FINAL SAFETY ANALYSIS REPORT

CHAPTER 19

PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT EVALUATION

19.0 PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT EVALUATION

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements as identified in the following sections.

The U.S. EPR FSAR includes the following COL Item in Section 19.0:

> The COL applicant that references the U.S. EPR design certification will either confirm that the PRA in the design certification bounds the site-specific design information and any design changes or departures, or update the PRA to reflect the site-specific design information and any design changes or departures.

This COL Item is addressed as follows:

{The PRA in the U.S. EPR design certification bounds CCNPP Unit 3 as discussed in this chapter.}

19.1 PROBABILISTIC RISK ASSESSMENT

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

19.1.1 Uses and Application of the PRA

19.1.1.1 Design Phase

The U.S. EPR FSAR includes the following COL Item in Section 19.1.1.1:

> A COL applicant that references the U.S. EPR design certification will describe the uses of PRA in support of site-specific design programs and processes during the design phase.

This COL Item is addressed as follows:

{No additional PRA-related design activities are anticipated for CCNPP Unit 3.} The adequacy of the PRA will be assessed relative to any future risk-informed application during the design phase.

The PRA maintenance and update activities described in Section 19.1.2.4.1 will be performed as needed during the design phase.

19.1.1.2 Combined License Application Phase

The U.S. EPR FSAR includes the following COL Item in Section 19.1.1.2:

> A COL applicant that references the U.S. EPR design certification will describe the uses of PRA in support of licensee programs and identify and describe risk-informed applications being implemented during the combined license application phase.

This COL Item is addressed as follows:

PRA uses in the combined license application phase include:

- identification of risk-informed safety insights associated with the design and operation.
- provide PRA importance measures for input to the Reliability Assurance Program (RAP).
- gain risk insights associated with establishing allowed outage times for certain equipment technical specifications.
- input to the procedure development process/human factors.

The PRA is used to perform a conservative, quantitative screening of airplane hazard and tornado hazard in the assessment of external events. There are no additional risk-informed applications currently proposed. The adequacy of the PRA will be assessed relative to any future risk-informed application during the Combined License Application Phase.

19.1.1.3 Construction Phase

The U.S. EPR FSAR includes the following COL Item in Section 19.1.1.3:

> A COL applicant that references the U.S. EPR design certification will describe the uses of PRA in support of licensee programs and identify and describe risk-informed applications being implemented during the construction phase.

This COL Item is addressed as follows:

{No specific PRA uses are anticipated during the construction phase. There are no risk-informed applications currently proposed.} The adequacy of the PRA will be assessed relative to any future risk-informed application during the construction phase.

19.1.1.4 Operational Phase

The U.S. EPR FSAR includes the following COL Item in Section 19.1.1.4:

> A COL applicant that references the U.S. EPR design certification will describe the uses of PRA in support of licensee programs and identify and describe risk-informed applications being implemented during the operational phase.

This COL Item is addressed as follows:

The PRA risk insights will be used to support typical licensee programs such as:

- the Significance Determination Process (SDP).
- Mitigating System Performance Index (MSPI).
- 10 CFR 50.65 Maintenance Rule and associated (a)(4) determinations.

{There are no risk-informed applications currently proposed.}

19.1.2 Quality of PRA

No departures or supplements.

19.1.2.1 PRA Scope

No departures or supplements.

19.1.2.2 PRA Level of Detail

The U.S. EPR FSAR includes the following COL Item in Section 19.1.2.2:

> A COL applicant that references the U.S. EPR design certification will describe the process to review as-designed and as-built information and conduct walk-downs as necessary to confirm that the assumptions used in the PRA, including PRA inputs to RAP and severe accident mitigation design alternatives (SAMDA), remain valid with respect to internal events, internal flooding and fire events (routings and locations of pipe, cable and conduit), and human reliability analyses (HRA) (i.e., development of operating procedures, emergency operating procedures and severe accident management guidelines and

training), external events including PRA-based seismic margins, plant and sequence level high confidence low probability of failure (HCLPF) capacities, and low power shutdown (LPSD) procedures. The process to review and confirm assumptions shall consider key uncertainties identified by the PRA.

This COL Item is addressed as follows:

A process to review as-designed and as-built information will be developed and walk-downs will be performed, as necessary, to confirm that the assumptions used in the PRA, including design certification related PRA assumptions found in U.S. EPR FSAR Table 19.1-109 and PRA inputs to RAP and SAMDA, remain valid with respect to internal events, internal flooding and fire events (routings and locations of pipe, cable and conduit), and HRA (i.e., development of operating procedures, emergency operating procedures and severe accident management guidelines and training), external events including PRA-based seismic margins, HCLPF fragilities, and LPSD procedures. This process and the results will be documented in the site-specific PRA, which is described in Section 19.1.2.4.1.

19.1.2.3 PRA Technical Adequacy

The U.S. EPR FSAR includes the following COL Item in Section 19.1.2.3:

A COL applicant that references the U.S. EPR design certification will conduct a peer review of the PRA relative to the ASME PRA Standard prior to use of the PRA to support risk-informed applications.

This COL Item is addressed as follows:

A peer review of the PRA relative to the ASME PRA Standard shall be performed prior to use of the PRA to support risk-informed applications.

19.1.2.4 PRA Maintenance and Upgrade

No departures or supplements.

19.1.2.4.1 Description of PRA Maintenance and Upgrade Program

The U.S. EPR FSAR includes the following COL Item in Section 19.1.2.4.1:

A COL applicant that references the U.S. EPR design certification will describe the applicant’s PRA maintenance and upgrade program.

This COL Item is addressed as follows:

A PRA Maintenance and Update program was included in the U.S. EPR FSAR. The information contained in this section is a supplement to that program to support the additional needs of an operating nuclear plant.

The PRA is treated as a living document. The PRA Configuration Control Program maintains (updates) or upgrades the PRA in the manner prescribed by ASME RA-Sc-2007, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications" (ASME, 2007) and as clarified by Regulatory Guide 1.200 (NRC, 2007a). Thus:

- Not later than the date of initial fuel loading, the site specific PRA will be upgraded to contain Level 1 and Level 2 analyses, and to include those events and modes for which NRC-endorsed consensus standards on PRA existed one year prior to scheduled fuel loading.

- The PRA will be upgraded every four years until permanent cessation of operations. The upgraded PRA will include initiating events and modes of operation contained in NRC-endorsed consensus standards in effect one year prior to each upgrade.

- Not later than the date on which a site specific application for a renewed license is submitted, the PRA will be upgraded to cover all modes and all initiating events.

The key PRA terms "Maintenance" and "Upgrade" are defined as follows:

- **PRA Maintenance:** Update of PRA models to reflect plant changes such as design modifications, procedure changes, or plant performance (data).

- **PRA Upgrade:** Incorporation into a PRA system of a new PRA methodology or a significant change in PRA scope or capability. This could include, for instance, items such as a new human error analysis methodology, new data update method, new approach to quantification or truncation, or new treatment of common cause failure.

Industry peer review will be performed for the PRA upgrades, as they are defined above. Appendix A of ASME RA-Sc-2007 (ASME, 2007) provides example revisions to increase clarity on what constitutes an upgrade, versus an update and, therefore, what requires a peer review. When assessing a need for a peer review, consideration will also be given to scope or number of PRA maintenance activities performed. Although individual changes to a PRA model may be considered PRA maintenance activities, the integrated nature of several changes may make a peer review desirable. This is because multiple PRA maintenance activities can, over time, lead to considerable changes in the PRA insights (e.g., relative risk importance of SSCs), and a periodic peer review might be prudent.

Peer reviews will be performed in accordance with Regulatory Guide 1.200 (NRC, 2007a), which endorses NEI 00-02, "Probabilistic Risk Assessment (PRA) Peer Review Process Guidance" (NEI, 2006), with exceptions. Peer review findings and observations using this process will indicate what improvements are needed to raise the grade given for each PRA technical element. Review findings and observations will be dispositioned based on their importance.

19.1.3 Special Design/Operational Features

No departures or supplements.

19.1.4 Safety Insights from the Internal Events PRA for Operations at Power

19.1.4.1 Level 1 Internal Events PRA for Operations at Power

{Two CCNPP Unit 3 site-specific items have been identified as having the potential to affect the PRA model:

- Loss of Offsite Power (LOOP) frequency and duration

- Circulating Water System (CWS) and Normal Heat Sink (NHS)

These items are evaluated as follows for potential deviations from the U.S. EPR FSAR.

Loss of Offsite Power

LOOP frequencies used in the U.S. EPR FSAR PRA model are consistent with NUREG/CR-6890 (NRC, 2005). The LOOP value used in the PRA model is approximately 1.9E-02/yr. This value departs from the NUREG/CR-6890 base value of 3.6E-02/yr by not including consequential LOOP events (consequential LOOP is treated separately in the model) and crediting the U.S. EPR full load rejection capability for grid-related events.

NUREG/CR-6890 provides specific LOOP frequency values for each U.S. nuclear plant. The base value for LOOP at CCNPP Units 1 and 2, is approximately 2.9E-02/yr or 1.9E-02/yr if adjusted for full load rejection capability. These values include plant-centered and switchyard-centered LOOPs, as well as grid-centered and weather-centered LOOP events. A composite LOOP frequency is calculated by using the U.S. EPR FSAR-generated values for plant and switchyard centered LOOP events, and site-specific values for weather and grid centered LOOP events. This gives a LOOP event frequency (adjusted for consequential LOOP and full load rejection) of approximately 1.7E-02/yr for the CCNPP Unit 3 site. This LOOP event frequency is smaller than the value used in the U.S. EPR FSAR PRA model (1.9E-02/yr); therefore the LOOP event frequency for CCNPP Unit 3 is bounded by the value in the U.S. EPR FSAR PRA model. In general, given that the generic LOOP frequency for the USA is used in the U.S. EPR PRA, this frequency is likely to be conservative for advanced plants because better plant and switchyard performances are expected.

The site-specific LOOP nonrecovery probabilities are as follows:

- 1-Hour LOOP nonrecovery probability of 0.516 compared with a U.S. EPR value of 0.530;
- 2-Hour LOOP nonrecovery probability of 0.307 compared with a U.S. EPR value of 0.318;
- 24-Hour LOOP and nonrecovery probability of 3.7E-05 compared with a U.S. EPR value of 4.8E-05.

The use of U.S. EPR data for LOOP nonrecovery probabilities bounds CCNPP Unit 3 site-specific values and the difference does not have a significant impact on the PRA results.

For the consequential LOOP, there is limited industry data. The U.S. EPR FSAR analysis used generic data from NUREG/CR-6890. This data is applicable to CCNPP Unit 3.

Circulating Water System

The CWS is not modeled in detail in the U.S. EPR FSAR PRA. Failures of the CWS are included in the determination of initiating event frequencies for loss of balance of plant (LBOP). Although generic frequencies were used for the Loss of Condenser and Loss of Main Feedwater initiating events, the LBOP initiating event was added to ensure that the contribution of the support systems that could fail both the Main Feedwater and the Startup and Shutdown systems were modeled. The LBOP initiating event can be caused by a failure of the Normal Heat Sink, Circulating Water system, Auxiliary Cooling Water system, or Closed Cooling Water system, which are included in the LBOP fault tree. The LBOP frequency was calculated using design-specific fault tree analyses. Lognormal distribution is used to model uncertainties in the calculated value.

The NHS is modeled as a support system to the CWS auxiliary cooling system, which provides cooling to the condenser. Failure of the NHS is assumed to result in a loss of main feedwater and startup and shutdown feedwater (SSS). The failure of the NHS for 24 hours following a plant trip is modeled to envelop all failures of the CWS.

The CWS design for CCNPP Unit 3 includes four 25% capacity circulating water pumps. The design for the NHS is a hybrid (wet/dry) cooling tower. It is judged that the U.S. EPR FSAR PRA adequately models the different aspects of the site-specific circulating water system.

The Normal Heat Sink (NHS) and the CWS are modeled in the U.S. EPR PRA as one undeveloped event, with scope that consists of:

- The NHS
- The CWS ability to provide cooling to the Main Condenser and to the Auxiliary Cooling Water (ACW) system

This undeveloped event has a failure frequency of 1.0E-02 per year and a failure probability of 2.8E-05 in a 24-hour mission time. These numbers are based on generic industry data from NUREG/CR-6928 and NUREG/CR-5750. These NUREGs give a frequency of failure of 1.3E-02. The use of 1.0E-02 is considered reasonable for the following reasons:

- The value of 1.3E-02 included events such as screen plugging, not likely in a closed system, as is used in CCNPP Unit 3
- Loss of Auxiliary Cooling Water events, to which failures of the Circulating Water System and Normal Heat Sink contribute, are also included within the Loss of Main Feedwater initiating event and the Loss of Condenser initiating event, multiple-counting some events

The values used and system characteristics used for the NHS and CWS are generic and/or applicable to CCNPP Unit 3.

Regarding the Closed Cooling Water system, the CCNPP Unit 3 system is consistent with the U.S. EPR model.

Regarding the ACW system, the CCNPP Unit 3 system is conservatively modeled by the U.S. EPR model. The U.S. EPR models does not take credit for the bypass around both ACW pumps that allows the CCNPP Unit 3 CWS system to provide the water supply and motive force for the ACW system. This is the normal mode of operation with both ACW pumps in standby. The use of U.S. EPR ACW system model bounds CCNPP Unit 3 specific system design and the difference does not have a significant impact on the PRA results.

It is concluded that the U.S. EPR FSAR PRA for Level 1 internal events at power is applicable and bounding for the CCNPP Unit 3 site. The site and plant-specific parameters do not have a significant impact on the PRA results and insights. Therefore, no changes to the U.S. EPR FSAR Level 1 internal events PRA are necessary when considering specific CCNPP Unit 3 site and plant parameters.

19.1.4.2 Level 2 Internal Events PRA for Operations at Power

No departures or supplements.}

19.1.5 Safety Insights from the External Events PRA for Operations at Power

19.1.5.1 Seismic Risk Evaluation

No departures or supplements.

19.1.5.1.1 Description of the Seismic Risk Evaluation

19.1.5.1.1.1 Methodology

No departures or supplements.

19.1.5.1.1.2 Seismic Hazard Input

{Section 3.7 discusses the GMRS. The GMRS for CCNPP Unit 3 is shown in Figure 2.5-81. The PRA-based seismic margin assessment follows the guidance in SECY 93-087 and demonstrates that there is a minimum seismic margin of 1.67 times the GMRS for CCNPP Unit 3.}

19.1.5.1.1.3 Seismic Fragility Evaluation

The U.S. EPR FSAR includes the following COL Item in Section 19.1.5.1.1.3:

> A COL applicant that references the U.S. EPR design certification will, for equipment on the Seismic Equipment List (SEL), confirm that seismic margin is achieved through the seismic qualification implementation program by demonstrating High Confidence Low Probability of Failure (HCLPF) capacities as provided in Table 19.1-106.

This COL Item is addressed as follows:

> For equipment within the certified design scope on the SEL, the High Confidence Low Probability of Failure (HCLPF) capacities are determined using the U.S. EPR CSDRS as the seismic input. If one or more HCLPF values is determined to have a value of less than 0.5g peak ground acceleration (PGA), an analysis is required prior to fuel load to demonstrate that the plant level HCLPF meets or exceeds 1.67 times the CSDRS (0.5g PGA).

19.1.5.1.1.4 Systems and Accident Sequence Analysis

No departures or supplements.

19.1.5.1.1.5 HCLPF Sequence Assessment

{The HCLPF capacity for the CCNPP Unit 3 Structures, Systems and Components (SSCs) that are part of the U.S. EPR generic design is established at 1.67 times CSDRS (0.5 g PGA). The CCNPP Unit 3 meets this requirement since the site specific In Structure Response Spectra (ISRS) are bounded by the U.S. EPR ISRS, except at very low frequencies.

The DC Plant SSCs that are susceptible to low frequency ground motion will meet a HCLPF of 1.67 the times GMRS or CSDRS, whichever is controlling.}

19.1.5.1.2 Results from the Seismic Risk Evaluation

19.1.5.1.2.1 Risk Metrics

No departures or supplements.

19.1.5.1.2.2 Significant Initiating Events and Sequences

No departures or supplements.

19.1.5.1.2.3 Significant Functions, SSCs, and Operator Actions

No departures or supplements.

19.1.5.1.2.4 Key Assumptions and Insights

The U.S. EPR FSAR includes the following COL Item in Section 19.1.5.1.2.4:

> A COL applicant that references the U.S. EPR design certification will confirm that the U.S. EPR PRA-based seismic margin assessment is bounding for their specific site, and will update it to include site-specific SSC and soil effects (including sliding, overturning, liquefaction, and slope failure).

This COL Item is addressed as follows:

The PRA-based seismic margins assessment performed for the U.S. EPR FSAR is based on the assumption that the U.S. EPR is designed using the EUR-based certified seismic design response spectra (CSDRS) anchored to a peak ground acceleration (PGA) of 0.3g for selected generic soil profiles. The seismic margins assessment for the U.S. EPR FSAR used CSDRS times 1.67 to define the targeted seismic margin. The seismic margins assessment for the U.S. EPR FSAR remains valid if it can be demonstrated that the U.S. EPR FSAR seismic design parameters bound those for the site-specific seismic characteristics, including the ground motion response spectra (GMRS) and site-specific soil profiles.

{For site specific effects and plant specific components, the HCLPF capacity for the CCNPP Unit 3 site is established at 1.67 times the GMRS. In particular instances such as sliding analysis of buildings, the Foundation Input Response Spectra (FIRS) are conservatively used instead of the GMRS.

In accordance with ISG-20, the need for an update of the U.S. EPR Seismic Margin Analysis (SMA) has been evaluated for the CCNPP Unit 3 site. The scope of CCNPP Unit 3 related SMA update includes the following site specific effects and plant specific components:

- Site specific effects
  - Liquefaction
  - Slope stability
  - Nuclear Island (NI) related soil effects
    - Sliding Stability
    - Seismic induced bearing pressures over soil dynamic bearing capacity
  - Emergency Power Generation Building (EPGB) related soil effects
    - Sliding Stability
    - Seismic induced bearing pressures over soil dynamic bearing capacity

- Essential Service Water Building (ESWB) related soil effects
  - Sliding Stability
  - Seismic induced bearing pressures over soil dynamic bearing capacity
- Nuclear Auxiliary Building (NAB) related soil effects
  - Sliding Stability/Gap distance between the NAB and the Safeguards and Fuel Buildings of the NI
  - Seismic induced bearing pressures over soil dynamic bearing capacity
- Access Building (AB) related soil effects
  - Sliding Stability/Gap distance between the AB and the Safeguards Buildings of the NI
  - Seismic induced bearing pressures over soil dynamic bearing capacity
- Turbine Island (TI) related soil effects (Includes Switchgear and Turbine Buildings)
  - Sliding Stability
  - Seismic induced bearing pressures over soil dynamic bearing capacity

♦ Plant specific Category I and Category II structures
- Makeup Water Intake Structure (MWIS)
- Turbine Island (TI)
- Access Building (AB)

♦ Plant specific seismically qualified safety related components
- Buried pipes in the vicinity of the Powerblock Area
- Components in the MWIS

As indicated in Section 19.1.5 of the CCNPP Unit 3 Final Safety Analysis Report (FSAR), makeup to the ESWB cooling towers is not credited in the Design Certification (DC) Probabilistic Risk Assessment (PRA). Therefore, an update of the U.S. EPR PRA does not require the fragility or margin analysis of the CCNPP Unit 3 MWIS, the pipeline corridor between the MWIS and the Powerblock Area, or the soil effects associated to these components.

The Category II TI houses the Station Blackout (SBO) Diesels and is designed to Category I seismic requirements. Therefore, its design will ensure that the Plant Level High Confidence Low Probability of Failure (HCLPF) of 1.67 is maintained.

The NAB and AB are also Category II structures designed to meet Category I seismic design criteria and do not house any risk significant or safety-related components. Therefore, only the effects related to soil interface (sliding and soil bearing failure) may impact the Plant Level HCLPF. The soil effects related to the NAB and AB are addressed further in this section.

Given the low seismicity of the CCNPP Unit 3 site with respect to the U.S. EPR CSDRS, the SMA update approach is based on the screening of rugged site specific effects and plant specific components of the CCNPP Unit 3 site. The screening considers the GMRS, or FIRS, as applicable, with the PGA scaled by a factor of 1.67.

Site specific effects and plant specific components are demonstrated to be rugged for 1.67 times GMRS seismic demand.

The CCNPP Unit 3 SMA update approach is based on the screening of site specific and plant specific information for the CCNPP Unit 3 site. The analyses and results shown in the following paragraphs indicate that the site specific effects and plant specific components are screened as rugged items based on the GMRS (or FIRS), with the PGA scaled by a factor of 1.67.

In order to describe the screening of each of the site effects and plant components listed above, it is required to indicate that the SSE is higher than the GMRS and related FIRS and therefore some level of margin is already built into the analysis. Therefore, the Factor of Safety (FOS) that meets the required margin for the CCNPP Unit 3 site is:

$$FOS = \frac{1.67 \times PGA_{GMRS}}{PGA_{SSE}} = \frac{1.67 \times 0.115}{0.150} = \frac{0.192}{0.150} = 1.28$$

Where:

FOS $\rightarrow$ Factor of Safety

PGA_{GMRS} $\rightarrow$ Peak ground acceleration of the CCNPP Unit 3 GMRS

PGA_{SSE} $\rightarrow$ Peak ground acceleration of the CCNPP Unit 3 SSE

LIQUEFACTION

The details of the calculations that establish the potential for liquefaction are included in Section 2.5.4.8 of the CCNPP Unit 3 FSAR. The FOS to prevent liquefaction does not have a linear relationship to the PGA. Therefore, the 0.15 g analysis presented in Section 2.5.4.8 was supplemented with a counterpart that uses an input PGA of 0.192 g, and an earthquake magnitude of 6. Both analyses indicate that liquefaction potential is only present for very limited locations of the surface terrace sands. These sands are therefore to be removed and replaced by engineered backfill material that is not susceptible to liquefaction. Consequently, even for seismic ground motion consistent with 1.67 x PGA of the GMRS, there is no potential for liquefaction at the CCNPP Unit 3 site.

SLOPE STABILITY

For slope stability, since the CCNPP Unit 3 analysis was performed for an acceleration level of 0.15 g (FSAR Section 2.5.5) a Factor of Safety (FOS) against sliding that meets the required seismic margin for screening of effects and components is:

$$FOS = \frac{1.67 \times 0.115}{0.150} = 1.28$$

As described in FSAR Section 2.5.5, a pseudo-static analysis is used for two cases: total stress and effective stress. Several slope sections are evaluated for stability.

A pseudo-static analysis is used to incorporate seismic forces into the slope stability analysis. Total stress conditions are representative of dynamic conditions at the site, since pore water pressures do not have time to dissipate.

The lowest FOS reported in FSAR Section 2.5.5 (for 0.15g horizontal motion) is 1.48. This exceeds the required FOS of 1.28. Therefore, it is concluded that the FOS for slope stability meets the required margin of 1.67 times the GMRS.

BUILDING RELATED SITE SOIL EFFECTS

For site soil effects that correspond to sliding analysis and dynamic bearing pressure demands of buildings, the building-specific FIRS are used instead of the GMRS. The FIRS are the seismic design basis that are used for the building analyses and are generally higher than the GMRS. Therefore, lesser margin is available for these site effects.

Table 19.1-2 provides the FIRS PGA levels for each building, the required seismic margin, and the overall required FOS, which is calculated as follows:

$$FOS = \frac{1.67 \times PGA_{FIRS}}{PGA_{SSE}}$$

Where:

FOS → Factor of Safety

PGA_{FIRS} → Peak ground acceleration of the building specific FIRS

PGA_{SSE} → Peak ground acceleration of the CCNPP Unit 3 SSE

The 0.15 g level SSE is used for the sliding and bearing demands analyses of the NI, the NAB, and the AB (NI/NAB/AB). For the case of the EPGB, the ESWB, and the TI, additional margin was incorporated into the analysis with the use of higher than anticipated Structure to Soil to Structure Interaction (SSSI) effects. Details of the calculation of FIRS and the incorporation of SSSI effects are described in Section 3.7.1 and 3.7.2 of the CCNPP Unit 3 FSAR. Table 19.1-2 provides the building specific seismic margins that are required for screening as well as their associated FOS target values.

The Category II Buildings that are close to the NI (NAB, AB) are included since soil related sliding and bearing failures of these structures may potentially impact the stability of the adjacent Category I structures. These Category II structures are analyzed and designed to Seismic Category I design criteria.

Table 19.1-3 provides the seismic margins related to each particular site effect. The values reported in Table 19.1-3 originate from the analysis performed with the seismic design basis input.

As indicated in Table 19.1-3, the design basis FOS to prevent sliding of the AB does not meet the required margin. However, the design basis sliding analysis of the AB assumed several conservatisms that allow one to conclude that the actual FOS is higher than the reported value of 1.38.

The FOS to prevent sliding for the AB was obtained assuming that:

- Seismic forces, from all directions, act with the highest acceleration demand occurring at the same point in time and towards the same direction; a pseudo-static approach was used to incorporate seismic forces using the Zero Period Acceleration (ZPA) obtained from a dynamic Soil Structure Interaction (SSI) analysis.
- Uplift forces include buoyancy and the vertical seismic force; the vertical seismic force is assumed to act upward at all times.
- No side wall friction or adhesion of the walls in contact with the soils is considered.

As discussed below, by removing only the first conservatism listed above, the FOS will increase by more than 35%, from 1.38 to 1.89.

Inter-story forces of the AB are calculated by multiplying the story masses times the ZPA. The maximum base horizontal shear is obtained after performing a Square Root Sum of the Squares (SRSS) combination of the orthogonal ZPA related forces. The resulting base shear is conservative since it is obtained with the assumption that seismic forces act at their maximum magnitude, at the same moment in time, and toward the same direction. The SRSS combination of orthogonal forces always use the maximum ZPA related values of each direction. In order to obtain an estimate of the FOS without the incorporation of this conservatism, horizontal forces are combined at each time step and the maximum force is obtained as the maximum recorded throughout the time history. The use of the time history approach indicates that the FOS to prevent sliding of the AB exceeds the required target FOS of 1.47 by ample margin. It is therefore concluded that the sliding stability of the AB may be screened out as a rugged component since the FOS is higher than the one required when using a seismic margin level of 1.67 x AB building specific FIRS.

PLANT SPECIFIC COMPONENTS, BURIED PIPES

The seismic design basis calculation of buried pipes is provided in CCNPP Unit 3 FSAR Section 3.0 Appendix 3E.6. The maximum Demand/Capacity ratio reported is 0.5, obtained for an acceleration level of 0.15 g. Since the design of buried pipes is likely controlled by loads other than seismic, the 0.5 ratio suggests that buried pipes have sufficient ruggedness to meet 1.67 times the 0.115g GMRS ZPA. However, since a FOS for this item was not calculated during design basis analysis, a seismic margin for buried pipes was calculated using three representative duct bank sizes analyzed for 0.192 g ZPA. The method of analysis for seismic response accounts for soil-structure interaction (SSI) effect between the duct bank and surrounding soil (the design basis calculation had conservatively ignored this aspect). The dead and soil load responses, which are based on a beam-on-elastic-foundation approach, are taken from the design basis calculation. Moment and shear demands for these loads are combined with respective values obtained for seismic loads.

The Seismic Category I Buried Duct Banks for CCNPP Unit 3 have been found to be adequate in design for the increased ZPA of 0.192 g. The duct banks have a minimum Seismic Margin (SM) of 0.37 g, which provides an FOS greater than 3.0 (0.37/0.115). The SM is higher than the required 0.192 g value since the design of buried pipes is heavily influenced by loads other than seismic.

SCREENING OF PLANT SPECIFIC COMPONENTS AND SITE SPECIFIC EFFECTS

The analysis of the site specific soil effects and plant specific components indicates that the DC HCLPF calculations are not affected by the CCNPP Unit 3 site effects and plant specific components. The site specific effects and plant specific components are screened out for ruggedness and do not impact the plant level HCLPF of 1.67 times the GMRS (or FIRS).}

19.1.5.1.2.5 Sensitivities and Uncertainties

No departures or supplements.

19.1.5.2 Internal Flooding Risk Evaluation

{Most systems considered as internal flooding sources, including the ESWS, are addressed as part of the standard design described in the U.S. EPR FSAR. Site-specific systems modeled in the

PRA, such as the CWS could only cause flooding events in the Turbine Building. The internal flooding frequency in the Turbine Building in the U.S. EPR FSAR PRA is based on a generic conservative frequency; therefore, it is considered conservative for CCNPP Unit 3. The U.S. EPR FSAR internal flooding PRA is applicable for CCNPP Unit 3.}

19.1.5.3 Internal Fires Risk Evaluation

No departures or supplements.

19.1.5.4 Other External Risk Evaluations

The U.S. EPR FSAR includes the following COL Item in Section 19.1.5.4:

> A COL applicant that references the U.S. EPR design certification will perform the site-specific screening analysis and the site specific risk analysis for external events applicable to their site.

This COL Item is addressed as follows:

The U.S. EPR FSAR scope of external event screening includes a high level assessment of high winds, hurricanes, and tornadoes, external flooding and external fires.

{A screening analysis of the risks posed by external events to the CCNPP Unit 3 site was performed. All of the external events listed in Appendix A of ANSI/ANS 58.21 2007 (ANSI, 2007) have been addressed. For each external event, a progressive approach is used following the guidance in ANSI/ANS 58.21 2007 and in NUREG-1407 (NRC, 1991). To reflect the lower risk profile of the U.S. EPR, the quantitative screening value has been adjusted according to the relative baseline risk value. The quantitative screening threshold has been lowered to either:

1. Initiating event frequency for the external hazard event is less than or equal to 1E-7 per year (assuming that the event would not completely disable the plant mitigating ability), or

2. The Core Damage Frequency (CDF) is less than 10% of the baseline CDF, using demonstrably conservative analysis. The U.S. EPR baseline CDF at power is 5.3E-7 per year.

The screening evaluation for the CDF (Number 2 above) was done based on the at-power CDF only, with the screening value of 5.3E-8 per year, because the screened hazard events are evaluated to present lesser challenges to the shutdown operation. This evaluation is based on the following:

- ♦ The external hazard events leading to a LOOP event would not necessarily cause an initiating event in shutdown (a loss of shutdown cooling) if emergency power is available, and the emergency diesel generators are located in the separated and protected buildings.

- ♦ The mitigating systems that are located in the non-safety/not-protected structures, like Balance of Plant (BOP) systems, are not credited in the shutdown operation.

An external event that meets the ANSI/ANS-58.21-2007 screening criteria, and is assessed as having a low risk value both in absolute terms and with consideration of the low risk values for the U.S. EPR assessment, is not considered to be a significant contributor to risk and is screened from further consideration.

The plant design bases for external events are compared against ANSI/ANS 58.21 2007 and NUREG-0800 (NRC, 2007c) screening criteria. If the event cannot be qualitatively screened, a quantitative PRA assessment is performed to assess the risk posed by that external event against the quantitative screening criteria.

As defined in ANSI/ANS-58.21-2007, Table 19.1-1 provides a list of all external events considered. Also provided is the reason for screening each event or the relevant section where screening is discussed.

19.1.5.4.1 High Winds, Hurricanes, and Tornado Risk Evaluation

The risks posed by high winds, hurricane and tornado wind loads and hurricane and tornado missile events at the CCNPP Unit 3 site on U.S. EPR structures were evaluated versus NUREG-0800 acceptance criteria. The design requirements for safety-related structures of the U.S. EPR FSAR meet these criteria. The non-safety-related structures located on-site and not designed for tornado loads are evaluated in Section 3.3.

The non-safety-related structures which have systems and components modeled in the PRA include:

- Turbine Building
- Switchgear Building
- Transformer and Switchyard Areas
- Normal Heat Sink
- Nuclear Auxiliary Building
- Ultimate Heat Sink Makeup Structure

High Wind Load

The U.S. EPR safety related structures are designed to withstand high wind load characteristics as specified in NUREG-0800, Section 3.3.1. The SRP acceptance criteria for high winds specify that the design velocity pressure for safety-related structures must be greater than or equal to the velocity pressure corresponding to the speed of the 100-year return period 3-second wind gust. The design basis wind speed is 145 mph (65 m/sec) in open terrain with a 50-year mean recurrence interval. For the safety-related structures, the design wind speed is increased by an importance factor of 1.15 to obtain a 100-year mean recurrence interval.

As documented in Section 2.3.1.2.2.15, the 100 year return period 3-second wind gust for the CCNPP Unit 3 site is 102 mph (46 m/sec). This is significantly less than the design basis wind speed. Site-specific structures will be designed in compliance with ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures," (ASCE, 2006), therefore the design wind speed for those structures will be no less than 102 mph. Therefore the NUREG-0800, Section 3.3.1 screening criteria are met for high winds (other than tornadoes).

The non safety-related structures located on-site and not designed for high wind loads are evaluated in Section 3.3, to show that their collapse would not result in an impact on any of the safety-related structures. A subset of these structures that contain systems and components modeled in the PRA are listed below:

- Transformer and Switchyard Areas
- Normal Heat Sink

The Ultimate Heat Sink Make-up Structure also contains equipment that supports the long term operation of systems and components credited in the PRA. However, its function is not credited within the mission time assumed in the PRA model.

A re-occurrence interval of 1/150 years was also evaluated to confirm that extreme winds do not result in impacts greater than the 1/100 year wind speed and do not affect core damage frequency (CDF). The wind speed associated with the 1/150 year re-occurrence interval is 105.45 mph. Extreme winds affect normal and shutdown CDFs if they damage SSCs credited in contributing Probabilistic Risk Assessments (PRAs) or if they contribute to Loss of Offsite Power (LOOP) events, e.g., at the switchyard. Each scenario was examined with respect to the 1/150 year wind speed re-occurrence interval and no effect in CDF was confirmed based on the following:

- PRA/CDF credited SSCs that are, or are located within safety-related structures are, by definition, not affected by extreme winds. PRA/CDF credited SSCs that are located within non safety-related structures and completely dependent on offsite power are addressed by the LOOP PRA/CDF evaluation below. Remaining PRA/CDF credited SSCs that are located within non safety-related structures and not completely dependent on offsite power include the Switchgear Building and its contents (e.g., the station black-out diesel generators and the non safety-related uninterruptible power supply equipment). The Switchgear Building is designed to withstand tornado wind loadings (230 mph) as discussed in FSAR Sections 19.1.5.4.1 and 3.3.2.3, therefore, the building and its systems and components, are not affected by extreme winds.

- Wind initiated LOOP events are described in NUREG/CR-6890 and its Glossary cites hurricanes, strong winds, and tornados as examples. These LOOP events have been factored into the U.S. EPR PRA and full power/shutdown CDFs. Impact from the 1/150 year reoccurrence interval wind speed is bounded by these wind initiated LOOP events. Historically, none of the wind initiated LOOP events in NUREG/CR-6890 have occurred at the Calvert Cliffs Units 1 and 2 site and site data post NUREG/CR-6890 through 2012 shows no subsequent wind related LOOPs have occurred even though FSAR Section 2.3.1.2.2.6 and Table 2.3-4, show Calvert County recorded 104 mph winds (April 2000).

  Since wind initiated LOOP events in the U.S. EPR PRA remain bounding and there have been no wind initiated LOOP events historically at the Calvert Cliffs Site, the U.S. EPR PRA and CDFs are not affected by extreme winds.

Tornado and Hurricane Wind Load

The U.S. EPR safety-related structures are designed to meet the design-basis tornado wind characteristics of Tornado Intensity Region I and the hurricane wind characteristics as specified in NUREG 0800, Section 3.3.2. Tornado Intensity Region 1 (Central U.S.) is the most limiting for tornado wind loads and is characterized by a maximum tornado wind speed of 230 mph

(103 m/sec) (184 mph (82 m/ sec) maximum rotational speed, 46 mph (21 m/sec) maximum translational speed). Hurricane is characterized by a selected maximum hurricane wind speed of 230 mph.

The safety-related structures of the U.S. EPR are designed for the tornado and the hurricane wind loads corresponding to a maximum tornado wind speed of 230 mph (103 m/sec). Additionally, non-safety-related structures must not, upon failure caused by a tornado, cause failure of adjacent safety-related structures.

Tornado Wind Load Quantitative Analysis

A more detailed quantitative analysis is performed to evaluate plant risk as a result of tornado and the hurricane wind characteristics impact on non-safety-related structures, which contain systems and components modeled in the PRA. The detailed quantitative analysis considers a bounding tornado event plant impact scenario and tornado event frequency. The screening core damage frequency associated with the bounding scenario is the plant impact (conditional core damage probability) multiplied by the event frequency.

As stated above, safety-related structures are screened from further evaluation based on NUREG-0800 criteria and their tornado design features. Therefore, it is assumed that a tornado event will not affect safety-related structures or associated systems and components. A bounding plant impact scenario is used to develop risk insights associated with a tornado wind loading on non-safety-related U.S. EPR plant structures, which contain systems and components credited in the PRA model. The following non-safety-related structures of the U.S. EPR plant and associated systems and components are considered in the bounding impact scenario.

1. Auxiliary Power Transformer Area and Switchyard Area - contain components related to offsite power. Unrecoverable loss of offsite power event (LOOP) is assumed in the bounding scenario.

2. Switchgear Building - contains the two station black-out diesel generators (SBO DG), non-1E switchgear equipment, load centers, motor control centers and 12-hour severe accident battery divisions. Failure of both SBO DGs and failure of all non-1E electrical buses and buses powered by the 12-hour severe accident battery divisions is assumed in the bounding scenario.

3. Turbine Building/Normal Heat Sink - contains systems and components associated with secondary heat removal, for example, main condenser and feedwater. The risk impact from a loss of these locations is enveloped by the impact from the switchgear building.

4. Nuclear Auxiliary Building - contains the operational chilled water system (OCWS). Note – because of its proximity to safety-related structures, the Nuclear Auxiliary Building is a reinforced concrete structure and designed for tornado loading per Regulatory Guide 1.76 (NRC, 2007d). Therefore, the plant impact scenario assumes that this structure and associated equipment are not affected by the postulated tornado event.

The U.S. EPR FSAR Level 1 PRA LOOP event tree model is used to calculate the conditional core damage probability (CCDP). Based on the above scenario, the CCDP is approximately 8.8E-04. The dominant CCDP sequence involves common cause failure of all four emergency diesel generators (EDGs), resulting in a station blackout event.

NUREG/CR-4461, Tornado Climatology of the Contiguous United States (NRC, 2007e) is used to determine the tornado strike frequency. The tornado strike frequency is the likelihood that a tornado will strike a given point or structure on an annual basis. It is calculated as the sum of two terms: (1) point structure probability (which is calculated based on recorded tornado dimensions within a certain area) and (2) the life-line term (which is based on the dimensions of the plant-specific target structure).

The point structure probability, life-line term, and the total strike probability are calculated for the local 2° box containing the CCNPP Unit 3 site (37-39° N, 76-78° W). The characteristic dimension used to calculate the plant-specific life-line term is the Turbine Building length of 300 feet (91 m).

Based on the NUREG/CR-4461 information, the CCNPP Unit 3 site-specific strike frequency of a tornado with a wind speed greater than 95 mph (42 m/sec), the design wind velocity for non-safety-related structures at CCNPP Unit 3 site, is determined as approximately 6.1E-05/yr.

The assessed core damage frequency is revised qualitatively based on relaxing the following conservatism:

- The strike frequency was conservatively calculated for tornadoes with wind speed greater than 95 mph (42 m/sec). However, the Switchgear Building is designed for a design basis tornado with a maximum wind speed of 230 mph (103 m/sec). Therefore, credit is given for the availability of the SSC in the Switchgear Building, including the two SBO DGs, non-1E switchgear equipment, load centers, motor control centers and 12-hour uninterruptible power supply system. These SSC had been conservatively considered to be failed in the bounding impact scenario discussion above.

External events can be screened if the CDF, or initiating event frequency, calculated using a demonstrably conservative analysis, demonstrates a high confidence that the risk is low in absolute and relative terms. The results of this demonstrably conservative analysis, combined with the qualitative insights, show that the contribution to CDF from tornado winds is low.

Tornado and Hurricane Missiles

The U.S. EPR safety-related structures are designed for the tornado missile characteristics of Region 1 (most limiting U.S. region) and design-basis hurricane missile characteristics as specified in NUREG-0800, Section 3.5.1.4. The design basis tornado and hurricane missiles include: (1) a massive high kinetic energy missile that deforms on impact, (2) a rigid missile that tests penetration, and (3) a small rigid missile of a size sufficient to pass through any opening in protective barriers.

The bounding tornado strike scenario defined and quantified above conservatively assumes failure of all non-safety-related structures of the plant. The tornado strike scenario is judged bounding for all credible tornado and tornado missile events. Therefore, tornado missile effect on unprotected plant structures is not evaluated further.

High Winds, Hurricane, and Tornado Evaluation Conclusion

A quantitative PRA analysis was performed to evaluate the risk associated with tornadoes and hurricanes (including tornado missiles). The results of this demonstrably conservative analysis, combined with the qualitative insights, show that the contribution to CDF from tornado winds and tornado and hurricane generated missiles is low in absolute terms and relative to the baseline values of risk for the U.S. EPR.

19.1.5.4.2 External Flooding Evaluation

Section 2.4.3 through 2.4.7 provide an evaluation of the different flooding conditions considered for the CCNPP Unit 3 site, as well as the U.S. EPR FSAR's protection features against those conditions. The flooding conditions include the probable maximum flood (PMF) on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami and ice effect flooding. Maximum flooding levels due to local intense precipitation are also addressed.

Section 2.4.2 summarizes the flooding evaluations and provides required flood protection requirements. The maximum water level for Nuclear Island due to a local probable maximum precipitation (PMP) is Elevation 81.5 ft (24.8 m) with respect to the reference level. Safety-related structures of the Nuclear Island have a minimum grade slab or entrance at Elevation 84.6 ft (25.8 m) or higher. Grading in the power block area around the safety-related facilities is such that all grades slope away from the structures at a minimum of 1% towards collection ditches. Other than for local PMP flooding, the maximum estimated water surface elevations resulting from all design basis flood considerations discussed in Sections 2.4.2 through 2.4.7 are well below the entrance and grade slab elevations for the power block safety-related facilities.

However, flood protection measures are required for the UHS Makeup Water Intake Structure. The grade level at the UHS intake location is at elevation 10.0 ft (3.05 m). The maximum flood level at the intake location is elevation 33.2 ft (10.11 m) as a result of the surge, wave heights, and wave run-up associated with the probable maximum hurricane (PMH) as discussed in Section 2.4.5.

Flood protection measures for the UHS Makeup Water Intake Structure, as described in Section 2.4.10, include structural measures to withstand static and dynamic flooding forces, water proofing and water tight doors and hatches. Furthermore, makeup water to the safety-related essential service water cooling tower structures is not required for more than six days of heat removal, if four trains are available. This would provide ample time to provide alternate means to supply the cooling towers. Makeup to the essential service water cooling tower structures is not credited in the U.S. EPR FSAR PRA.

Therefore, the applicable SRP screening criteria in NUREG-0800, SRP Section 2.4.10, are met for the different types of external flooding events, and the risk posed by external flooding can be screened for the CCNPP Unit 3 site.

19.1.5.4.3 External Fire Evaluation

As described in Section 2.2.3.1.4, the cleared zones surrounding CCNPP Unit 3 are of sufficient size to afford substantial protection in the event of a fire, and it is not expected that there would be any hazardous effects from fires or heat fluxes associated with wild fires, fires in adjacent industrial plants or from onsite storage facilities.

In addition, the impact of external smoke on the habitability of the main control room is considered in the design of the control room envelope (CRE) and the control room air conditioning system (CRACS) (refer to Section 6.4 and Section 9.4). The CRE has isolation capability in the event of external fire/smoke and the CRACS can be operated in full recirculation mode. The CRACS maintains the control room envelop at a positive pressure to prevent uncontrolled, unfiltered in-leakage during normal and accident conditions. The CRACS can support occupancy for eight people in the MCR and associated rooms for 70 hours without outside makeup air. Portable self-contained breathing apparatus (SCBA) are also available for use by the control room operators.

19.1.5.4.4 Aircraft Crash Hazard Risk Evaluation

This section is added as a supplement to the U.S. EPR FSAR.

The risk posed by random airplane crash events to the CCNPP Unit 3 site are evaluated using a progressive screening approach. The location of the site with respect to airports, military training routes and airways was evaluated against the screening criteria presented in Section 19.1.5.4 and NUREG-0800, Section 3.5.1.6.

Screening Analysis for Airplane Crash

NUREG-0800, Section 3.5.1.6 acceptance criteria for airplane crash hazard stipulates that the frequency of an event causing radiological consequences greater than the 10 CFR 100 exposure guidelines should be less than 1E-07/yr. This acceptance criterion can be met provided that all of the following conditions exist:

- The plant-to-airport distance D is between 5 and 10 statute miles (8 and 16 km), and the projected annual number of operations is less than the numerical value of 500 D^2.
- The plant is at least 5 statute miles (8 km) from the nearest edge of military training routes, including low-level training routes, except for those military training routes associated with usage greater than 1000 flights per year, or where activities (such as practice bombing) may create an unusual stress situation.
- The plant is at least 2 statute miles (3.2 km) beyond the nearest edge of a Federal airway, holding pattern, or approach pattern.

The following information is specific to the CCNPP Unit 3 site:

- The CCNPP Unit 3 site lies just within 10 statute miles (16 km) from the Patuxent Naval Air Station. The distances from the CCNPP Unit 3 site to various runways at Patuxent NAS vary from 8.2 miles to 10.0 miles (13.1 km to 16.1 km). The Captain Walter Duke Regional Airport is also located just within 10 statute miles from the CCNPP Unit 3 site.
- According to 2005 data, the number of annual operations at Patuxent NAS is 52,626 and the number of annual operations at Captain Walter Duke Regional Airport is 52,618.

Using the screening methodology presented in NUREG-0800 and assuming a value of 10 miles for D, the total number of operations per year at Patuxent NAS and Walter Duke Regional Airport would have to be less than 50,000 operations (10 * 10 * 500) to meet the screening criteria. In addition, the CCNPP Unit 3 site is within 2 statute miles of a federal airway. Therefore, the risk from airplane crash at CCNPP Unit 3 cannot be screened using the above NUREG-0800 criteria. Therefore, an assessment was performed to quantitatively assess the risk posed by an airplane crash against NUREG-0800 acceptance criteria.

Detailed Airplane Crash Assessment

Based on the U.S. EPR building design, a quantitative assessment of aircraft hazard was performed for various random aircraft hazard scenarios using the U.S. EPR FSAR PRA.

The analysis was performed using the following steps:

1. Develop target sets based on similar building structural strength (hardened or non-hardened), site location and expected response.

2. Calculate the estimated impact frequency (initiating event frequency) for each target set based on representative dimensions of the buildings within each target set.

3. Incorporate the calculated initiating event frequencies with PRA event trees to analyze the plant response and obtain a conservative/bounding core damage frequency estimate for each scenario.

Target sets were screened when it was judged that one of the following conditions applies:

- A crash into the target set would not result in damages to SSCs modeled in the PRA (e.g., shielded buildings).

- The consequences of a crash into the target set would be enveloped by an initiating event already modeled in the PRA, and the frequency of this initiating event is several orders of magnitude higher than the postulated airplane crash frequency.

Target sets that were retained for the analysis are: (a) Safeguard Building 1 (or 4) and (b) Turbine and Switchgear Building. Aircraft crash frequencies into these two target sets are estimated using the methodology of DOE Standard 3014-2006 (DOE, 2006). Bounding aircraft crash scenarios are developed for the two target sets defined. The most limiting failures of all the components in the affected building are assumed. This is a demonstrably conservative approach since conservative consequence assumptions were applied, including that the PRA models used for the defined scenarios conservatively estimate the crash impacts based on a limiting direction of movement and then conservatively apply that scenario to all impacts, and the emergency feedwater (EFW) suction cross-connect valves are conservatively assumed to be open.

Based on an aircraft impact analysis (Safeguards Information) performed to support the safeguards aircraft crash analysis it was concluded that the crash of a general aviation aircraft into SB 1 or 4 (i) would not result in a breach of a steam or main feedwater line inside the protected area (i.e., between the containment wall and the isolation valves), (ii) would not physically damage the main steam isolation valves in a way that would prevent them to close, and (iii) would not result in a breach of any fluid-carrying system located inside the safeguard building. Therefore, a general aviation impact onto the safeguards building 1 or 4 was modeled as an isolable steam line break initiating event, with failure of the electrical division housed within the impacted structure.

Accordingly, in order to account for the differences in the damage assessment, the SB1/4 aircraft crash scenario is calculated separately based on aircraft type:

- The commercial\military aircraft scenario results in large scale building damage (including items (i), (ii) and (iii) above) but the aircraft crash frequency is limited to commercial and military aircrafts.

- The general aviation aircraft scenario is modeled as an isolable steam line break initiating event concurrent with failure of the electrical division in the affected safeguards building.

The Turbine and Switchgear Building target set is not modified. All aircraft types are assumed to inflict the maximum damage.

The results of this analysis are as follows:

- Large Aircraft Crash into Safeguards Building 1 or 4 is estimated to have a CDF of 3.9E-08 per year
- Small Aircraft Crash into Safeguards Building 1 or 4 is estimated to have a CDF of 4.5E-10 per year
- Aircraft Crash into the Turbine and Switchgear Buildings is estimated to have a CDF of 7.4E-09 per year

Conclusion for Detailed Airplane Crash Hazard Assessment

External events can be screened if the CDF, or initiating event frequency, calculated using a demonstrably conservative analysis, demonstrates that the risk is low in absolute terms and relative to the risk values for the U.S. EPR. Also, the NUREG-0800 screening criteria are met if the frequency of a release exceeding 10 CFR 100 limits is less than 1E-07 per year. The total CDF (CDF bounds large release frequency) from airplane crash into CCNPP Unit 3, using a demonstrably conservative analysis, is calculated as having a core damage frequency of 4.7E-08 per year.

Based on a comparison of this analysis to NUREG-0800 and ANSI/ANS-58.21-2007, it is concluded that that CCNPP Unit 3 design can be screened. As a result, aircraft crash has been screened from the PRA.

19.1.5.4.5 Industrial and Transportation Accidents Risk Evaluation

This section is added as a supplement to the U.S. EPR FSAR.

The risks posed by potential industrial and transportation accidents to CCNPP Unit 3 are evaluated against the ANSI/ANS-58.21-2007 and SRP screening criteria as defined in NUREG-0800, Section 2.2.3. External events can be screened if the CDF, or initiating event frequency, calculated using a demonstrably conservative analysis, demonstrates that the risk is low in absolute terms and with consideration of the low risk values for the U.S. EPR.

The following types of hazards are evaluated: highway hazards, waterway hazards, pipeline hazards, railroad hazards, and nearby facilities hazards:

Highway Hazards

In Section 2.2.3.1, an evaluation is made of the risks posed by an accident involving hazardous material occurring on the major highway in Calvert County, Maryland Highway 2/4, which is adjacent to the CCNPP Unit 3 site. CCNPP Unit 3 is located approximately 1.2 miles (1.9 km) from Maryland Highway 2/4 at its closest approach. For each type of event and for the largest amount of hazardous material susceptible to being involved in that event, the minimum separation distance (i.e., safe distance) is calculated. The results are summarized in Table 2.2-8 (for explosions), Table 2.2-9 (for flammable vapor clouds) and Table 2.2-10 (for toxic chemicals). In each case, the largest minimum separation distance is found to be less than 1.2 miles (1.9 km). Therefore, highway hazards have been screened from the PRA.

Waterway Hazards

In Section 2.2.3.1, an evaluation is made of the risks posed by an accident involving transportation of hazardous material along the Chesapeake Bay. Per Section 2.2.3.1.1, the distance between potential waterway traffic and the nearest structure (UHS makeup water intake structure) is about 2.2 miles (3.5 km). For each type of event and for the largest amount of hazardous material susceptible to being involved in that event, the minimum separation distance is calculated. The results are summarized in Table 2.2-8 (for explosions), Table 2.2-9 (for flammable vapor clouds) and Table 2.2-10 (for toxic chemicals). With the exception of ammonia, the distance the cloud traveled prior to dispersing enough to fall below the identified toxicity limit was less than the distance from the spill site to the control room for CCNPP Unit 3.

For ammonia on the Chesapeake Bay, the U.S. Army Corps of Engineers estimates that there are less than 5 shipments per year of ammonia passing within the vicinity of the CCNPP site. Given that the frequency of ammonia shipments is less than 50 per year passing within the vicinity of the CCNPP site, the probability of an accident occurring involving a barge within the exposure distance from the control room is below the screening criteria established by Regulatory Guide 1.78. Therefore, waterway hazards have been screened from the PRA.

Pipeline Hazards

The Dominion Cove Point pipeline passes within the vicinity of the Calvert Cliff site. The closest distance between the plant and the pipeline is 1.54 miles (2.5 km). Section 2.2.3.1.1 addresses the risk from the pipeline and concludes that an explosion following a rupture in the pipeline would not adversely affect the safe operation of CCNPP Unit 3. The safe distance for exposure to thermal consequences from a rupture in the pipeline is 0.45 mi (0.72 km), which is significantly less than the actual separation. Therefore, pipeline hazards have been screened from the PRA.

Railroad Hazards

There are no railroads within 5 miles (8 km) of the CCNPP Unit 3 site. Therefore, railroad hazards have been screened from the PRA.

Nearby Facilities Hazards

Section 2.2.1 identifies three potential external hazard facilities within 5 miles of the CCNPP Unit 3 site: CCNPP Unit 1 and 2, the Dominion Cove Point Liquid Natural Gas (DCPLNG) Terminal and the Dominion Cove Point pipeline (see above).

The safe distance for each of the hazardous chemicals inventories stored on the CCNPP Unit 1 and 2 sites is shown in Table 2.2-8 (for explosions) and Table 2.2-9 (for flammable vapor clouds). Toxic chemicals release is also evaluated. It is shown in Section 2.2.3.1.3 that the main control room would remain habitable after the worst case release in all scenarios, except the 3500 gallon gasoline delivery truck. A probabilistic assessment was performed for the gasoline release, which could not be qualitatively screened.

For gasoline, a quantitative risk assessment was used in Section 2.2.3.1 to show that:

- The rate of exposure to a peak positive incident overpressure in excess of 1 psi is less than 1E-07 per year.
- The rate of exposure to a postulated vapor cloud at or above the 8-hour Time-Weighted Average (TWA) threshold value in the control room is approximately 2.66E-07 per year.

However, as shown in FSAR Table 2.2-10, gasoline has an 8-hour TWA threshold value of 300 ppm, a Short-Term Exposure Limit (STEL) of 500 ppm and a maximum control room concentration of 343 ppm. Given that the maximum control room concentration is less than the STEL and is approximately 15% greater than the 8-hour TWA, it is expected that a control room operator will take protective measures within 2 minutes (adequate time to don a respirator and protective clothing) after the detection and, therefore, will not be subjected to prolonged exposure at dangerous concentration levels. This meets the acceptance criteria of Regulatory Guide 1.78, therefore gasoline at CCNPP Units 1 & 2 has been screened from the PRA.

The DCPLNG terminal is located approximately 3.2 miles (5.1 km) away from the CCNPP Unit 3 site. Section 2.2.3.1.1 shows that the risk of an explosion resulting from a complete tank failure at the DCPLNG terminal would not adversely affect the safe operation of CCNPP Unit 3. The safe distance for exposure to a flash fire resulting from a total loss of the storage tanks is 1.0 mile (1.6 km), which is significantly less than the actual separation. Therefore, nearby facilities hazards have been screened from the PRA.

Based on the above evaluations, the risks posed by potential industrial and transportation accidents to the CCNPP Unit 3 site have been screened from the PRA.

19.1.5.4.6 Other External Events Risk Evaluation

This section is added as a supplement to the U.S. EPR FSAR.

Two types of external events from Table 19.1-1 are addressed in this section. These are turbine generated missiles and collisions with the UHS Makeup Water Intake Structure or Forebay.

Turbine Missiles

NUREG-0800, Section 3.5.1.3 provides acceptance criteria for turbine missile hazard based on the frequency of a turbine failure resulting in the ejection of turbine rotor (or internal structure) fragments through the turbine casing. The acceptance criteria are 1E-04/year for favorably oriented turbines and 1E-05/yr for unfavorably oriented turbines. A favorable orientation is one that excludes the containment and all, or mostly all, safety-related structures, systems or components (SSCs) from the low trajectory missile (LTM) pathway. Meeting these criteria provides confidence that the frequency of unacceptable damage from turbine missiles is less than or equal to 1E 07/yr.

- The design includes a favorably oriented turbine with respect to containment. CCNPP Unit 3 is designed so that the probability of steam turbine failure resulting in ejection of turbine disk (or internal structure) fragments through the turbine casing shall be less than 1E-04/yr for a favorably oriented turbine and shall be less than 1E-05/yr for an unfavorably oriented turbine. The design includes a favorably oriented turbine with respect to containment. Detailed analyses and assessments show that the probability of turbine rotor failure resulting in ejection of the turbine rotor fragments through the turbine casing is less than 1E-04 for a favorable oriented turbine with respect to containment. Furthermore, reconciliation of minor energy turbine missiles for CCNPP Unit 3 shows that the potential missile effects on the Essential Service Water Buildings 3 and 4 (located directly adjacent to the Turbine Building in an unfavorable orientation) are consistent with RG 1.115 (NRC, 1977) in that the CCNPP Unit 3 design will ensure that minor missiles which could be ejected will not result in any damage to essential systems. Therefore, the risk to CCNPP Unit 3 from a turbine missile from the CCNPP

Unit 3 turbine is within the NRC acceptance criteria as provided in NUREG-0800, Section 3.5.1.3.

- ♦ The threat to CCNPP Unit 3 from turbine missiles generated from CCNPP Units 1 and 2 was also considered. The CCNPP Unit 1 and Unit 2 turbines are unfavorably oriented to their respective safety-related buildings, and favorably oriented to the safety-related buildings of CCNPP Unit 3. The frequency of a turbine missile accident is found sufficiently low to screen SRP screening criteria for their own, unfavorably oriented safety-related buildings. Therefore, it can also be screened for the favorably oriented safety-related buildings of CCNPP Unit 3. Therefore, the threat to CCNPP Unit 3 from turbine missiles generated from CCNPP Unit 1 or Unit 2 turbines meets the acceptance criteria provided in NUREG-0800.

Therefore it is concluded that turbine missiles do not constitute a significant core damage risk to CCNPP Unit 3, and can be screened.

Collisions with UHS Makeup Water Intake Structure or Forebay

CCNPP Unit 3 is located on a navigable waterway. The only safety-related structures located near the shore line are the UHS Makeup Water Intake Structure and Forebay. These are safety-related structures located adjacent to the CWS Makeup Intake Structure. The UHS Makeup Water Intake Structure and the Forebay for CCNPP Unit 3 are situated in an area that is set back from the Chesapeake Bay shoreline at the south end of the intake structure for CCNPP Units 1 and 2. Additionally, the portion of the Chesapeake Bay in the vicinity of the intake structure is sufficiently shallow that any vessel of significant size that could possibly cause damage to the intake structure would most likely run aground before it could impact the intake structure (Section 2.2.3.1.5). In the unlikely event of a collision involving the UHS Makeup Water Intake Structure or Forebay, no initiating event would occur. If a plant trip were to occur (automatic or manual), the initial inventory of the four Essential Service Water Cooling Tower Structures would have adequate capacity for more than six days of heat removal assuming all four divisions are available. This would provide ample time to provide alternate means to supply the Essential Service Water Cooling Tower Structures. Makeup to the Essential Service Water Cooling Tower Structures is not credited in the PRA. Therefore, collisions with the UHS Makeup Water Intake Structure or Forebay have been screened from the PRA.}

19.1.6 Safety Insights from the PRA for Other Modes of Operation

{One CCNPP Unit 3 site-specific item has been identified as having the potential to affect the low power shutdown (LPSD) PRA model:

- ♦ Loss of Offsite Power (LOOP) frequency and duration

NUREG/CR-6890 provides a shutdown LOOP frequency for Calvert Cliffs 1 and 2 of 0.183 and 0.184, respectively. The U.S. EPR shutdown LOOP frequency is 0.2. The use of U.S. EPR data in this case bounds CCNPP Unit 3 site-specific values and the difference does not have a significant impact on the PRA results. The U.S. EPR shutdown LOOP nonrecovery value is 0.413 and is generic data taken from NUREG/CR-6890. The value is applicable to CCNPP Unit 3.

It is concluded that the U.S. EPR™ FSAR PRA for low power shutdown is applicable and bounding for the CCNPP Unit 3 site. The site and plant-specific parameters do not have a significant impact on the PRA results and insights. Therefore, no changes to the U.S. EPR LPSD PRA are necessary when considering specific CCNPP Unit 3 site and plant parameters.}

19.1.7 PRA-Related Input to Other Programs and Processes

{No departures or supplements.}

19.1.8 Conclusions and Findings

No departures or supplements.

19.1.9 References

{**ALOHA, 2007.** Areal Locations of Hazardous Atmospheres (ALOHA) Version 5.4.1, NOAA, February 2007, Website: http://www.epa.gov/emergencies/content/cameo/ index.htm.

ANSI, 2007. External Events PRA Methodology, ANSI/ANS 58.21 2007, American National Standards Institute/American Nuclear Society, March 2007.

ASME, 2007. Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, ASME RA-Sc-2007, American Society of Mechanical Engineers, August 2007.

CFR, 2007a. Maintenance of Records, Making of Reports, Title 10, Code of Federal Regulations, Part 50.71, U. S. Nuclear Regulatory Commission, 2007.

CFR, 2007b. Reactor Site Criteria, Title 10, Code of Federal Regulations, Part 100, U. S. Nuclear Regulatory Commission, 2007.

DOE, 2006. DOE-STD-3014-2006 DOE Standard, Accident Analysis for Aircraft Crash into Hazardous Facilities, October 1996, Reaffirmed May 2006.

NEI, 2006. Probabilistic Risk Assessment (PRA) Peer Review Process Guidance, NEI 00-02, Revision 1, Nuclear Energy Institute, 2006.

NRC, 1977. Protection Against Low-Trajectory Turbine Missiles, Regulatory Guide 1.115, U. S. Nuclear Regulatory Commission, July 1977.

NRC, 1991. Procedural and Submittal Guidance for the Individual Plant Examination of External Events, NUREG-1407, U. S. Nuclear Regulatory Commission, May 1991.

NRC, 2005. Reevaluation of Station Blackout Risk at Nuclear Power Plants, NUREG/CR-6980, U.S. Nuclear Regulatory Commission, November 2005.

NRC, 2007a. An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities, Regulatory Guide 1.200, U. S. Nuclear Regulatory Commission, January 2007.

NRC, 2007b. Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants, NUREG/CR-6928, U. S. Nuclear Regulatory Commission, February 2007.

NRC, 2007c. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, NUREG-0800, U. S. Nuclear Regulatory Commission, January 2007.

NRC, 2007d. Design Basis Tornado and Tornado Missiles for Nuclear Power Plants, Regulatory Guide 1.76, Revision 1, U. S. Nuclear Regulatory Commission, March 2007.

NRC, 2007e. Tornado Climatology of the Contiguous United States, NUREG/CR-4461, Revision 2, U. S. Nuclear Regulatory Commission, February 2007.}

Table 19.1-1 — {Summary of External Events Evaluated for CCNPP Unit 3}
(Page 1 of 2)

External Event Hazard	Evaluation
Aircraft	Screened in Section 19.1.5.4.4.
Avalanche	No nearby mountains.
Biological Events	The ultimate heat sinks for CCNPP Unit 3 are closed systems cooled by cooling towers. These would not be subject to biological events such as fish, or debris ingestion.
Shoreline Erosion	Shore erosion would be a slowly developing condition. There would be adequate time to respond to any significant shore erosion. The only safety-related structure located at the shore line is the UHS Makeup Water Intake Structure. In the case of an accident, the four Essential Service Water Cooling Tower structures would have adequate capacity for more than six days of heat removal assuming all four trains are available. This would provide ample time to provide alternate means to supply the cooling tower structures.
Drought	The CCNPP Unit 3 ultimate heat sink consists of four Essential Service Water Cooling Towers with a combined inventory for 72 hours of heat removal under DBA conditions (2 of 4 trains available). Enough inventory would be available for over 6 days of heat removal assuming all four trains are operational. Makeup is supplied from the Chesapeake Bay. Makeup sources should not be significantly impacted by a period of prolonged drought.
External Fire	Screened in Section 19.1.5.4.3.
External Flooding	Screened in Section 19.1.5.4.2.
Extreme Winds and Tornadoes	Screened in Section 19.1.5.4.
Fire	Internal fires are analyzed in the U.S. EPR FSAR Level 1 PRA.
Fog	Fog can be a contributor to transportation accidents. Airplane crash and transportation accidents are covered in Section 19.1.5.4.4 and 19.1.5.4.5, respectively. An additional scenario could be the collision of a boat with the CCNPP Unit 3 Makeup Water Intake Structure. See Section 19.1.5.4.6 for a discussion of this scenario.
Frost	The impact of frost is bounded by snow and ice loads.
Hail	The impact of hail would be bounded by events such as tornado missiles. Therefore, it is not a significant risk.
High Tide	Screened in Section 19.1.5.4.2.
High Summer Temperature	A maximum ambient air temperature of 115 °F is assumed for buildings within Nuclear Island. HVAC systems are designed with consideration of this outdoor temperature.
Hurricane	Hurricane flooding impacts are screened in Section 19.1.5.4.2 and hurricane winds are bounded be the analysis in Section 19.1.5.4.1.
Ice Cover	The CCNPP Unit 3 minimum design live load due to precipitation (snow and ice) is 100 psf on the ground. This value includes the weight of the normal winter precipitation event and the weight of the extreme winter precipitation event. This bounds the CCNPP Unit 3 site specific design snow load of 53 psf. (Section 4.4.1).
Industrial or Military Facility Accident	Screened in Section 19.1.5.4.5.
Internal Flooding	Internal flooding events are analyzed in the U.S. EPR FSAR Level 1 PRA.
Landslide	No nearby mountains or steep slopes in the vicinity of CCNPP Unit 3. Therefore, no hazards are identified.

Table 19.1-1 — {Summary of External Events Evaluated for CCNPP Unit 3}
(Page 2 of 2)

External Event Hazard	Evaluation
Lightning	The primary impact of lightning is a loss of offsite power. The effect of lightning is judged to be included in the loss of offsite power model of the U.S. EPR FSAR PRA, with the resulting CDF of 1.5E-07/yr.
Low Water Level	The CCNPP Unit 3 ultimate heat sink consists of four Essential Service Water Cooling Towers with a combined inventory for 72 hours of heat removal under DBA conditions (2 of 4 trains available). Enough inventory should be available for over 6 days of heat removal, assuming all four trains are available. Makeup is supplied from the Chesapeake Bay. Low water would be a slowly developing event with ample time to provide coping measures.
Low Winter Temperature	A minimum ambient air temperature of -40 °F is assumed for buildings within the Nuclear Island. HVAC systems are designed with consideration of this outdoor temperature.
Meteorite/Satellite	Low probability event.
Intense Precipitation	Screened in Section 19.1.5.4.2.
Onsite Release of Chemicals	Screened in Section 19.1.5.4.5.
Pipeline Accident	Screened in Section 19.1.5.4.5.
River Diversion	NA
Sandstorm	No nearby sand dunes or desert. No dust/sandstorms were reported in Calvert County between January 1 1993 and September 31, 2006 (FSAR Section 2.3.1.2.2.8)
Seiche	Screened in Section 19.1.5.4.2.
Seismic Activity	Plant seismic capacity is evaluated in the PRA-based seismic margins assessment. (Section 19.1.5.1).
Snow/Ice Loads	The CCNPP Unit 3 minimum design live load due to precipitation (snow and ice) is 100 psf on the ground. This value includes the weight of the normal winter precipitation event and the weight of the extreme winter precipitation event. This bounds the CCNPP Unit 3 site specific design snow load of 53 psf. (Section 4.4.1).
Soil Shrink-Swell	Lateral loads due to soil bearing pressure shall apply to all exterior walls up to the specified yard finished grade elevation. Lateral earth pressure shall be based upon the soil density of normally compacted, structural fill, and shall include the effects of groundwater. No hazards were identified.
Storm Surge	Screened in Section 19.1.5.4.2.
Toxic Gas	Screened in Section 19.1.5.4.5.
Transportation Accidents (other than aircraft)	Screened in Section 19.1.5.4.5.
Tsunami	Screened in Section 19.1.5.4.2.
Turbine Missile	Screened in Section 19.1.5.4.6.
Volcanic Activity	No volcanoes in vicinity.
Waves	Screened in Section 19.1.5.4.2.
Other	None identified.

Table 19.1-2 — Building Site Specific FIRS and Associated Seismic Margins Required for Screening of Sliding and Bearing Demands

Building	FIRS[1] [g]	FIRS[2] (w/SSSI) [g]	SSE[3] (w/SSSI) [g]	Required Margin[4] [g]	FOS_T[5]
NI/NAB/AB	0.135	0.135	0.150	0.225	1.50
EPGB	0.117	0.130	0.181	0.217	1.20
ESWB	0.130	0.144	0.181	0.240	1.33

1 Building specific FIRS using site specific response analysis

2 Building specific FIRS using site specific response analysis and SSSI factor(1.105, except NI)

3 SSE Based outcrop motion at foundation level (includes higher utilized SSSI factor)

4 Required seismic margin calculated as 1.67 x FIRS

5 Target FOS with 0.15 g analysis calculated as (1.67 x FIRS / SSE Motion)

Table 19.1-3 — Summary of Seismic Design Basis and Screening Target FOS

Case	SM_T(1) [g]	FOS_T(2)	FOS_D(3)	SM_{CHECK}(4)	FOS_R(5)
NI Sliding	0.224	1.47	1.79	PASS	>> 1.79
NI Bearing(a)	0.224	1.47	1.57	PASS	>> 1.57
EPGB Sliding	0.216	1.11	1.57	PASS	>> 1.57
EPGB Bearing(b)	0.216	1.11	7.10	PASS	>> 7.10
ESWB Sliding	0.240	1.23	1.99	PASS	>> 1.99
ESWB Bearing(b)	0.240	1.23	3.86	PASS	>> 3.86
NAB Sliding(d)	0.224	NOTE (d)	NOTE (d)	PASS	NOTE (d)
NAB Bearing(d)	0.224	1.47	1.49	PASS	>> 1.49
AB Sliding(e)	0.224	1.47	1.38	< 1.47	1.89
AB Bearing(e)	0.224	1.47	3.22	PASS	>> 3.22
TI Sliding(f)	0.227	NOTE (f)	NOTE (f)	PASS	NOTE (f)

(1) Target seismic margin to screen component

(2) Target Factor of Safety to screen component

(3) Factor of Safety obtained from the analysis for seismic design basis (0.15 g)

(4) 1.67 x HCLPF Check; pass if $FOS_D > FOS_T$

(5) Factor of Safety for rugged component under design basis ground motion level. >> Symbol indicates that FOS_R for component is greater than the design basis value

(a) Allowable dynamic bearing capacity (DBC) is 31.3 ksf, site demand is 23.0 ksf

(b) Allowable DBC is 51.1 ksf (Ref. 8), site demand is 7.2 ksf

(c) Allowable DBC is 41.3 ksf (Ref. 9), site demand is 10.7 ksf

(d) NI/NAB gap is greater than twice the sliding distance plus the displacement related to building rotation (30” gap to accommodate 10” of displacement); allowable DBC is 52.9 ksf (Ref. 10); demand is 35.5 ksf

(e) AB does not slide; NI/AB gap is greater than twice the displacement related to building rotation; allowable DBC is 58.0 ksf; demand is 18.1 ksf; additional ruggedness was incorporated into FOS_R to show that sufficient margin is available

(f) No sliding; TI GAP is at least 30 ft and sliding/bearing failure does not impact Category I structures

19.2 SEVERE ACCIDENT EVALUATIONS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

19.2.1 Introduction

No departures or supplements.

19.2.2 Severe Accident Prevention

No departures or supplements.

19.2.3 Severe Accident Mitigation

No departures or supplements.

19.2.4 Containment Performance Capability

No departures or supplements.

19.2.5 Accident Management

The U.S. EPR FSAR includes the following COL Item in Section 19.2.5:

> A COL applicant that references the U.S. EPR design certification will develop and implement severe accident management guidelines using the Operating Strategies for Severe Accidents (OSSA) methodology described in U.S. EPR FSAR Section 19.2.5 and ANP-10314, "The Operating Strategies for Severe Accidents Methodology for the U.S. EPR Technical Report".

This COL Item is addressed as follows:

Severe accident management guidelines will be developed and implemented prior to initial fuel loading using the Operating Strategies for Severe Accidents (OSSA) methodology described in U.S. EPR FSAR Section 19.2.5 and ANP-10314, "The Operating Strategies for Severe Accidents Methodology for the U.S. EPR Technical Report."

19.2.6 Consideration of Potential Design Improvements under 10 CFR 50.34(f)

No departures or supplements.

19.2.7 Beyond Design Basis Large Commercial Aircraft Impact Assessment

No departures or supplements.

19.2.8 Beyond Design Basis Extended Loss of AC Power Assessment

{The COL Applicant is responsible for addressing Phases 2 and 3 in the CCNPP Unit 3 FSAR.

Fukushima Near-Term Task Force Recommendation 7.1 is addressed through enhancement of spent fuel makeup capability and instrumentation in the spent fuel pool. The training program to demonstrate that spent fuel pool instrumentation will be maintained available in an extended loss of AC power is addressed by means of COL Item 13.2-2.

Fukushima Near-Term Task Force Recommendation 9.3 is addressed by COL Item 13.3-2 addressing Emergency Preparedness Communications and Staffing.

Fukushima Near-Term Task Force Recommendations 4.2 and 7.1 are addressed by means of the COL Item 19.2-2 described below.}

The U.S. EPR FSAR includes the following COL Item in Section 19.2.8:

AREVA Technical Report ANP-10329 discusses the Phase 1, Phase 2, and Phase 3 actions that are performed to mitigate an ELAP event. A COL applicant that references the U.S. EPR design certification will address the actions listed in Table 19.2-6. The COL applicant will also address obtaining sufficient offsite resources to sustain core cooling, containment, and spent fuel pool cooling functions indefinitely.

The COL Item is addressed as follows:

{The COL Responsibilities listed in U.S. EPR Design Certification FSAR Table 19.2-6 and the actions necessary to obtain sufficient offsite resources to sustain core cooling, containment, and spent fuel pool cooling functions indefinitely are described in the FLEX Integrated Plan.}

19.2.9 References

No departures or supplements.

19.3 OPEN, CONFIRMATORY, AND COL ACTION ITEMS IDENTIFIED AS UNRESOLVED

This section of the U.S. EPR FSAR is incorporated by reference.