

## BellBendCOLPEm Resource

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**From:** Segala, John  
**Sent:** Monday, September 14, 2009 9:52 AM  
**To:** Canova, Michael  
**Cc:** Miernicki, Michael; Colaccino, Joseph; Shum, David; BellBendCOL Resource  
**Subject:** SUBMITTAL - Phase 1 inputs for the Bell Bend SER Sections 3.5.1.1, 3.5.1.2, 3.5.1.4, and 3.5.2  
**Attachments:** 090914B P1 SER 3 5 1 4 doc.doc; 090914 RAI for Section 3 5 1 2.doc; 090914A P1 SER 3 5 1 2.doc

Mike,

I approve of the attached phase 1 inputs for the Bell Bend SER Sections 3.5.1.2 and 3.5.1.4.

Section 3.5.1.2 has 1 RAI which will be issued in eRAI workflow shortly.

Section 3.5.1.4 has no RAIs.

Sections 3.5.1.1 and 3.5.2 are IBR with no supplements, departures, and/or COL items.

*John*

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SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS  
BELL BEND NUCLEAR POWER PLANT FINAL SAFETY ANALYSIS REPORT  
Docket No. 52-039  
SRP 3.5.1.4 "MISSILES GENERATED BY TORNADOES AND EXTREME WINDS"  
TAC: RC6117

3.5.1.4 Missiles Generated by Tornadoes and Extreme Winds

3.5.1.4.1 Introduction

In support of General Design Criteria (GDC) 2, "Design bases for protection against natural phenomena," and 4, "Environmental and dynamic effects design bases," the design basis is reviewed to ensure that missiles generated by most severe tornado and extreme winds are identified based on site specific parameters for Bell Bend Nuclear Power Plant (BBNPP) Combined License (COL) application.

3.5.1.4.2 Summary of Application

In Section 3.5.1.4 of the BBNPP COL application Final Safety Analysis Report (FSAR), Tier 2, the applicant (UniStar) incorporated the US Evolutionary Power Reactor (EPR) Design Control Document (DCD), Tier 2, Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," by reference without repeating the information from the DCD. No departures from the EPR design, no additional interface requirements or additional inspections, tests, analyses, and acceptance criteria (ITAAC) associated with Section 3.5.1.4 of the BBNPP COL application FSAR, Tier 2, were identified. In addition, the applicant provided the following information:

Interface Requirements

The applicant provided an evaluation for the potential missiles generated by hurricanes or extreme winds to demonstrate conformance to site parameter interface requirements identified as Interface Item 3-2, "Missiles Generated By Tornadoes or Extreme Winds," in US EPR DCD Table 1.8-1, "Summary of US EPR Plant Interfaces with Remainder of Plant."

Combined License Information Items

The applicant addressed the COL Information Items 3.5-4 and 3.5-7 described in the US EPR DCD Table 1.8.2, "U.S. EPR Combined License Information Items."

- COL Information Item 3.5-4: A COL applicant that references the US EPR design certification will evaluate the potential for other missiles generated by natural phenomena, such as hurricanes and extreme winds, and their potential impact on the missile protection design features of the US EPR.
- COL Information Item 3.5-7: For sites with surrounding ground elevations higher than plant grade, a COL applicant that references the US EPR design certification will confirm that automobile missiles cannot be generated within a 0.5 mile radius of safety related structures, systems and components (SSCs) that would lead to impact higher than ? meters (30 ft) above plant grade.

#### 3.5.1.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference and the supplemental information presented in this application is addressed within the safety evaluation report (SER) related to the US EPR DCD.

#### 3.5.1.4.4 Technical Evaluation

The NRC staff reviewed Section 3.5.1.4 of the BBNPP COL application FSAR, Revision 1, and considered the referenced US EPR DCD sections. The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to this section. Section 3.5.1.4 of the US EPR DCD is being reviewed by the NRC staff under docket number 52-020. The NRC staff's technical evaluation of the information incorporated by reference related to missiles generated by tornadoes and extreme winds will be documented in the corresponding SER for the US EPR DCD.

NRC staff acceptance of the design is based on meeting the requirements of Design Criteria (GDC) 2, "Design bases for protection against natural phenomena," and GDC 4, "Environmental and dynamic effects design bases." The BBNPP design is considered to be in compliance with GDC 2 and 4 if it meets Regulatory Positions C.1, "Design-Basis Tornado Parameters," and C.2, "Design-Basis Tornado-Generated Missile Spectrum," of Regulatory Guide (RG) 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1 dated March 2007.

In the event of a tornado strike, plant designs must consider the impact of tornado-generated missiles (i.e., objects moving under the action of aerodynamic forces induced by the tornado wind), in addition to the direct action of the tornado wind and the moving ambient pressure field.

The plant design must provide protection from a spectrum of missiles (ranging from a massive missile that deforms on impact to a rigid penetrating missile) to assure that the necessary structures, systems, and components will be available to mitigate the potential effects of a tornado on plant safety. The U.S. EPR is designed to the Region I missile spectrum of RG 1.76

#### Interface Requirements

Item 3-2 in Table 1.8-1, "Summary of U.S. EPR Plant Interfaces with Remainder of Plant," of the US EPR DCD, Revision 1, identifies a site interface with missiles generated by tornadoes and extreme winds. US EPR DCD, Tier 2, Revision 1, Section 3.5.1.4 identifies tornado-generated missiles that conform to the Region I missile spectrum presented in Table 2, "Design Basis Tornado Missile Spectrum and Maximum Horizontal Speeds," of RG 1.76. Region I has associated tornado wind speeds of 370 km/h (230 mph). BBNPP is located in Region I, therefore, resulting missile spectrum used for BBNPP is identical to the U.S. EPR standard design. Therefore, the NRC staff concludes that BBNPP design complies with GDCs 2 and 4 with respect to missiles generated by tornado and extreme winds.

#### COL Information Items

COL Information Item 3.5-4 specifies that a COL applicant will evaluate the potential for other missiles generated by natural phenomena, such as hurricanes and extreme winds and the impact on missile protection design features.

The applicant reviewed the following relevant meteorological data for the BBNPP site to determine the potential for extreme winds:

- From 1950 to 1995, the annual average number of tornados occurred in Pennsylvania was 10, with an annual average of 3 strong tornados ranging with Fujita damage scale from F2 to F5 for the same time period.
- Based on National Weather Service meteorological data from January 1, 1950 to August 31, 2007, there had been 15 tornados reported in Luzerne County, Pennsylvania with estimated maximum Fujita damage scale of F2, which equates to a maximum estimated wind speed of 253 km/hr (157 mph).
- A review of the National Hurricane Center statistics identified 52 tropical storms and hurricanes that have passed within 161 km (100 statute miles) of BBNPP. Of these storms, there were two category 1 hurricanes that occurred in the month of October, with an estimated maximum wind speed of 41 m/s (92 mph).
- A review of the National Climatic Data Center's Storm Events database data from June 6, 1971 through August 25, 2007 identified 52 high wind events. Maximum wind speed recorded was 90 m/s (201 mph) on May 31, 1998.

Since the U.S. EPR tornado-generated missiles are based on a wind speed of 370 km/hr (230 mph), the applicant concluded that the Region I tornado missile spectrum from RG 1.76 is a conservative representation of those that could be generated by the less intense extreme wind conditions anticipated at the BBNPP site.

The NRC staff concurs with the applicant that the Region I tornado missile spectrum from RG 1.76 is a conservative representation of those that could be generated by the less intense extreme wind conditions anticipated at the BBNPP site. Therefore, the NRC staff concludes that BBNPP complies with GDCs 2 and 4 with respect to missiles generated by tornado and extreme winds.

Section 2.3.1, "Regional Climatology," of this SER addresses the staff's evaluation of site specific extreme winds.

COL Information Item 3.5-7 specifies that a COL applicant will evaluate the potential for automobile missiles generated within a 0.8 km (0.5 mile) radius that could impact higher than 9.1 m (30 ft) above plant grade.

The applicant stated that that plant grade is approximately 205 m (674 ft). The highest elevation within the 0.8 km (0.5 mile) radius is 268 m (880 ft), which means all structural elements below elevation 277 m (910 ft) require evaluation for an automobile missile impact. This elevation corresponds to a height of 66 m (216 ft) above grade. The heights of all safety-related structures outside the NI base mat are less than 216 ft (66 m) tall; therefore, all walls and roofs

for Category I structures, including the essential service water buildings (ESWBs), are designed for automobile missiles.

The applicant stated that Category I structures on the nuclear island (NI) basemat meet the Region I tornado missile protection requirements. Additionally, the walls and roof slabs of all Category I structures outside the NI basemat meet the Region I tornado missile protection requirements including automobile missile impacts.

The essential service water emergency makeup system (ESWEMS) pumphouse structural components, such as floors, walls, and the roof, have a minimum thickness of 610 mm (24 inches) of heavy reinforced 5,000 psi (34.5 MPa) concrete which is adequate to protect the inside safety-related equipment from tornado-generated missiles. U.S. EPR DCD Tier 2, Table 3.5-2, shows a thickness of 405 mm (16 in) and 432 mm (17 in) for reinforced concrete wall and roof, respectively, with a minimum strength of 34.5 MPa (5,000 psi) is adequate to resist the impact of tornado-generated missiles for both penetration and structural response. Openings are protected by 0.6 m (2.0 ft) thick reinforced concrete labyrinths. The labyrinths prevent a direct hit from the design-basis missile to the openings.

Steel gratings at the water intake are designed as missile barriers; they are classified as non-safety-related, Seismic Category II. The gratings are designed to absorb the missile impact energy without compromising the structural integrity.

The impact of tornado missiles on the EWEMS retention pond slope, bottom, and spill-way were evaluated using the Region I missile spectrum. The projectiles were evaluated for their possible impact to the slope and bottom of the pond. Due to the long travel path under water, an automobile missile would sink slowly enough to rest on the pond bottom without causing a significant impact force.

The slope of the EWEMS retention pond is protected by layers of riprap and 0.3 m (1 ft) of bedding on top of 6.71 m (22 ft) of engineered and compacted cohesive soil. These layers provide enough energy absorption to mitigate the impact force from tornado generated missiles. To cause a leak at the bottom of the pond at elevation 198.6 m (651.5 ft) mean sea level (msl), the pipe or sphere would have to fall through water, and then penetrate the cohesive fill to elevation 195.1 m (640 ft) msl to reach the underlying rock. Although the pipe or sphere may become embedded in the cohesive fill, the combination of energy dissipation in the water and cohesive fill below will prevent the pipe or steel sphere from creating a leak in the pond below elevation 201.8 m (662 ft) msl.

The applicant also analyzed a missile impact on the reinforced concrete spillway for the ESWEMS retention pond. The applicant's analysis confirmed the spillway slab is capable of withstanding a missile impact. Additionally, the spillway discharge is at an elevation of 205.4 m (674 ft), and the minimum required water level is at 202.4 m (664 ft). Therefore a tornado missile impacting the ESWEMS spillway would not cause the spillway to fail in a manner that would result in the retention pond water level dropping below the minimum.

Based on its review, the NRC staff concludes that the assessment of possible hazards attributable to missiles generated by the design-basis tornado and other extreme winds is acceptable and conforms to the requirements of GDCs 2 and 4.

## ITAACs

The NRC staff reviewed the BBNPP COL application ITAACs in accordance with the guidance described in Section 14.3, "Inspections, Tests, Analyses, And Acceptance Criteria," of NUREG-0800, "Standard Review Plan (SRP)," Revision 3, March 2007. The NRC staff finds that no additional ITAACs are needed in connection with this BBNPP COL application FSAR, Tier 2, Section 3.5.1.4.

### 3.5.1.4.5 Post Combined License Activities

There are no post COL activities related to this section.

### 3.5.1.4.6 Conclusions

The NRC staff is reviewing the information for the U.S. EPR on Docket No. 52-020. The results of the NRC staff's technical evaluation of the information related to this section to be incorporated by reference in the BBNPP FSAR will be documented in the NRC staff's safety evaluation report on the design certification application for the U.S. EPR. The SER for the U.S. EPR is not yet complete, and this is being tracked as part of Open Item 1-1. The NRC staff will update Section 3.5.1.4 of this SER to reflect the final disposition of the design certification application for the U.S. EPR.

In conclusion, the applicant has provided sufficient information for satisfying the applicable regulatory requirements. This conclusion is based on the NRC staff's review of the information provided in the BBNPP FSAR Tier 2 and the evaluation discussed above. The NRC staff concludes the assessment of possible hazards attributable to missiles generated by the design-basis tornado and other extreme winds is acceptable and conforms to the requirements of GDCs 2 and 4, as they relate to tornado-generated missiles. This conclusion is based on BBNPP having met the requirements of GDCs 2 and 4 by meeting the guidance of RG 1.76.

REQUEST FOR ADDITIONAL INFORMATION (RAI) BY THE OFFICE OF NEW REACTORS  
BELL BEND NUCLEAR POWER PLANT FINAL SAFETY ANALYSIS REPORT (FSAR)

Docket No. 52-039

SRP 3.5.1.2 "INTERNALLY GENERATED MISSILES (INSIDE CONTAINMENT)"

TAC: RC6305

RAI 3.5.1.2-1

In the response to COL Information Item 3.5-1, regarding when the applicant will establish plant procedural controls to ensure that unsecured maintenance equipment inside containment will be removed, the applicant proposed that:

- BBNPP shall establish plant procedural controls to ensure that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile. This requirement shall be incorporated into a plant procedure that controls the conduct of maintenance prior to initial fuel load.

The NRC staff finds the above applicant's proposal to incorporate procedural controls to ensure that unsecured maintenance equipment will be removed from containment prior to initial fuel load into a plant procedure acceptable. However, Subsection 3.5.1.2.3 of the BBNPP FSAR should be revised to reflect that unsecured maintenance equipment will be removed from containment prior to initial fuel load. Therefore, provide a mark-up or final version of the Subsection 3.5.1.2.3 in the BBNPP FSAR to reflect that unsecured maintenance equipment will be removed from containment prior to initial fuel load.

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS  
Bell Bend NUCLEAR POWER PLANT FINAL SAFETY ANALYSIS REPORT (FSAR)  
Docket No. 52-039  
SRP 3.5.1.2 "INTERNALLY GENERATED MISSILES (INSIDE CONTAINMENT)"  
TAC: RC6305

3.5.1.2 Internally Generated Missiles Inside Containment

3.5.1.2.1 Introduction

In support of General Design Criterion (GDC) 4, "Environmental and Dynamic Effects Design Bases," the design basis is reviewed to ensure that internally generated missiles inside containment are identified based on site specific parameters for the Bell Bend Nuclear Power Plant (BBNPP) Combined License (COL) application.

3.5.1.2.2 Summary of Application

In Section 3.5.1.2 of the BBNPP COL application FSAR, Tier 2, the applicant (UniStar) incorporated the US Evolutionary Power Reactor (EPR) Design Control Document (DCD), Tier 2, Subsection 3.5.1.2.3, "Missile Prevention and Protection Inside Containment," by reference without repeating the information from the EPR DCD. No departures from the EPR design and no additional interface requirements or additional inspections, tests, analyses, and acceptance criteria (ITAAC) associated with Section 3.5.1.2 of the BBNPP COL application FSAR, Tier 2, were identified.

In addition, in BBNPP FSAR Tier 2, Revision 1, Subsection 3.5.1.2.3, "Missile Prevention and Protection Inside Containment," the applicant provided information to address the following COL Information Item 3.5-1 described in the US EPR DCD Table 1.8.2, "US EPR Combined License Information Items:"

- COL Information Item 3.5-1: A COL applicant that references the US EPR design certification will describe controls to confirm that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile.

3.5.1.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference and the supplemental information presented in this application is addressed within the safety evaluation report (SER) related to the US EPR DCD.

3.5.1.2.4 Technical Evaluation

The NRC staff reviewed Section 3.5.1.2 of the BBNPP FSAR Tier 2, Revision 1 and considered the referenced US EPR DCD sections. The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to this section. Section 3.5.1.2 of the US EPR DCD is being reviewed by the staff under

docket number 52-020. The NRC staff's safety evaluation of the information incorporated by reference related to internally generated missiles inside containment will be documented in the corresponding SER for the US EPR DCD.

### Combined License Information Items

COL Information Item 3.5-1 specifies that the applicant will describe controls to confirm that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile.

In Subsection 3.5.1.2.3 of the BBNPP FSAR, Tier 2, Revision 1, the applicant stated that it will establish plant procedural controls to ensure that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or restrained to prevent it from becoming a missile.

Further, in the section, "Proposed Appendix A - Proposed Combined License Conditions," of the BBNPP COL application Part 10, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) and ITAAC Closure," the applicant proposed that:

- BBNPP shall establish plant procedural controls to ensure that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile. This requirement shall be incorporated into a plant procedure that controls the conduct of maintenance prior to initial fuel load.

The NRC staff finds the above applicant's proposal to incorporate procedural controls to ensure that unsecured maintenance equipment will be removed from containment prior to initial fuel load into a plant procedure acceptable. However, Subsection 3.5.1.2.3 of the BBNPP FSAR should be revised to reflect that unsecured maintenance equipment will be removed from containment prior to initial fuel load. Therefore, in a request for additional information (RAI 3.5.1.2 -1), the NRC staff request the applicant to provide a mark-up or final version of the Subsection 3.5.1.2.3 in the BBNPP FSAR to reflect that unsecured maintenance equipment will be removed from containment prior to initial fuel load. **(This is an open item being tracked by RAI 3.5.1.2 -1).**

### ITAACs

The NRC staff reviewed the BBNPP COL application ITAACs in accordance with the guidance described in Section 14.3, "Inspections, Tests, Analyses, And Acceptance Criteria," of NUREG-0800, "Standard Review Plan (SRP)," Revision 3, March 2007. The NRC staff finds that no additional ITAACs are needed in connection with this BBNPP COL application FSAR, Revision 1, Tier 2, Section 3.5.1.2.

#### 3.5.1.2.5 Post Combined License Activities

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

#### 3.5.1.2.6 Conclusions

The NRC staff is reviewing the information for the U.S. EPR on Docket No. 52-020. The results of the NRC staff's safety evaluation of the information related to this section to be incorporated by reference in the BBNPP FSAR will be documented in the NRC staff's safety evaluation report on the design certification application for the U.S. EPR. The SER for the U.S. EPR is not yet complete. The staff will update Section 3.5.1.2 of this SER to reflect the final disposition of the design certification application for the U.S. EPR.