# Chapter 19 Probabilistic Risk Assessment and Severe Accidents

## 19.1 Introduction

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

## 19.2 PRA Results and Insights

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

19.2.3.2.4 **Evaluation of External Event Seismic**

**Significant Core Damage Sequences of External Event Seismic**

Add the following to the second paragraph.

**STD COL 19.2.6-1-A** **[START COM 19.2-001]** As-built SSC High Confidence Low Probability of Failures (HCLPFs) will be compared to those assumed in the ESBWR seismic margin analysis shown in DCD Table 19.2-4. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation will be analyzed to determine if any new vulnerabilities have been introduced. This comparison and analysis will be completed prior to fuel load. **[END COM 19.2-001]**

19.2.6 **COL Information**

19.2.6-1-A **Seismic High Confidence Low Probability of Failure Margins**

**STD COL 19.2.6-1-A** This COL Item is addressed in Subsection 19.2.3.2.4.

## 19.3 Severe Accident Evaluations

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

## 19.4 PRA Maintenance

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

## 19.5 Conclusions

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

**EF3 SUP 19.5-1**

In accordance with 10 CFR 52.79(a)(46), this report is required to contain a description of the plant-specific PRA and its results. As part of the development of the certified design PRA, site and plant specific information were reviewed to determine if any changes from the certified design PRA were warranted. This review included consideration of site-specific information such as site meteorological data and site-specific population distributions, as well as plant-specific design information that replaced conceptual design information described in the DCD. Subsection 1.8.5 was also reviewed to determine if there were any departures affecting the PRA results. This review is summarized in Appendix 19AA

The review of site-specific information and plant-specific design information determined that: 1) the DCD PRA bounds site-specific and plant-specific design parameters and design features and 2) these parameters and features have no significant impact on the DCD PRA results and insights. Therefore, based on this review, it is concluded that there is no significant change from the certified design PRA. In that there are no significant changes from the certified design PRA, incorporation of DCD Chapter 19 into the FSAR satisfies the requirement of 10 CFR 52.79(a)(46) for a description of the plant-specific PRA and its results.

## Appendix 19A Regulatory Treatment of Non-Safety Systems (RTNSS)

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

## Appendix 19ACM Availability Controls Manual

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

## Appendix 19B Deterministic Analysis for Containment Pressure Capability

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

## Appendix 19C Probabilistic Analysis for Containment Pressure Fragility

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

## Appendix 19D Assessment of Malovent Aircraft Impact

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

EF3 SUP 19.5-2

## Appendix 19AA Summary of Plant-Specific PRA Review

### 19AA.1 Introduction

In accordance with 10 CFR 52.79(a)(46), this appendix provides a summary of plant-specific PRA and its results.

### 19AA.2 Development of the ESBWR and Plant-Specific PRAs

The following Fermi site-specific PRA attributes were compared to the ESBWR PRA to determine if the ESBWR PRA is suitable for assessing risks and insights for Fermi 3:

- Loss of Preferred Power (LOPP) frequency – to determine if the site has unusual off-site power availability problems. The LOPP frequency is divided into plant-centered, switchyard, grid-related, and weather-related initiating events.
- Loss of Service Water frequency – to determine if any unusual characteristics would apply to a particular site, with consideration to loss of ultimate heat sink, and the effects of extreme seasonal temperatures.
- Seismic fragilities – to determine whether the site specific design response spectra affects the ESBWR Seismic Margins Analysis (SMA) or the PRA. Note that HCLPF values will be confirmed as described in Subsection 19.2.3.2.4.

- Other Known Site-Specific Issues – to identify site-specific initiating events that are not identified in the ESBWR PRA, such as unique offsite consequence issues.

These parameters represent site-specific features that have the potential to affect the PRA. To ensure that the ESBWR PRA is a bounding standard design, the site-specific values for these parameters were reviewed.

The ESBWR LOPP frequencies are based on NUREG/CR-6890, "Reevaluation of Station Blackout Risk at Nuclear Power Plants." The Fermi 3 LOPP frequencies were compared to the ESBWR frequencies to identify any outliers. The data shows that grid-related losses are significantly more frequent than plant-centered, switchyard, or weather-related losses of power. Although there is a variance in the values for the LOPP frequencies, their range is acceptable. The conclusions in ESBWR DCD Section 19.2.3.1, Risk from Internal Events, remain valid for the minor variances in LOPP frequencies.

The ESBWR Loss of Service Water frequency is based on NUREG/CR-5750, "Rates of Initiating Events at U. S. Nuclear Power Plants: 1987-1995." Loss of Service Water contributes less than one percent to the ESBWR Core Damage Frequency (CDF). Variances between the reported values depend on the design configuration (e.g., redundancy) of the current plants versus the ESBWR design, or external influences such as loss or degradation of heat sink. A review of the Fermi 3 design did not identify any site specific vulnerabilities that would cause the Loss of Service Water frequency to be higher than assumed in the ESBWR PRA. The Fermi 3 Plant Service Water System (PSWS) is designed so that neither a single active nor single passive failure results in a complete loss of plant component cooling and/or plant dependence on any safety-related system. This is achieved through the use of redundant components, automatic valves and piping cross-connects for increased reliability. Additional PSWS design features to improve system reliability include:

- The PSWS is designed for remote operation from the main control room (MCR), for ease of restoration of its function after a component failure without a plant operating mode or power level change, and to operate even during a LOPP.

- The PSWS is designed to take suction from closed-cycle treated water systems and is not susceptible to raw water failure mechanisms (e.g., intake blockage). During normal operation the Circulating Water System supplies water to the PSWS. Makeup water to the Circulating Water System and the PSWS is provided from Lake Erie by the Plant Cooling Tower Makeup System. The PSWS is designed to operate for up to 7 days without makeup.
- The PSWS heat load is rejected to the Circulating Water System during normal operation, which is cooled by a Natural Draft Cooling Tower (Normal Power Heat Sink). Upon loss of the Circulating Water System, the PSWS heat load is rejected by the PSWS Mechanical Draft Cooling Towers (Auxiliary Heat Sink).
- During normal operation, one of two PSWS pumps per train is operating. The standby pump will automatically start upon detection of low PSWS pressure, loss of power to the operating pump, or a trip of the operating pump.
- The PSWS pumps each have a self-cleaning strainer which operates automatically. The pump discharge strainers have a remote manual override feature for their automatic cleaning cycle.

These items would reduce the Loss of Service Water frequency because of the redundant features included in the design and design features that minimize dependence on Lake Erie as a source of water for the PSWS.The conclusions in DCD Section 19.2.3.1, Risk from Internal Events, remain valid for the minor variances in Loss of Service Water frequencies.

The ESBWR design incorporates a seismic response spectrum that bounds the potential U.S. sites. The conclusions in DCD Section 19.2.3.2.4, Evaluation of External Event Seismic, remain valid for site-specific differences in seismic response.

There are no unusual terrain features that would affect meteorological data or plume dispersion. The conclusions in DCD Section 19.2.5 for offsite consequences remain valid for any potential differences between site features.

In addition to the bounding treatment of PRA parameters, there are no departures from the standard design in any systems considered in the PRA model. Therefore, there are no site-specific design features that affect the PRA because the boundary of the certified design covers all of the SSCs necessary for the PRA.

### 19AA.3 Internal Flooding

#### 19AA.3.1 Internal Flooding Associated with the Yard Area

The yard flood zone is essentially all outside areas of the site, and thus the site plot drawing (FSAR Figure 2.1-204) illustrates the areas of concern. In addition DCD Section 3.4.1.1 stipulates that the plant grade level is above the design flood level. The only components located in the yard that support a safety function are the manual fire hose connections to the Reactor Building and Fuel Building. These connections are also above design flood level. These connections provide the capability to connect another source of water to the Isolation Condenser/Passive Containment Cooling System (IC/PCCS) pools and the Spent Fuel Pool after seven days following a postulated accident. This timeframe is beyond the time required to be considered for the PRA; therefore, external flooding in the yard does not affect PRA equipment.

#### 19AA.3.2 Internal Flooding Associated with the Yard Area

The Service Water Structure is a site-specific design feature. It is treated in a bounding manner in the ESBWR PRA to demonstrate that site-specific differences in Service Water Structure design do not have a significant effect on the PRA results. The Service Water Structure houses the four Service Water pumps and their associated power supplies and controls. Because Service Water is a RTNSS function, in accordance with DCD Table 19A-4, the design and installation of the Service Water Structure is required to include protection from the effects of external and internal flooding.

In the ESBWR PRA model, the Service Water Structure is conservatively considered to be one flood zone. All four pumps are assumed to fail in an internal flood. Thus, the ESBWR PRA is bounding for design differences in the Service Water Structure. In addition, the ESBWR PRA model does not credit operator actions to mitigate a flooding event, so differences in building location are not significant.

The conclusion in DCD Section 19.2.3.2.2 is that there are no significant flood-initiated accident sequences due to the low CDF. Overall, the potential effects of Service Water Structure design differences are accounted for by using a bounding analysis, and therefore, are not significant to the ESBWR PRA.

In summary, the ESBWR PRA provides a reasonable representation of the parameters and conditions that are specific to the Fermi site.