59.10.5

STD SUP 19.59-1

### 19.59.10.6 PRA Configuration Controls

PRA configuration controls contain the following key elements:

- A process for monitoring PRA inputs and collecting new information.
- A process that maintains and updates the PRA to be reasonably consistent with the as-built, as operated plant.
- A process that considers the cumulative impact of pending changes when applying the PRA.
- A process that evaluates the impact of changes on currently implemented risk-informed decisions that have used the PRA.
- A process that maintains configuration control of computer codes used to support PRA quantification.
- A process for upgrading the PRA to meet PRA standards that the NRC has endorsed.
- Documentation of the PRA.

PRA configuration controls are consistent with the regulatory positions on maintenance and upgrades in Regulatory Guide 1.200.

Schedule for Maintenance and Upgrades of the PRA

The PRA update process is a means to reasonably reflect the as designed and as operated plant configurations in the PRA models. The PRA upgrade process includes an upgrade of the PRA plus a general review of the entire PRA model, and as applicable the application of new software that implements a different methodology, implementation of new modeling techniques, as well as a comprehensive documentation effort.

- During construction, the PRA is upgraded prior to fuel load to cover those initiating events and modes of operation contained in NRC-endorsed consensus standards on PRA in effect one year prior to the scheduled date of the initial fuel load for a Level 1 and Level 2 PRA.
- Prior to license renewal the PRA is upgraded to include all modes of operation.
- During operation, PRA updates are completed as part of the upgrade process at least once every four years.
- A screening process is used to determine whether a PRA update should be performed more frequently based upon the nature of the changes in

design or procedures. The screening process considers whether the changes affect the PRA insights. Changes that do not meet the threshold for immediate update are tracked for the next regulatory scheduled update. If the screening process determines that the changes do warrant a PRA update, the update is made as soon as practicable consistent with the required change importance and the applications being used.

PRA upgrades are performed in accordance with 10 CFR 50.71(h).

Process for Maintenance and Upgrades of the PRA

Various information sources are monitored to determine changes or new information that affects the model assumptions or quantification. Plant-specific design, procedure, and operational changes are reviewed for risk impact. Information sources include applicable operating experience, plant modifications, engineering calculation revisions, procedure changes, industry studies, and NRC information.

The PRA upgrade includes initiating events and modes of operation contained in NRC-endorsed consensus standards on PRA in effect one year prior to each required upgrade.

This PRA maintenance and update incorporates the appropriate new information including significant modeling errors discovered during routine use of the PRA.

Once the PRA model elements requiring change are identified, the PRA computer models are modified and appropriate documents revised. Documentation of modifications to the PRA model include the changes as well as the upgraded portions clearly indicating what has been changed. The impact on the risk insights is clearly indicated.

PRA Quality Assurance

Maintenance and upgrades of the PRA are subject to the following quality assurance provisions:

Procedures identify the qualifications of personnel who perform the maintenance and upgrade of the PRA.

Procedures provide for the control of PRA documentation, including revisions.

For updates of the PRA, procedures provide for independent review, or checking of the calculations and information.

Procedures provide for an independent review of the model after an upgrade is completed. Additionally, after the PRA is upgraded, the PRA is reviewed by outside PRA experts such as industry peer review teams and the comments incorporated to maintain the PRA current with industry practices. Peer review findings are entered into a tracking system. PRA upgrades receive a peer review for those aspects of the PRA that are upgraded.

PRA models and applications are documented in a manner that facilitates peer review as well as future updates and applications of the PRA by describing the processes that were used, and provide details of the assumptions made and their bases. PRA documentation is developed such that traceability and reproducibility is maintained. PRA documentation is maintained in accordance with Regulatory Position 1.3 of Regulatory Guide 1.200.

Procedures provide for appropriate attention or corrective actions if assumptions, analyses, or information used previously are changed or determined to be in error. Potential impacts to the PRA model (i.e., design change notices, calculations, and procedure changes) are tracked. Errors found in the PRA model between periodic updates are tracked using the site tracking system.

PRA-Related Input to Other Programs and Processes

The PRA provides input to various programs and processes, such as the Maintenance Rule implementation, reactor oversight process, the RAP, and the RTNSS program. The use of the PRA in these programs is discussed below, or cross-references to the appropriate FSAR sections are provided.

PRA Input to Design Programs and Processes

The PRA insights identified during the design development are discussed in DCD Subsection 19.59.10.4 and summarized in DCD Table 19.59-18. DCD Section 14.3 summarizes the design material contained in AP1000 that has been incorporated into the Tier 1 information from the PRA. A discussion of the plant features important to reducing risk is provided in DCD Subsection 19.59.9.

PRA Input to the Maintenance Rule Implementation

The PRA is used as an input in determining the safety significance classification and bases of in-scope SSCs. SSCs identified as risk-significant via the Reliability Assurance Program for the design phase (DRAP, Section 17.4) are included within the initial Maintenance Rule scope as high safety significance SSCs.

For risk-significant SSCs identified via DRAP, performance criteria are established, by the Maintenance Rule expert panel using input from the reliability and availability assumptions used in the PRA, to monitor the effectiveness of the maintenance performed on the SSCs.

The Maintenance Rule implementation is discussed in Section 17.6.

PRA Input to the Reactor Oversight Process

The mitigating systems performance indicators (MSPI) are evaluated based on the indicators and methodologies defined in NEI 99-02 (Reference 201).

The Significance Determination Process (SDP) uses risk insights, where appropriate, to determine the safety significance of inspection findings.

PRA Input to the Reliability Assurance Program

The PRA input to the Reliability Assurance Program is discussed in DCD Subsection 19.59.10.1.

PRA Input to the Regulatory Treatment of Nonsafety-Related Systems Programs

The importance of nonsafety-related SSCs in the AP1000 has been evaluated using PRA insights to identify SSCs that are important in protecting the utility's investment and for preventing and mitigating severe accidents. These investment protection systems, structures and components are included in the D-RAP/MR Program (refer to Subsection 17.4), which provides confidence that availability and reliability are designed into the plant and that availability and reliability are maintained throughout plant life through the maintenance rule. Technical Specifications are not required for these SSCs because they do not meet the selection criteria applied to the AP1000 (refer to Subsection 16.1.1).

MOV Program

The MOV Program includes provisions to accommodate the use of risk-informed inservice testing of MOVs (Subsection 3.9.6).

## 19.59.11 REFERENCES

Add the following text to the end of DCD Subsection 19.59.11:

201. NEI 99-02, Nuclear Energy Institute, "Regulatory Assessment Performance Indicator Guideline," Technical Report NEI 99-02, Revision 5, July 2007.

# APPENDIX 19A
# THERMAL HYDRAULIC ANALYSIS TO SUPPORT SUCCESS CRITERIA

This section of the referenced DCD is incorporated by reference with no departures or supplements.

# APPENDIX 19B
# EX-VESSEL SEVERE ACCIDENT PHENOMENA

This section of the referenced DCD is incorporated by reference with no departures or supplements.

# APPENDIX 19C
# ADDITIONAL ASSESSMENT OF AP1000 DESIGN FEATURES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

# APPENDIX 19D
# EQUIPMENT SURVIVABILITY ASSESSMENT

This section of the referenced DCD is incorporated by reference with no departures or supplements.

# APPENDIX 19E
# SHUTDOWN EVALUATION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

# APPENDIX 19F
# MALEVOLENT AIRCRAFT IMPACT

This section of the referenced DCD is incorporated by reference with no departures or supplements.