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19.45 FISSION PRODUCT SOURCE TERMS

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

19.46 NOT USED

This section was not required for DCD and is not used by DCD and FSAR.

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This section was not required for DCD and is not used by DCD and FSAR.

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This section was not required for DCD and is not used by DCD and FSAR.

19.49 OFFSITE DOSE EVALUATION

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

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

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

19.52 NOT USED

This section was not required for DCD and is not used by DCD and FSAR.

19.53 NOT USED

This section was not required for DCD and is not used by DCD and FSAR.

19.54 LOW POWER AND SHUTDOWN PRA ASSESSMENT

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

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

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

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.

19.58.2.1 Severe Winds and Tornadoes

Replace the text of DCD Subsection 19.58.2.1 with the following:

PTN DEP 19.58-1 The overall methodology recommended by NUREG-1407, “Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities” for analyzing plant risk due to high winds and tornadoes is a progressive screening approach. This approach is modified to consider hazards occurrence, likelihood and risk.

High winds (including tornadoes) can affect plant structures in at least two ways: (1) If wind forces exceed the load capacity of a building or other external facility, the walls or framing might collapse or the structure might overturn from the excessive loading; and (2) If the wind is strong enough, as in a tornado or hurricane, it may be capable of lifting materials and thrusting them as missiles against the plant structures that house safety related equipment. Critical components or other contents of plant structures not designed to resist missile penetration might be damaged and lose their ability to function.

NUREG-1407, Section 2.3, High Winds and Tornados, states that “For plants designed against NRC's current criteria, these events pose no significant threat of a severe accident because the current design criteria for wind are dominated by tornadoes having an annual frequency of exceedance of about 10^{-7}.” This is interpreted to mean that external events with an annual frequency less than about 1.0E–07 may be screened from further consideration and events with an annual frequency greater than 1.0E–07 may require further evaluation. However, the NUREG-1407 screening criterion was developed for current operating plants.

If the external event category cannot be screened out on the basis of its annual frequency, a second screening criterion based on the annual core damage frequency (CDF) associated with that external event category can be used. If the CDF can be demonstrated to not exceed 1.0E–08, the external event category can be screened out.

The AP1000 design basis wind speed is 300 mph, as described in DCD Chapter 2. This value is assumed to be the maximum wind speed that will not challenge the safety related structures. The AP1000 operating basis wind speed is 145 mph, also described in DCD Chapter 2. This value is assumed to be the maximum wind speed that will not challenge the non-safety related structures.

The structures protecting safety related features of the AP1000 are designed for extreme winds and missiles associated with these winds. As long as the external event wind speeds are less than the design basis value, the safety features of the AP1000 will be unaffected. If the winds exceed the design values, then the integrity of the safety related structures may be compromised.

The structures protecting non-safety related features of the AP1000 are designed according to the Uniform Building Code that provides some level of protection against seismic and high wind events. As long as the external event winds are less than the operating basis wind speed, the non-safety features of the AP1000 will be unaffected. If the winds exceed the operating basis values, then the integrity of the non-safety related structures may be compromised.

Per the Enhanced Fujita (EF) Scale for Tornadoes, no tornadoes are expected to have wind speeds that exceed 300 mph; however, EF3, EF4, and EF5 tornado wind speeds do exceed the operating basis wind speed. Per the Saffir-Simpson Scale for Hurricanes, no hurricanes are expected to reach 300 mph winds; however, Category 3, Category 4, and Category 5 hurricane winds may exceed the operating basis wind speed.

The evaluation of the high winds hazard uses the two screening criteria established from the previous description. The first criterion is that if the high wind event category annual frequency does not exceed 1.0E–07, the event category can be screened out from the requirement to perform further analysis. If the first criterion is not met, the second criterion is that if the annual CDF for the event category is assessed to not exceed 1.0E–08, the event category can be screened out. As can be seen from Table 19.58-201, the annual frequency of tornado and hurricane events exceeds 1.0E–07 per year. Therefore, the screening CDF is calculated for high winds to determine if detailed analysis is required.

Risk assessment studies for nuclear power plants typically assume that high wind events cause a Loss of Offsite Power (LOSP) because the site switchyard is not designed to withstand hurricane and tornado wind speeds. For wind speeds greater than the operating basis wind speed, additional structures, systems and components (SSC) may also be damaged. Two analyses were performed to calculate the conditional core damage probability (CCDP) for two plant states resulting from high wind events and are presented in Reference 201. One analysis considered only a LOSP with all plant systems available and the other analysis considered a LOSP along with failure of all standby non-safety systems. These two plant states are defined by the maximum wind speed experienced during the event being either (1) less than or equal to the plant operating basis wind speed or (2) greater than the plant operating basis wind speed. The CCDP for the case of maximum wind speed less than or equal to the operating basis wind speed is 9.81E–09 and the CCDP for the case of maximum wind speed greater than the operating basis wind speed is 5.85E–08.

Risk (CDF) due to the event can then be estimated using the equation:

$$CDF = IEF * CCDP$$

where IEF is the initiating event frequency. If this evaluation indicates an acceptably small contribution to risk (e.g., CDF not greater than about 1.0E–08 events/yr) then the progressive screening is complete and a detailed PRA is not required.

Three studies (Case 1, Case 2, and Case 3) are presented to evaluate CDF for the high wind events for Units 6 & 7. These studies utilize the process described in Reference 201 along with event frequencies specifically for Units 6 & 7.

In the Case 1 study, plant response is a LOSP induced by high wind, with all plant equipment available. All tornados and hurricanes are considered in this Case 1 as they may challenge the switchyard. Extratropical cyclones are normal storms and thunderstorms that typically have wind speeds below the operating basis, but they can, however, regain winds of hurricane or tropical storm force and are also included in the Case 1 analysis, assuming that they cause a LOSP. In Case 1, the CCDP of 9.81E–09 is applied to all storms.

The Case 2 study was performed by modifying Case 1 to apply the CCDP of 5.85E–08 to events that could expose the plant to wind speed greater than the operating basis wind speed.

Category 2 and lower hurricanes and EF0, EF1, and EF2 tornadoes have a CCDP of 9.81E–09 applied.

The range of sustained wind speed for Category 3 hurricanes is 111 mph to 130 mph. Although this range of wind speed is less than the operating basis wind speed, Category 3 hurricanes can have wind gusts that do exceed the operating basis wind speed. Hurricanes labeled as "Category 3" had a maximum wind speed that was within the Category 3 range but some storms were below the Category 3 level for some of the time. To more appropriately represent the effect of Category 3 hurricanes in this Case 2 study, the Category 3 hurricane data for Units 6 & 7 was subdivided on the basis of the fraction of time, while within the 100 nautical mile radius of the site, that the storms were at or below Category 3. If the storm intensity decayed below the Category 3 level, then even wind gusts from the storm would not generate wind speeds that exceed operating basis wind speed and for this fraction of the time that Category 3 hurricanes resided in the 100 nautical mile radius of interest, they would not pose a threat to AP1000 non-safety systems. For the 13 documented Category 3 hurricanes, there are a total of 42 data points reported. Of these 42 data points, 13 indicate that the storm was below Category 3 hurricane intensity. On this basis, 13/42, or 31 percent of the Category 3 event frequency will have a CCDP of 9.81E–09 applied and 69 percent of the Category 3 event frequency will have a CCDP of 5.85E–08 applied.

Category 4 and higher hurricanes and EF3, EF4, and EF5 tornados have a CCDP of 5.85E–08 applied.

Case 3 is a conservative study where all high wind events are evaluated as a LOSP with failure of all non-safety systems. The CCDP of 5.85E–08 was applied to all events. This case was created to represent the risk to the plant if the non-safety structures were not designed to any code. This is a very conservative sensitivity study because all of the structures are designed to the Uniform Building Code.

Results of the calculation of CDF, using the appropriate value of CCDP and the tornado and hurricane occurrence frequencies for Units 6 & 7, are shown in Table 19.58-201. As can be seen from Table 19.58-201, both Cases 1 and 2 have CDF not greater than 1.0E–08 per year. Case 3 has a CDF slightly higher than 1.0E–08 per year.

Case 2 is the "base case" and is considered to be the representative conservative model for high winds, with Case 1 and Case 3 being treated as sensitivity studies. Case 3 is very conservative in that it assumes total failure of the standby non-safety systems (CVS, RNS, SFW, automatic DAS, and Diesel Generators) for all high wind events. Non-safety structures are designed to the Uniform Building Code that offers a degree of robustness such that the above failures are considered extreme and conservative. Therefore, while the total Case 3 CDF does fall slightly above the 1.0E–08 per year CDF screening criterion, the results are considered very conservative for the above reasons. The CDF for Case 2 is

1.0E–08 and, consequently, further detailed PRA is not necessary for the Units 6 & 7 High Winds and Tornados analysis.

19.58.4 REFERENCES

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201. APP-GW-GLR-101, “AP1000 Probabilistic Risk Assessment Site-Specific Considerations,” Revision 1, Section 3.0, High Winds Evaluation.

DEP 19.58-1

Table 19.58-201
High Winds and Tornadoes Results for Units 6 & 7

Category	Event	Limiting Initiating Event Freq. (events/yr)	CDF (events/yr)		
			LOSP (Case 1) (events/yr)	LOSP with Non-Safety Systems Unavailable for Select Events (Case 2) (events/yr)	LOSP with Non-Safety Systems Unavailable for All Events (Case 3) (events/yr)
High Winds	EF0 Tornado	2.56E–06	2.51E–14	2.51E–14	1.50E–13
	EF1 Tornado	4.56E–06	4.47E–14	4.47E–14	2.67E–13
	EF2 Tornado	1.41E–05	1.38E–13	1.38E–13	8.25E–13
	EF3 Tornado	5.37E–06	5.27E–14	3.14E–13	3.14E–13
	EF4 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EF5 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Cat. 1 Hurricane	1.01E–01	9.91E–10	9.91E–10	5.91E–09
	Cat. 2 Hurricane	5.10E–02	5.00E–10	5.00E–10	2.98E–09
	Cat. 3A Hurricane	2.50E–02	2.45E–10	2.45E–10	1.46E–09
	Cat. 3B Hurricane	5.70E–02	5.59E–10	3.33E–09	3.33E–09
	Cat. 4 Hurricane	7.00E–02	6.87E–10	4.10E–09	4.10E–09
	Cat. 5 Hurricane	1.30E–02	1.28E–10	7.61E–10	7.61E–10
	Extratropical Cyclones	1.90E–02	1.86E–10	1.86E–10	1.11E–09
Totals			3.3E–09	1.0E–08	2.0E–08

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 DCD 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 any design changes or departures from the design certification PRA.

PTN COL 19.59.10-2 As discussed in Section 19.58.2.1, 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, Section 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 analyses 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 or departures from the certified design.

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.

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).

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 update 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).

<u>Process for Maintenance and Upgrades of the PRA</u>

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.