

## PMBelCOL PEmails

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**From:** Joshi, Ravindra  
**Sent:** Friday, June 19, 2009 4:52 PM  
**To:** Sebrosky, Joseph; 'alsterdis@tva.gov'; 'Spink, Thomas E'  
**Cc:** BelCol Resource; Wade, Tony; Coffin, Stephanie; Sebrosky, Joseph; Comar, Manny  
**Subject:** RE: Bellefonte chapter 19 SER with open items  
**Attachments:** ML09160022219.pdf; ML0911107110.pdf

To All,

Attached is Bellefonte Chapter 19 SER with Open Items.

Sincerely,

Ravi Joshi  
Senior Project Manager  
NRO/DNRL/NWE1  
301-415-6191

**Hearing Identifier:** Bellefonte\_COL\_Public\_EX  
**Email Number:** 1578

**Mail Envelope Properties** (CEEA97CC21430049B821E684512F6E5ECA4929DC52)

**Subject:** RE: Bellefonte chapter 19 SER with open items  
**Sent Date:** 6/19/2009 4:51:58 PM  
**Received Date:** 6/19/2009 4:51:59 PM  
**From:** Joshi, Ravindra

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<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	184	6/19/2009 4:51:59 PM
ML09160022219.pdf	96007	
ML0911107110.pdf	184406	

**Options**

**Priority:** Standard  
**Return Notification:** No  
**Reply Requested:** No  
**Sensitivity:** Normal  
**Expiration Date:**  
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June 19, 2009

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Mr. Joseph A. (Buzz) Miller  
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SUBJECT: BELLEFONTE UNITS 3 AND 4 SAFETY EVALUATION REPORT WITH OPEN ITEMS FOR CHAPTER 19, "PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT EVALUATION"

Dear Ms. Sterdis and Mr. Miller:

By letter dated October 30, 2007 (ML073110527), as supplemented by letters dated November 2, 2007 (ML073090428), January 8, 2008 (ML080100104), and January 14, 2008 (ML080160252), the Tennessee Valley Authority (TVA) submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for two AP1000 advanced passive pressurized water reactors in accordance with the requirements of 10 CFR 52, "Licenses, Certifications and Approvals for Nuclear Power Plants." The NRC formally docketed the application on January 18, 2008. These reactors are identified as Bellefonte (BLN) Units 3 and 4 and would be located near the town of Scottsboro in Jackson County, Alabama. The docket numbers established for Units 3 and 4 are 52-014 and 52-015, respectively. Subsequent to the original BLN COL application, TVA has updated and revised the application by letters dated October 10, 2008 (ML083100262), November 18, 2008 (ML083250490), and January 21, 2009 (ML090290406).

Based on our review of your application, the staff prepared the enclosed Safety Evaluation Report (SER) with Open Items for Chapter 19, "Probabilistic Risk Assessment and Severe Accident Evaluation." Unless otherwise stated in the SER with Open Items, the staff's review was based on revisions and updates made to the BLN COL application through January 21, 2009. The SER with Open Items is being provided to support the upcoming meeting of the subcommittee of the Advisory Committee on Reactor Safeguards (ACRS) scheduled to be held on July 23-24, 2009. The ACRS Full Committee meeting will be held at a later date. Issuance of this SER is an important milestone in the staff's review to determine whether TVA's application meets the Commission's regulations.

In a letter dated April 28, 2009, the NuStart Energy Development, LLC, consortium informed the NRC that it had changed the Reference COL designation for the AP1000 Design Center from BLN Nuclear Plant, Units 3 and 4 to the Vogtle Electric Generating Plant (VEGP), Units 3 and 4. The NRC staff is taking steps necessary to implement this change. During this transition, the BLN Units 3 and 4 docket will continue to be the vehicle of standard content for the ACRS subcommittee reviews. It is the staff's understanding that Southern Nuclear Operating Company will be responsible for responding to open items related to standard content within a 45-day response period.

The staff concludes that the enclosed SER with Open Items does not contain any information for which exemption from public disclosure has been sought or approved. However, the NRC will withhold the enclosed SER from public disclosure for ten calendar days from the date of this letter to allow TVA the opportunity to verify the staff's conclusion that the SER contains no such exempt information. If within that time, you do not request that all or portions of the SER be withheld from public disclosure in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," the enclosure will be made available for public inspection through the NRC's Public Document Room and the Publicly Available Records component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the Public Electronic Reading Room section of the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions, please contact Mr. Ravindra Joshi, the NRC project manager at (301) 415-6191, [ravindra.joshi@nrc.gov](mailto:ravindra.joshi@nrc.gov) or Mr. Joseph Sebrosky, the lead project manager for the BLN COL application at (301) 415-1132, [joseph.sebrosky@nrc.gov](mailto:joseph.sebrosky@nrc.gov).

Sincerely,

**/RA/**

Stephanie Coffin, Branch Chief  
AP1000 Projects Branch 1 (NWE1)  
Division of New Reactor Licensing  
Office of New Reactors

Docket Nos. 52-014  
52-015  
52-025  
52-026

Enclosure:  
As stated

cc w/ encl: see next page

In a letter dated April 28, 2009, the NuStart Energy Development, LLC, consortium informed the NRC that it had changed the Reference COL designation for the AP1000 Design Center from BLN Nuclear Plant, Units 3 and 4 to the Vogtle Electric Generating Plant (VEGP), Units 3 and 4. The NRC staff is taking steps necessary to implement this change. During this transition, the BLN Units 3 and 4 docket will continue to be the vehicle of standard content for the ACRS subcommittee reviews. It is the staff's understanding that Southern Nuclear Operating Company will be responsible for responding to open items related to standard content within a 45-day response period.

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Docket Nos. 52-014  
52-015  
52-025  
52-026

Enclosure:  
As stated

cc w/ encl: see next page

**PKG: ML091600220**

**SER: ML091110711**

**Accession No.: ML091600222**

**ACRS Memo: ML091600230**

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## **19.0 PROBABILISTIC RISK ASSESSMENT (RELATED TO RG 1.206, SECTION C.III.1, CHAPTER 19, C.I.19, “PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT EVALUATION”)**

Title 10 of the *Code of Federal Regulations* (CFR), Part 52, Subpart C, Section 52.79, “Contents of applications; technical information in final safety analysis report,” requires applicants to submit a description of the plant-specific probabilistic risk assessment (PRA) and its results. The PRA provides an evaluation of the risk of core damage and release of radioactive material associated with both internal and external events that can occur during plant operation at power or while shutdown.

### **19.1–19.57 and Appendices 19A–19F Probabilistic Risk Assessment**

The Bellefonte (BLN) Combined License (COL) Final Safety Analysis Report (FSAR) incorporates by reference, with no departures or supplements, Sections 19.1 to 19.57 and Appendices 19A to 19F of the AP1000 Design Control Document (DCD) Revision 17:

- 19.1, “Introduction”
- 19.2, “Internal Initiating Events”
- 19.3, “Modeling of Special Initiators”
- 19.4, “Event Tree Models”
- 19.5, “Support Systems”
- 19.6, “Success Criteria Analysis”
- 19.7, “Fault Tree Guidelines”
- 19.8, “Passive Core Cooling System – Passive Residual Heat Removal”
- 19.9, “Passive Core Cooling System – Core Makeup Tanks”
- 19.10, “Passive Core Cooling System – Accumulator”
- 19.11, “Passive Core Cooling System – Automatic Depressurization System”
- 19.12, “Passive Core Cooling System – In-containment Refueling Water Storage Tank”
- 19.13, “Passive Containment Cooling”
- 19.14, “Main and Startup Feedwater System”
- 19.15, “Chemical and Volume Control System”
- 19.16, “Containment Hydrogen Control System”
- 19.17, “Normal Residual Heat Removal System”
- 19.18, “Component Cooling Water System”
- 19.19, “Service Water System”
- 19.20, “Central Chilled Water System”
- 19.21, “AC Power System”
- 19.22, “Class 1E DC and UPS System”
- 19.23, “Non-Class 1E DC and UPS System”
- 19.24, “Containment Isolation”
- 19.25, “Compressed and Instrument Air System”
- 19.26, “Protection and Safety Monitoring System”
- 19.27, “Diverse Actuation System”
- 19.28, “Plant Control System”
- 19.29, “Common Cause Analysis”
- 19.30, “Human Reliability Analysis”
- 19.31, “Other Event Tree Node Probabilities”
- 19.32, “Data Analysis and Master Data Bank”
- 19.33, “Fault Tree and Core Damage Quantification”

- 19.34, "Severe Accident Phenomena Treatment"
- 19.35, "Containment Event Tree Analysis"
- 19.36, "Reactor Coolant System Depressurization"
- 19.37, "Containment Isolation"
- 19.38, "Reactor Vessel Reflooding"
- 19.39, "In-Vessel Retention of Molten Core Debris"
- 19.40, "Passive Containment Cooling"
- 19.41, "Hydrogen Mixing and Combustion Analysis"
- 19.42, "Conditional Containment Failure Probability Distribution"
- 19.43, "Release Frequency Quantification"
- 19.44, "MAAP4.0 Code Description and AP1000 Modeling"
- 19.45, "Fission Product Source Terms"
- 19.46 Deleted
- 19.47 Deleted
- 19.48 Deleted
- 19.49, "Offsite Dose Evaluation"
- 19.50, "Importance and Sensitivity Analysis"
- 19.51, "Uncertainty Analysis"
- 19.52 Deleted
- 19.53 Deleted
- 19.54, "Low Power and Shutdown PRA Assessment"
- 19.55, "Seismic Margin Analysis"
- 19.56, "PRA Internal Flooding Analysis"
- 19.57, "Internal Fire Analysis"
- Appendix 19A, "Thermal Hydraulic Analysis to Support Success Criteria"
- Appendix 19B, "Ex-Vessel Severe Accident Phenomena"
- Appendix 19C, "Additional Assessment of AP1000 Design Features"
- Appendix 19D, "Equipment Survivability Assessment"
- Appendix 19E, "Shutdown Evaluation"
- Appendix 19F, "Malevolent Aircraft Impact"

The Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The NRC staff's review confirmed there are no outstanding issues related to these sections.

The Westinghouse application to amend Appendix D to 10 CFR Part 52 includes changes to the majority of Sections 19.1 through 19.57 and Appendices 19A through 19F of the AP1000 DCD, as stated in Revision 17 of the AP1000 DCD. The staff is reviewing this information on Docket Number 52-006. The results of the NRC staff's technical evaluation of the information related to PRA results and insights incorporated by reference in the BLN COL FSAR will be documented in a supplement to the NRC staff's "Final Safety Evaluation Report [FSER] Related to Certification of the AP1000 Standard Design," (NUREG-1793). The supplement to NUREG-1793 is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Chapter 19 of this Safety Evaluation Report (SER) to reflect the final disposition of the design certification (DC) application.

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<sup>1</sup> See Section 1.2.2 for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

For the remaining sections of Chapter 19, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (SRP), Section 19.0, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors," was the principal source of guidance for the review. NUREG-0800, Section 19.1, "Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," was also used. The acceptability of the risk to public health and safety was determined on the basis of the results and insights derived from the applicant's plant-specific internal events PRA, site-specific assessment of external events, and severe accident evaluations. The staff's evaluation of the remaining sections of Chapter 19 is described below.

## **19.58 Winds, Floods, and Other External Events**

### **19.58.1 Introduction**

Section 19.58 of the BLN COL FSAR discusses risk associated with external events other than earthquakes. (The risk from seismic events is discussed in Section 19.55 of the AP1000 DCD, which is incorporated in the BLN COL application by reference.) The staff uses this information to confirm that the total risk represented by core damage frequency (CDF) and large release frequency (LRF) remains acceptably low when accounting for external events.

With respect to external events, the applicant's response to COL Information Item 19.59.10-2 may also affect BLN COL FSAR Section 19.58. Therefore, the staff's evaluation of this COL information item is discussed in Section 19.58.4 below.

### **19.58.2 Summary of Application**

Section 19.58 of the BLN COL FSAR, Revision 1, incorporates by reference with no departures or supplements, Section 19.58 of the AP1000 DCD, Revision 17.

In addition, in BLN COL FSAR Section 19.59.10.5, the applicant provided the following:

#### **AP1000 COL Information Item**

- STD COL 19.59.10-2

The applicant provided AP1000 standard (STD) plant COL information item STD COL19.59.10-2 to resolve COL Information Item 19.59.10-2, dealing with the site-specific PRA for external events.

Although this information is provided in a different section of the application, it has its most significant impact on this section and, therefore, its evaluation is documented in this section.

### **19.58.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD.

In addition, the applicable regulatory requirements for the evaluation of plant-specific information evaluated in Section 19.58 of this SER are as follows:

- 10 CFR 52.79(a)(46), “The final safety analysis report shall include...at a level of information sufficient to enable the Commission to reach a final conclusion on all safety matters that must be resolved...before issuance of a combined license:...[a] description of the plant-specific probabilistic risk assessment (PRA) and its results.”
- 10 CFR 52.79(d)(1), “If the combined license application references a standard design certification, then the...final safety analysis report need not contain information or analyses submitted to the Commission in connection with the design certification, *provided, however*, that the final safety analysis report must either include or incorporate by reference the standard design certification final safety analysis report and must contain, in addition to the information and analyses otherwise required, information sufficient to demonstrate that the site characteristics fall within the site parameters specified in the design certification. In addition, the plant-specific PRA information must use the PRA information for the design certification and must be updated to account for site-specific design information and any design changes or departures.”

Interim Staff Guidance COL/DC-ISG-3, “Probabilistic Risk Assessment Information to Support Design Certification and Combined License Applications,” provides clarifying guidance regarding the scope and quality of PRAs being used to support COL applications, and documentation that must be submitted in support of these applications.

For external events analysis purposes, COL/DC-ISG-3 considers the requirements of 10 CFR 52.79(d)(1) met if the COL applicant compares the site’s characteristics to those assumed in the bounding analyses to ensure that the site is enveloped. If the site is enveloped, the COL applicant need not perform further PRA evaluations for these external events. However, the COL applicant should perform site-specific PRA evaluations to address any site-specific hazards for which a bounding analysis was not performed or that are not enveloped by the bounding analyses to ensure that no vulnerabilities due to siting exist.

#### **19.58.4 Technical Evaluation**

The NRC staff reviewed Section 19.58 of the BLN COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.<sup>1</sup> The NRC staff’s review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to winds, floods, and other external events. Section 19.58 of the AP1000 DCD is being reviewed by the staff under Docket Number 52-006. The NRC staff’s technical evaluation of the information incorporated by reference related to winds, floods, and other external events will be documented in the staff’s SER on the DC application for the AP1000 design.



The staff reviewed the information contained in the BLN COL FSAR:

AP1000 COL Information Item

- STD COL 19.59.10-2

The NRC staff reviewed STD COL 19.59.10-2 related to COL Information Item 19.59.10-2 included under Section 19.59 of the BLN COL FSAR.

In support of the AP1000 design certification amendment (DCA), and to address part of COL Information Item 19.59.10-2, the DC applicant submitted APP-GW-GLR-101, "AP1000 Probabilistic Risk Assessment Site-Specific Considerations." This technical report expanded Section 19.58 of the AP1000 DCD with descriptions of its analyses of selected external events at a hypothetical AP1000 site. The DC applicant gathered site-specific data for those external events hazards determined applicable to each of the sites proposing to build AP1000 plants. For each event, it used the most limiting of the parameters provided by the several sites to characterize the generic AP1000 site. This produced a set of bounding analyses for the selected external events. The DC applicant evaluated these limiting external events against the criteria of NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities," suitably modified.

The AP1000 DCD, Revision 17, Section 19.58 provides an analysis of the capability of the AP1000 design to withstand external flooding, tornadoes, hurricanes, and other site-specific external events. The second part of COL Information Item 19.59.10-2 in the AP1000 DCD makes the following statement:

[The] Combined License applicant will confirm that the High Winds, Floods, and Other External Events analysis documented in Section 19.58 is applicable to the COL site. Further evaluation will be required if the COL site is shown to be outside of the bounds of the High Winds, Floods, and Other External Events analysis documented in Section 19.58.

In the BLN COL FSAR, Revision 1, the applicant provided STD COL 19.59.10-2, which included the following paragraph:

It has been confirmed that the Winds, Floods, and Other External Events analysis documented in Section 19.58 is applicable to the site. The site-specific design has been evaluated and is consistent with the AP1000 PRA assumptions. Therefore, Chapter 19 of the AP1000 DCD is applicable to this design.

Staff Request for Additional Information

Although site-specific information at currently proposed AP1000 sites was considered in performing the generic analyses of DCD Section 19.58, details were not made available to the staff. The staff issued a request for additional information (RAI) for sufficient information to be able to confirm the basis for concluding that the BLN site was bounded by the generic analysis (RAI 19-2).

In a letter dated September 4, 2008 (ML082520224), the applicant described the methodology used to develop the generic external event analysis and provided some additional information on event frequency and severity.

Potential external events and hazards were first screened for applicability to the BLN site. For events that were judged applicable, the applicant developed an initiating event frequency and provided this information to Westinghouse for use in the bounding analysis of the generic AP1000 site. Westinghouse developed a limiting event to bound the severity and frequency of all reported events; a hypothetical site for the generic analysis was characterized by these limiting events.

To address the external events in the scope of the generic analysis, the applicant provided a comparison between the DCD limiting events and site-specific events in the response to RAI 19-2. Table 1 in the RAI 19-2 response provides an assessment of external event applicability to the BLN site (with a brief justification), as well as the applicant's estimate of event frequency for relevant external events.

The staff independently compared these inputs to the event frequencies assumed in the DCD.

The staff reviewed the data, the applicability justifications, and the basis for event frequency estimations in this table. Events that were bounded by the external events documented in the DCD (no more frequent and no more damaging) required no additional evaluation. Events that are predicted to occur no more than once in ten million years can be screened because they occur so infrequently (frequency less than  $1E-07$ /year). Events that may occur more frequently but less than once in a million years (frequency less than  $1E-06$ /year) are assessed to determine that their consequences make a negligible contribution to core damage frequency (change CDF less than  $1E-08$ /year). Other events, if any, must be explicitly evaluated and included in the plant-specific PRA.

A number of questions remained, and the staff issued several RAIs requesting additional details and clarification to allow the staff to confirm that the key site-related assumptions in the AP1000 DCD, Section 19.58 external events analyses remain valid for the BLN site (RAIs 19-8 through 19-19):

- RAI 19-8 requested that the applicant clarify the definition of "applicable" in this context and to ensure that it is applied consistently.
- RAI 19-9 requested: (a) the basis for screening; and (b) assessment of risk from events that cannot be screened (to be reported in the FSAR).
- RAI 19-10 requested reclassification of tornadoes reported in the BLN COL FSAR using the enhanced Fujita scale (to allow direct comparison between the FSAR and the referenced DCD).
- RAI 19-11 requested an expanded sample size for the assessment of tornado frequency.
- RAI 19-12 requested clarification of the treatment of tornado frequency in light of adjustments that may be appropriate for large structures and the length of a tornado's path.
- RAI 19-13 requested additional basis for the estimated hurricane frequency.

- RAI 19-14 requested clarification of the calculation of event frequency.
- RAI 19-15 requested clarification of the frequency of extratropical cyclones.
- RAI 19-16 requested additional discussion of the basis for the BLN assessment of external flooding.
- RAI 19-17 requested discussion of risk related to the release of toxic materials.
- RAI 19-18 requested discussion of risk related to nearby facilities
- RAI 19-19 requested the basis for screening of external fires.

In a letter (ML091100173) dated April 15, 2009, the applicant responded to these RAIs with the requested clarification and discussion. In addition, the applicant revised the table that had been submitted in response to RAI 19-2 and proposed to include it in the BLN COL FSAR as Table 19.58-201, "External Event Frequencies for BLN," to document the basis for its assessment of risk related to winds, floods, and other external events.

A summary of the staff's review of each of the external event categories follows.

#### Winds that would threaten safety-related SSCs (exceed 300 mph)

Because BLN safety-related structures, systems, and components (SSCs) are designed to withstand winds of 300 miles per hour (mph), the COL applicant should confirm the assumption that high wind events exceeding 300 mph (the design basis for the structures of the nuclear island) are extremely rare (frequency  $<1E-7$  per year). Subsequent to certification of the AP1000 design, the staff issued Regulatory Guide (RG) 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1. This guide states that for the continental United States, the staff considers the highest tornado wind speed with a frequency as high as  $1E-07$  to be 230 mph. Clearly, the expected frequency of 300 mph tornadoes is significantly lower. Therefore, staff considers such events at the BLN site to be screened from further analysis on the basis of negligible frequency.

#### High Winds—Tornadoes

The applicant is expected to verify that the frequency of each of the six tornado classes at the proposed site is bounded by the frequency assumed in Section 19.58 of the AP1000 DCD.

The applicant found this external event category applicable to the BLN site, and estimated frequencies for tornadoes striking the seven counties around the site. The applicant's estimated frequency for each class of tornado (on the enhanced Fujita scale) is less than what is assumed in Section 19.58 of the AP1000 DCD. The applicant reported that the large structure strike probability from any tornado at the BLN site is  $8.89E-4$  per year and assumed this frequency for each class of tornado.

The staff finds that the assigned frequencies are conservative and are an acceptable basis for considering the BLN site to be bounded by the generic analysis documented in the DCD.

### High Winds—Hurricanes and Extratropical Cyclones

The applicant is expected to verify that the frequency of each of the 12 high wind categories at the proposed site is bounded by the frequency assumed in Section 19.58 of the AP1000 DCD.

The applicant cited American Society of Civil Engineers (ASCE) Standard ASCE/SEI 7-05, "Minimum Design Loads for Buildings and Other Structures," which identifies areas in the U.S. that are considered to be prone to hurricanes. According to this source, the BLN site is not in a hurricane-prone region. In addition, no hurricane has been reported within 100 miles of the site since record-keeping was initiated in 1851. The applicant assigned a frequency of less than  $1E-02$  for each class of hurricanes (Classes 1–5).

The staff finds this to be an acceptable basis for screening Category 3, 4, and 5 hurricanes from further analysis. The assigned frequencies are conservative and are an acceptable basis for considering the BLN site to be bounded by the generic analysis documented in the DCD.

### External Floods

Flooding due to hurricane storm surge was addressed in the DCD, but the COL applicant does not consider it applicable to the BLN site. Because the plant is not located in a hurricane-prone area, the staff agrees that this cause of flooding is not applicable to the BLN site.

The staff's review of other external flooding events is documented in Chapter 2 of this SER. Upon completion of the staff's review of Section 2.4, "Hydrology," of the BLN COL FSAR, the PRA review of external floods will be finalized. This is Open Item 19.58-1

### Transportation and Nearby Facility Accidents—Aviation Accidents

The applicant is expected to demonstrate that it is bounded by Section 19.58 of the AP1000 DCD by limiting impact frequencies to  $1.2E-06$  per year by small aircraft and  $1.0E-07$  per year by commercial size aircraft. The bounding analysis for a small aircraft in the AP1000 DCD assumes that the impact would result in a loss of offsite power initiating event with subsequent loss of non-safety-related systems. Larger (commercial) aircraft may have the capacity to challenge safety-related SSCs, although some safety-related systems are expected to survive and remain functional. Because of the uncertainty of the consequences of the impact, the acceptable screening criterion for large, commercial aircraft is to demonstrate an accidental impact frequency of  $1.0E-07$  per year or less.

In response to RAI 19-2, the applicant identified this event category as applicable to the BLN site, and took credit for its response to RAI 3.5.1.6-2, which provides details of aircraft impact analysis performed for BLN COL FSAR Section 3.5.1.6, "Aircraft Hazards." The frequency of a small aircraft impact event from the Scottsboro Municipal Airport is  $7.8E-07$  per year, which is bounded by the limiting frequency of  $1.2E-06$  per year in the DCD.

The estimated frequency of accidental impact for commercial aircraft is  $1.01E-07$  events per year, provided in response to RAI 3.5.1.6-2. Although this exceeds the screening criterion by a small margin, the staff found sufficient conservatism in the calculation to make screening of accidental aircraft impact acceptable.

### Transportation and Nearby Facility Accidents—Marine Accidents

The applicant is expected to verify that the limiting initiating event frequency of  $1E-06$  per year is not exceeded for the release of toxic materials toward the plant (which can affect plant and control room habitability). This is not a screening based on frequency alone: it also considers consequence. It is predicated on a very low conditional core damage probability when there is no operator action or no operator action after tripping the reactor.

In response to RAI 19-2, the applicant found that this event category applied to the BLN site. In response to RAI 19-17, the applicant reported that all toxic chemicals from marine transportation sources had been screened out as documented in BLN COL FSAR Chapter 2, where the applicant takes credit for a calculation to quantify the risk to the site from barge accidents on the Tennessee River.

The staff finds that the applicant provided an acceptable basis for screening toxic release from marine transportation sources.

However, the applicant determined that explosion of a barge carrying ethyl alcohol could cause an exceedance of the 1-psi overpressure the threshold at the plant. BLN estimated an initiating event frequency for detonation risk to the site from barge traffic of  $1.9E-08$  per year. This is well below the screening value of  $1.0E-07$  per year. Overpressure from a vapor cloud with delayed ignition was found to be well below the 1 psi threshold.

On the basis of this estimate of event frequency, the staff finds it acceptable to screen marine-based overpressure events from further risk assessment.

### Transportation and Nearby Facility Accidents—Rail Accidents

As in the case of marine-based hazards there are two event subcategories of rail-based hazards: toxic materials and explosive hazards.

In response to RAI 19-2, the applicant found that this event category does not apply to the BLN site. The safe standoff distance for an explosive hazard (based on a tank car of trinitrotoluene) is less than the distance from the site boundary to the nearest railway.

In response to RAI 19-17, the applicant reported that chlorine, anhydrous ammonia, propylene oxide, and hydrogen fluoride railroad tanker traffic release events could not be screened from further evaluation. A more detailed analysis of this scenario is provided in Section 6.4 of the BLN COL FSAR, which meets the regulatory guidelines for evaluating this hazard as part of the safety design basis.

The staff's review of control room habitability is documented in Section 6.4 of this SER. Upon completion of the staff's review of Section 6.4, "Control Room Habitability," of the BLN COL FSAR, the PRA review of rail accidents will be finalized. This is Open Item 19.58-2.

### Transportation and Nearby Facility Accidents—Truck Accidents

In response to RAI 19-2, the applicant states that truck accidents are not applicable to the BLN site. Accordingly, the applicant does not discuss the toxic materials event subcategory. As previously noted, RAI 19-17 was issued to the applicant to provide an evaluation of this

subcategory for all mobile sources, including truck traffic, and to document the assessment of associated risk in Section 19.58 of the BLN COL FSAR.

The applicant's response to RAI 19-2 with respect to truck-based explosive and flammable vapor cloud hazards is similar to that for rail-based hazards, and it concluded that the safe standoff distance for an explosive hazard is less than the distance from the site boundary to the nearest highway.

The staff finds that the applicant has demonstrated that an overpressure event due to a truck-based explosive hazard does not pose a credible threat. In addition, a delayed ignition event from a truck-based vapor cloud does not pose a credible threat to the BLN units.

In response to RAI 19-17, the applicant reported that all hazardous materials except nitrogen could be screened from assessment on a frequency basis. Moreover, the maximum concentration at the control room heating, ventilation, and air conditioning intake would not exceed a level immediately dangerous to life or health. For this reason, it would have no risk significance.

The staff finds this an acceptable basis for screening truck accidents from further risk assessment.

#### Transportation and Nearby Facility Accidents—Pipelines

In response to RAI 19-2, the applicant states that there are no major pipelines within five miles of the BLN site. The position of the staff is that a release of hazardous material beyond this distance need not be considered. The staff confirmed that residential, commercial, and industrial distribution pipelines within five miles of the site do not constitute major pipelines. The staff concludes that this event is not applicable to the BLN site.

Because the limiting event evaluated for pipeline-related explosion in the DCD was a 76 centimeter (cm) (30-inch) pipe at a distance of 1700 m (5800 feet) from the plant, the staff finds that this is also an acceptable basis for screening explosion hazards due to pipeline accidents.

#### Transportation and Nearby Facility Accidents—Nearby Facilities

Section 19.58.2.3 of the AP1000 DCD, "Transportation and Nearby Facility Accidents," indicates that this section discusses events that "consist of accidents related to transportation near the nuclear power plant and accidents at industrial and military facilities in the vicinity." RAI 19-18 was issued requesting additional information about the toxic and explosive hazards associated with nearby facilities.

In Chapter 2 of the BLN COL FSAR, the military and industrial facilities within five miles of the plant are identified, the inventories of hazardous materials associated with each one are documented, and the potential consequences of release are evaluated. The applicant found the potential consequences to have negligible effect on safety. In response to RAI 19-18, the applicant proposed to document the basis for screening these sources from further evaluation.

The staff finds that this is an acceptable basis for screening these events from further evaluation.

## External Fires

The DCD calls for the applicant to “reevaluate the qualitative screening of external fires” and perform a risk assessment if it cannot be demonstrated that the frequency of hazard is  $< 1E-07$  per year. The NRC issued RAI 19-19 to request documentation of this reevaluation or assessment in the BLN COL FSAR.

External fires are discussed in BLN COL FSAR Chapter 2. On the basis of the distance separating the plant from potential external fires, the applicant concluded that safe operation of the plant is not jeopardized by external fires.

In response to RAI 19-19, the applicant proposed to document the basis for screening these sources from further evaluation. This is acceptable to the staff.

## Summary

On the basis of this additional information, the staff confirmed that the AP1000 DCD external events analysis envelops the reported parameters of the BLN site. With the exception of pending staff review of external flooding and control room habitability, the staff concludes that the incorporation of AP1000 DCD Section 19.58 by reference with plant-specific supplemental information is acceptable, resolving RAIs 19-2, 19-8 through 19-15, 19-18, and 19-19. The staff identifies inclusion of proposed Table 19.58-201 in a revision to the BLN COL FSAR as **Confirmatory Item 19.58-1**.

### **19.58.5 Post Combined License Activities**

There are no post-COL activities related to this section.

### **19.58.6 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to winds, floods, and other external events, and there is no outstanding information expected to be addressed in the BLN COL FSAR related to this section.

The Westinghouse application to amend Appendix D to 10 CFR Part 52 includes changes to Section 19.58 of the AP1000 DCD, as stated in Revision 17 of the AP1000 DCD. The staff is reviewing this information on Docket Number 52-006. The results of the NRC staff's technical evaluation of the information incorporated by reference in the BLN COL FSAR will be documented in a supplement to NUREG-1793. The supplement to NUREG-1793 is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Section 19.58 of this SER to reflect the final disposition of the DC application.

However, as a result of Open Items 19.58-1 and 19.58-2, as well as Confirmatory Item 19.58-1, the staff is unable to finalize its conclusions on STD COL 19.59.10-2 related to winds, floods and other external events specific to the BLN site in accordance with the requirements of 10 CFR 52.79(a)(46) and 10 CFR 52.79(d)(1).

## **19.59 PRA Results and Insights**

### **19.59.1 Introduction**

This section describes the use of the PRA in the design process. It also provides an overall summary of PRA results, including those from the following analyses:

- full power, internal events PRA (both Level 1 and Level 2, providing information on CDF and LRF)
- shutdown and low power events PRA (both Level 1 and Level 2 PRA, with information on CDF and LRF)
- internal flooding assessment (both Level 1 and Level 2 PRA, with information on CDF and LRF for both full power and shutdown/low power conditions)
- internal fire assessment (both Level 1 and Level 2 PRA, with information on CDF and LRF for both full power and shutdown/low power conditions)
- seismic margin analysis

In addition, this section discusses key insights from the PRA. It describes those plant features that are important to risk. It also provides information on where the PRA was used to support the certification of the AP1000 design, such as the assessment of design alternatives and scoping of the reliability assurance program.

### **19.59.2 Summary of Application**

Section 19.59 of the BLN COL FSAR incorporates by reference, with no departures or supplements, Section 19.59 of the AP1000 DCD, Revision 17.

In addition, in BLN COL FSAR Section 19.59.10.5, the applicant provided the following:

#### AP1000 COL Information Items

- STD COL 19.59.10-1

The applicant provided additional information in STD COL 19.59.10-1 to address COL Information Item 19.59.10-1. This item will evaluate any differences between the as-built plant and the certified design to confirm that seismic margins remain adequate.

- STD COL 19.59.10-2

The applicant provided additional information in STD COL 19.59.10-2 to address COL Information Item 19.59.10-2. The portion of this item dealing with evaluation of the as-built plant for conformance to the design modeled in the AP1000 PRA was originally identified in Revision 15 of the AP1000 DCD as a COL applicant's responsibility. It was subsequently identified as a COL holder's responsibility.



The portion of this item dealing with the site-specific PRA for external events remains the responsibility of the COL applicant and is discussed in Section 19.58 of this SER.

- STD COL 19.59.10-3

The applicant provided additional information in STD COL 19.59.10-3 to address COL Information Item 19.59.10-3. This item will evaluate any differences between the as-built plant and the certified design to confirm that there are no significant adverse changes to the internal fire and internal flood analysis results.

- STD COL 19.59.10-4

The applicant provided additional information in STD COL 19.59.10-4 to address COL Information Item 19.59.10-4. The COL applicant states that severe accident management guidance (SAMG) is implemented on a site-specific basis.

- STD COL 19.59.10-5

The applicant provided additional information in STD COL 19.59.10-5 to address COL Information Item 19.59.10-5. This item, thermal lag assessment of the as-built equipment required to mitigate severe accidents, must be completed prior to initial fuel loading (for equipment that has not been tested at severe accident conditions).

Section 19.59 of the BLN COL FSAR adds Section 19.59.10.6 to include the following:

Supplemental information:

- STD SUP 19.59-1

The applicant provided the following supplemental (SUP) information, discussing the processes for:

- maintaining the PRA reflective of the as-built, as-operated plant
- upgrading the PRA to incorporate improved methodologies and other information, as well as insuring that it continues to meet the required NRC-endorsed consensus standards
- maintaining proper quality controls on the PRA, including computer codes used to support PRA quantification
- maintaining the PRA documentation current
- using the PRA in applications, including those that support decision making

In addition, the applicant describes where the BLN PRA is expected to provide input to other programs and processes.

### License Conditions

Proposed License Condition 2, "COL Holder Items," identifies required actions that cannot be accomplished until a license is granted and provides milestones for their completion.

Proposed License Condition 6, "Operational Program Readiness" requires submittal of a schedule to support NRC inspections of operational programs consistent with SECY-05-0197, including those related to implementation of SAMG.

### **19.59.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD.

In addition, the following regulations apply to Sections 19.59.10.5 and 19.59.10.6 of the BLN COL FSAR:

- 10 CFR 50.71(h)(1), "No later than the scheduled date for initial loading of fuel, each holder of a combined license under subpart C of 10 CFR Part 52 shall develop a level 1 and a level 2 probabilistic risk assessment (PRA). The PRA must cover those initiating events and modes for which NRC-endorsed consensus standards on PRA exist one year prior to the scheduled date for initial loading of fuel."
- 10 CFR 50.71(h)(2), "Each holder of a combined license shall maintain and upgrade the PRA required by paragraph (h)(1) of this section. The upgraded PRA must cover initiating events and modes of operation contained in NRC-endorsed consensus standards on PRA in effect one year prior to each required upgrade. The PRA must be upgraded every four years until the permanent cessation of operations under 10 CFR 52.110(a) of this chapter."
- 10 CFR 52.79(a)(46), "The final safety analysis report shall include...at a level of information sufficient to enable the Commission to reach a final conclusion on all safety matters that must be resolved...before issuance of a combined license:...[a] description of the plant-specific probabilistic risk assessment (PRA) and its results."
- 10 CFR 52.79(a)(38), "The final safety analysis report shall include...at a level of information sufficient to enable the Commission to reach a final conclusion on all safety matters that must be resolved...before issuance of a combined license :...a description and analysis of design features for the prevention and mitigation of severe accidents..."
- 10 CFR 52.79(d)(1), "If the combined license application references a standard design certification, then the...final safety analysis report need not contain information or analyses submitted to the Commission in connection with the design certification, *provided, however*, that the final safety analysis report must either include or incorporate by reference the standard design certification final safety analysis report and must contain, in addition to the information and analyses otherwise required, information sufficient to demonstrate that the site characteristics fall within the site parameters specified in the design certification. In addition, the plant-specific PRA information must use the PRA information for the design certification and must be updated to account for site-specific design information and any design changes or departures."

NUREG-0800 provides the following acceptance criteria:

- Section 19.0, Section III.1.C provides guidance for reviewing a COL application referencing a DC, with emphasis on documented assumptions and insights from the PRA.
- Section 19.0, Section III.3 provides guidance for reviewing COL action items.
- Section 19.1 provides information regarding the review of the technical adequacy of a design-specific, site-specific PRA.

Additional guidance is found in the following documents:

- SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," establishes expectations for reporting scheduled implementation of operational programs.
- COL/DC-ISG-3, "Probabilistic Risk Assessment Information to Support Design Certification and Combined License Applications," clarifies the staff's expectations for information to be included in the COL application.

#### **19.59.4 Technical Evaluation**

The NRC staff reviewed Section 19.59 of the BLN COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to the PRA results and insights. Section 19.59 of the AP1000 DCD is being reviewed by the staff under Docket Number 52-006. The NRC staff's technical evaluation of the information incorporated by reference related to PRA results and insights will be documented in the staff SER on the DC application for the AP1000 design.

The staff reviewed the information in the BLN COL FSAR:

##### AP1000 COL Information Items

- STD COL 19.59.10-1

The NRC staff reviewed STD COL 19.59.10-1, which is related to the seismic margin evaluation found in Section 19.55 of the AP1000 DCD, incorporated by reference into the BLN COL FSAR.. RAI 19-1 requested justification of an apparent difference between STD COL 19.59.10-1 and the corresponding information item in the DCD. The applicant revised BLN COL FSAR Section 19.59.10.5 as follows:

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

1. Specific minimum seismic requirements [are] consistent with those used to define the Table 19.55-1 [high confidence, low probability of failure] HCLPF values. This includes the known frequency range used to define the HCLPF by comparing the required response spectrum (RRS) and test response spectrum (TRS). The range of frequency response that is required for the equipment with its structural support is defined.
2. Hardware enhancements that were determined in previous test programs and/or analysis programs will be implemented.

This is consistent with the AP1000 DCD, and is therefore acceptable to the staff. As a result, the staff considers RAI 19-1 to be closed.

STD COL 19.59.10-1 states that this should be completed prior to initial fuel load, rather than at the time of the COL application. The required comparison cannot be performed until completion of fabrication, installation, and construction of SSCs, and the as-built review of the seismic margin evaluation.

The NRC staff concluded in Section 19.1.5.1 of NUREG-1793 that the methodology for calculating the HCLPF values complied with the relevant regulatory requirements, based on the certified seismic design response spectra (CSDRS). The staff concludes that it is acceptable to complete the final verification of seismic margins when the walkdowns are performed after the plant is built.

- STD COL 19.59.10-2

As noted in SER Section 19.59.2 above, this COL information item has two parts. The first part requires the COL holder to compare the as-built plant to the design used as the basis for the AP1000 PRA and DCD Table 19.59-18 (which was incorporated by reference into Chapter 19 of the applicant's FSAR). The COL holder must update the site-specific PRA to reflect differences if they potentially result in a significant increase in CDF or LRF.

Revisions to 10 CFR Part 52 and related rules were issued after the initial AP1000 DC, but prior to the submittal of the BLN COL application. Two of them, 10 CFR 52.79(d)(1) and 10 CFR 50.71(h), require that a COL application provide a description of a site-specific PRA, and that this PRA will, by fuel load, meet those industry consensus PRA standards endorsed by the NRC no earlier than one year prior to the scheduled fuel load date. Additional guidance was provided in COL/DC-ISG-3, which states, "PRA maintenance should commence at the time of application for both DC and COL applicants. This means that the PRA should be updated to reflect plant modifications if there are changes to the design." COL/DC-ISG-3 also clarifies the staff position on what constitutes a significant change in PRA results.

The staff requested in RAI 19-5 clarification of how the BLN PRA will be updated to account for BLN site-specific information by fuel load. It also requested a definition of a "significant increase."

In response to RAI 19-5, the applicant indicated that the PRA would be updated as described in BLN COL FSAR Section 19.59.10.6. PRA updating will include evaluation of as-built plant differences, departures from the certified design, and a plant-specific review of all of the PRA insights and assumptions as documented in AP1000 DCD Table 19.59-18. The applicant

revised BLN COL FSAR Section 19.59.10.5 to clarify that any differences found would be evaluated and that the plant-specific PRA model would be modified as necessary to reflect both the plant-specific design and PRA-based insights.

The staff agrees that the applicant's response meets the expectations of 10 CFR 52.79(d)(1) regarding the requirement for a site-specific PRA, as well as the additional guidance described in COL/DC-ISG-3. STD COL 19.59.10-2 now states that this should be completed prior to initial fuel load, rather than at the time of the COL application. The required updates cannot be completed until completion of fabrication, installation, and construction.

The NRC staff concluded in Section 19.1.9 of NUREG-1793 that the quality and completeness of the AP1000 PRA are adequate and satisfy the regulatory requirements. The methodology for upgrading and updating the plant-specific PRA described in the BLN COL FSAR satisfies the guidance of RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities," Revision 1, January 2007, and is therefore acceptable to the staff. The staff concludes that it is acceptable to update the plant-specific PRA when walkdowns are performed after the plant is built. This is consistent with the 10 CFR 50.71(h) requirement that the plant-specific PRA reflect the risk profile of the as-built, as-operated plant.

The second part of this COL information item involves a review of site-specific external events to confirm that they are bounded by the external events addressed in the generic risk assessment for the AP1000 design. The staff's evaluation of this review is documented in Section 19.58 of this SER.

- STD COL 19.59.10-3

In response to RAI 19-20, the applicant proposed a change to its response to STD COL 19.59.10-3 to the effect that plant-specific internal fire and internal flood analysis will be evaluated and the analysis modified as necessary to account for the plant-specific design, and any design changes or departures from the certified design.

The staff reviewed STD COL 19.59.10-3, which is related to the internal fire and internal flood analyses evaluation included under Sections 19.56 and 19.57 of the AP1000 DCD, incorporated by reference in the BLN COL FSAR.

The NRC staff discussed, in Sections 19.1.5.2 and 19.1.5.3 of NUREG-1793, the methodology for assessing the risk from internal fire and floods, respectively. In Section 19.1.9, the staff concluded that the quality and completeness of the AP1000 PRA are adequate and satisfy the applicable regulatory requirements. Because the as-built configuration cannot be assessed until construction is complete, the staff finds that it is acceptable to update internal fire and flood analyses if the need to do so is identified when walkdowns are performed after the plant is built.

In a letter dated April 15, 2009 (ML091100173), the applicant proposed to revise its response to STD COL 19.59.10-1 through 19.59.10-3 and to revise License Condition 2 to conform to the revised wording of these three STD COL items. The staff identifies incorporation of these changes as **Confirmatory Item 19.59-1**.

- STD COL 19.59.10-4

The AP1000 DCD closed this COL information item with respect to the development of the SAMG. The COL holder will implement the AP1000 SAMG.

For STD COL 19.59.10-4 in Section 19.59.10 of the BLN COL FSAR, the applicant states, "The AP1000 Severe Accident Management Guidance (SAMG) from APP-GW-GLR-070, Reference 1 of DCD Section 19.59, is implemented on a site-specific basis." In Table 1.8-202 of the BLN COL FSAR, the applicant identifies this as a COL holder item. In response to RAI 19-3, the applicant revised its response to STD COL 19.59.10-4 in the BLN COL FSAR. The staff found this response incomplete and issued RAI 19-21.

In a letter dated April 15, 2009 (ML091100173), in response to RAI 19-21, the applicant proposed to revise License Conditions 2 and 6 to conform to the revised FSAR wording. Specifically, the applicant proposed to revise License Condition 2, Item 19.59.10-4 to reflect the fact that the SAMG development had been completed in the AP1000 DCD. In addition, the applicant proposed to revise License Condition 6 (Operational Program Readiness in Part 10 of the BLN COL application) to include a schedule for the implementation of site-specific SAMG, thereby supporting NRC inspections of operational programs in the period between issuance of a COL and authorization to load fuel in accordance with 10 CFR 52.103. This is consistent with the staff position documented in SECY-05-0197, and therefore, acceptable to the staff. The staff identifies the incorporation of these changes as Confirmatory Item 19.59-2.

- STD COL 19.59.10-5

The AP1000 DCD, Revision 17, changed the wording of COL Information Item 19.59.10-5 to clarify which equipment requires thermal lag assessment. STD COL 19.59.10-5 in Chapter 19 of the BLN COL FSAR, as well as the COL holder item listed in License Condition 2 (Part 10 of the BLN COL application) have been revised to conform with the AP1000 DCD.

The NRC staff concluded, in Section 19.2.3.3.7.3 of NUREG-1793, that the equipment and instrumentation identified as required to mitigate severe accidents meets the guidance of SECY-93-087 and 10 CFR 50.34(f). In addition, the staff required that the COL applicant referencing the AP1000 certified design perform a thermal response assessment of as-built equipment used to mitigate severe accidents. Since the as-built equipment and configuration are not available until after the COL is issued, the staff concludes that it is acceptable to complete thermal lag assessments prior to fuel load.

#### COL Action Items from Chapter 19 of NUREG-1793

The staff compared COL information items in Chapter 19 of the AP1000 DCD with the COL action items from NUREG-1793. The staff identified differences between them, which resulted in two RAIs:

#### RAI 19-6

Two items from NUREG-1793 relate to the training of operators to respond to certain conditions during shutdown. The first calls for the COL applicant to train operators to quickly close containment hatches and penetrations in the event of an accident during Modes 5 or 6. This must be completed before boiling begins in the reactor coolant system (RCS).

The BLN COL FSAR cited APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures." This is the template document for AP1000 procedure generation. The applicant also noted that BLN COL FSAR Section 13.2 incorporates by reference NEI 06-13, "Template for an Industry Training Program Description." Sections 1.1.1.1, 1.1.1.2, 1.1.2, and 1.2.1 of this document focus on training for operations during shutdown, including abnormal and emergency operations. Technical Specification 3.6.8 provides direction for maintaining containment closure capability prior to steaming during Modes 5 and 6, and it is expected that operators will be well versed in technical specification requirements.

The staff finds that this is an acceptable way to ensure that operators will be prepared to close containment hatches in the event of an accident during Mode 5 or 6.

The second calls for operator training in the use of the wide range pressurizer level indication to cross-check the safety-related narrow range hot-leg level instruments. This is to avoid inadvertent over-draining of the RCS, particularly during reduced inventory operation. The staff reviewed Table 19.59-18, "AP1000 PRA-Based Risk Insights." Item 62 of the table explicitly states, "It is important to maximize the availability of the non-safety-related wide range pressurizer level indication during RCS draining operations during cold shutdown. Procedures and training must be developed to encompass this item." BLN COL 19.59.10-2 includes verification of every item in this table by the COL holder, prior to fuel load. This is accomplished by comparing each item to the as-built (and as operated) plant.

The staff finds this to be an acceptable way to confirm that operators are adequately trained on the use of wide range pressurizer level indication as a cross-check on the safety-related narrow range hot-leg level instruments. Therefore, RAI 19-6 is closed.

#### RAI 19-7

The staff sought more specific information about compensatory measures used to maintain adequate internal fire and flooding detection and suppression capability during maintenance activities that may impair these features.

The applicant responded by indicating that compensatory measures for fire protection are addressed in BLN COL FSAR Section 9.5.1.8.1.2, which describes use of a permit system that controls and documents inoperability of fire protection systems and equipment, and establishes requirements to initiate proper notifications and compensatory actions, such as fire watches, when the inoperability of any fire protection system or component, such as detectors or suppression devices, is identified. The staff reviewed the cited section of the BLN COL FSAR, and found that it adequately addresses situations when maintenance activities potentially impair fire detection and suppression equipment.

The applicant also responded that flooding detection and suppression equipment, such as sump level indicators, are identified as specific design features in BLN COL FSAR Sections 3.4 and 9.3.5. The most important ones, containment sump level indicators, are controlled by technical specification limiting conditions for operations (LCOs) with required actions and completion times. In addition, flood control in other places is managed by a floor drain system, which provides level detection, as well as manual or automatic pump down of the sumps, which collect water entering the floor drains. Administrative procedures described in BLN COL FSAR Section 13.5.1 control maintenance activities and provide for equipment control and, if needed, compensatory action when maintenance activities impair flooding control equipment.

The staff reviewed the references provided by the applicant and finds the applicant's responses provide adequate compensatory action; therefore, RAI 19-7 is closed.

Site-Specific Information Replacing Conceptual Design Information

The plant-specific seismic ground motion response spectra (GMRS) at the BLN site are not enveloped by the CSDRS that formed the original basis for seismic qualification requirements for all safety-related SSCs in an AP1000 plant. Both BLN Unit 3 and Unit 4 are to be founded on hard rock. As a result, the propagation of the energy from a seismic event is more efficient at the higher end of the frequency spectrum, resulting in a GMRS that peaks at higher frequencies. As a result, the BLN GMRS exceeds the CSDRS over a certain range of frequencies. The staff cannot find any basis for neglecting this issue in the seismic margins analysis.

The Westinghouse AP1000 DCD, Revision 17, addresses sites similar to BLN. A new seismic design response for hard rock high frequency (HRHF) sites was developed to bound BLN and similar sites. This is documented in APP-GW-GLN-144, "AP1000 Design Control Document High Frequency Seismic Tier 1 Changes." A seismic evaluation of SSCs was performed and documented in APP-GW-GLR-115, "Effect of High Frequency Seismic Content on SSCs." For most of the frequency spectrum, the seismic loading of SSCs is lower at a hard rock site, thus for most SSCs, the seismic challenge is reduced at a hard rock site. However, there is a set of SSCs that are sensitive to high frequencies. These were identified for further testing. There is an additional design basis seismic evaluation (documented in APP-GW-GLN-144 and APP-GW-GLR-115, incorporated in Chapter 3 of the AP1000 DCD, Revision 17). There is also a requirement to ensure that equipment with the potential to be sensitive to higher accelerations at higher frequencies will be tested and procured in a manner that provides assurance of adequate design.

However, neither the AP1000 DCD nor the BLN COL application provides a revised seismic margins assessment. As a result, the staff issued RAI 19-4, which had two parts:

1. The applicant was asked to reconcile the following statement in BLN COL FSAR Table 2.0-201 with the need to test SSCs that are sensitive to high frequency seismic challenge:

High frequency exceedances of the horizontal ground motion response spectra has been evaluated by Westinghouse and these exceedances are within the seismic design margin of the AP1000 and will not adversely affect the systems, structures or components of the plant.

2. Given the above-described HRHF exceedance of the CSDRS excitation levels at the higher end of the frequency spectrum, demonstrate that the plant will have adequate margin as described in the SRM for SECY-93-087.

In response to the first part of RAI 19-4, the applicant proposed revisions to BLN COL FSAR Table 2.0-201 and a similar passage in BLN COL FSAR Section 3.7.1.1.1. These have been incorporated in Revision 1 of the BLN COL FSAR. The staff finds the need for additional testing to be inconsistent with the BLN COL FSAR, Revision 1 statements on this issue. This is Open Item 19.59-1.



In response to the second part of RAI 19-4, the applicant stated that the seismic margin analysis was developed using the AP1000 CSDRS, which is being reviewed by the staff as part of the AP1000 DCD.

Supplemental Information

- STD SUP 19.59-1

The applicant provided supplemental information in BLN COL FSAR Section 19.59.10.6, "PRA Configuration Controls." The applicant discusses how the BLN plant-specific PRA is developed and maintained to reflect the as-built and as-operated plant, as well as how it will be used to support other programs.

The applicant committed to upgrade the Level 1 and Level 2 PRA prior to fuel load to cover those initiating events and modes of operation set forth in NRC-endorsed consensus standards on PRA that are in effect one year prior to the scheduled date of the initial fuel load. In addition, upgrades are completed at least once every four years. This is consistent with 10 CFR 50.71(h) and, therefore, acceptable to the staff.

In addition, the applicant committed to monitor various information sources for changes or new information that could affect the model assumptions or quantification. Plant-specific design, procedure, and operational changes are reviewed for risk impact. A screening process determines whether a PRA update should be performed more frequently, and includes consideration of whether the changes affect the PRA insights. If the changes warrant a PRA update, the update is made as soon as practicable consistent with the importance of the change and the applications being used. Otherwise, changes are tracked and incorporated in the next regularly scheduled update. This is consistent with RG 1.200, Revision 1, and therefore acceptable to the staff.

PRA quality assurance (QA) provisions ensure that personnel involved in PRA are qualified, work is reviewed independently, documentation is adequately controlled, and upgrades to the PRA are peer-reviewed. When assumptions, analyses, or information used previously are changed or determined to be in error, potential impacts to the PRA model are tracked. If errors are found in the PRA model, they are tracked and appropriate corrective action governed by procedures is taken. This is consistent with RG 1.200 and, therefore, acceptable to the staff.

The PRA provides input to various programs and processes, such as implementation of the maintenance rule, reactor oversight process, the reliability assurance program, the program for regulatory treatment of non-safety systems, and the motor-operated valve (MOV) program. The staff agrees that a plant-specific, site-specific PRA, based on the generic PRA for the AP1000 and maintained as described in the BLN COL FSAR, is an appropriate model to provide input to each of these risk-informed activities.

**19.59.5 Post Combined License Activities**

The following items were identified as the responsibility of the COL license holder:

- License Condition 2, Item 19.59.10-1, relating to as-built SSC HCLPF comparison to seismic margin evaluation

- License Condition 2, Item 19.59.10-2, relating to evaluation of as-built plant versus design in AP1000 PRA and site-specific PRA external events
- License Condition 2, Item 19.59.10-3, relating to internal fire and internal flood analyses
- License Condition 2, Item 19.59.10-4, and License Condition 6, relating to implementation of SAMG
- License Condition 2, Item 19.59.10-5, relating to equipment survivability

#### **19.59.6 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to PRA results and insights, and there is no outstanding information expected to be addressed in the BLN COL FSAR related to this section.

The Westinghouse application to amend Appendix D to 10 CFR Part 52 includes changes to Section 19.59 of the AP1000 DCD, as stated in Revision 17 of the AP1000 DCD. The staff is reviewing this information on Docket Number 52-006. The results of the NRC staff's technical evaluation of the information incorporated by reference in the BLN COL FSAR will be documented in a supplement to NUREG-1793. The supplement to NUREG-1793 is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Section 19.59 of this SER to reflect the final disposition of the DC application.

However, as a result of Open Item 19.59-1 and Confirmatory Items 19.59-1 and 19.59-2, the staff is unable to finalize its conclusions related to PRA results and insights specific to the BLN site in accordance with the requirements of 10 CFR 52.79(a)(46) and 10 CFR 52.79(d)(1).

- License Condition 2, Item 19.59.10-2, relating to evaluation of as-built plant versus design in AP1000 PRA and site-specific PRA external events
- License Condition 2, Item 19.59.10-3, relating to internal fire and internal flood analyses
- License Condition 2, Item 19.59.10-4, and License Condition 6, relating to implementation of SAMG
- License Condition 2, Item 19.59.10-5, relating to equipment survivability

**19.59.7 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to PRA results and insights, and there is no outstanding information expected to be addressed in the BLN COL FSAR related to this section.

The Westinghouse application to amend Appendix D to 10 CFR Part 52 includes changes to Section 19.59 of the AP1000 DCD, as stated in Revision 17 of the AP1000 DCD. The staff is reviewing this information on Docket Number 52-006. The results of the NRC staff's technical evaluation of the information incorporated by reference in the BLN COL FSAR will be documented in a supplement to NUREG-1793. The supplement to NUREG-1793 is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Section 19.59 of this SER to reflect the final disposition of the DC application.

However, as a result of Open Item 19.59-1 and Confirmatory Items 19.59-1 and 19.59-2, the staff is unable to finalize its conclusions related to PRA results and insights specific to the BLN site in accordance with the requirements of 10 CFR 52.79(a)(46) and 10 CFR 52.79(d)(1).

**PKG No.: ML091600220**

**Accession No.: ML091110711**

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