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August 10, 2009

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

BELL BEND NUCLEAR POWER PLANT
RESPONSE TO RAI NO. 31, QUESTIONS 19-8 THROUGH 19-12 AND 19-14 THROUGH 19-19
BNP-2009-191 Docket No. 52-039

References: 1) M. Canova (NRC) to R. Sgarro (PPL Bell Bend, LLC), Bell Bend COLA – Request for Information No. 31 (RAI No. 31) – SPLA -2622, email dated July 10, 2009.

2) BNP-2009-222, R. Sgarro (PPL Bell Bend, LLC) to U.S. Nuclear Regulatory Commission, "Response to RAI No. 31, Question 19-13," dated August 10, 2009.

The purpose of this letter is to respond to the request for additional information (RAI) identified in the referenced NRC correspondence to PPL Bell Bend, LLC, (PPL) (Reference 1). This RAI addresses Probabilistic Risk Assessment and Severe Accident Evaluation, as discussed in Section 19 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Bell Bend Nuclear Power Plant Combined License Application (COLA).

The enclosure provides our response to RAI No. 31, questions 19-8 through 19-12 and 19-14 through 19-19, which includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes in a future revision of the COLA. This future revision of the COLA is the only new regulatory commitment.

Our response to RAI No. 31, question 19-13 is transmitted in Reference 2.

Should you have questions or need additional information, please contact the undersigned at 570.802.8102.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on August 10, 2009

Respectfully,

R R Sgarro

Rocco R. Sgarro

RRS/kw

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NRO

cc: (w/o Enclosures)

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Enclosure 1

Response to NRC Request for Additional Information Set No. 31 Questions 19-8 through 19-12 and 19-14 through 19-19
Bell Bend Nuclear Power Plant

BBNPP Question: 19-8

BBNPP Final Safety Analysis Report (FSAR) Section 19.1.2.4.1, Page 19-5, Item 1, states that "If the cumulative effect of pending changes is judged to either increase core damage frequency (CDF) to 1.0E-06 per year or greater, or increase large release frequency (LRF) to 1.0E-07 per year or greater, then a PRA model revision will be made in a timely manner, regardless of the next routine update-cycle schedule."

As mentioned in the American Society of Mechanical Engineers (ASME) RA-Sc 2007 PRA Standard, "The PRA shall be maintained and upgraded, such that its representation of the as-built, as-operated plant is sufficient to support the applications for which it is being used." The probability risk assessment (PRA) should be updated as frequently as necessary to ensure that the PRA remains an accurate representation of the plant risk. Thus, it would not be a good practice to accumulate a backlog of pending changes such that the effect is estimated to increase the CDF to 1.0E-6/yr, which is nearly twice that of the estimated baseline EPR CDF, and/or to increase the LRF to 1.0E-7/yr, which is almost 4 times greater than the baseline EPR LRF.

Please justify setting the targeted cumulative effect to 1E-6/yr CDF and 1E-7/yr LRF, and make appropriate changes to the BBNPP FSAR.

Response to Question 19-8:

This question is similar to U.S. EPR design certification RAI Set 172, question 19-270[1]. FSAR changes were made to the U.S. EPR FSAR in response to that question.

The BBNPP FSAR will be revised to more clearly reference the U.S. EPR FSAR and to remove redundant information between the BBNPP FSAR and the U.S. EPR FSAR.

FSAR Impact:

BBNPP FSAR, Section 19.1.2.4.1 will be revised as described in the response above and as shown below:

19.1.2.4.1 Description of PRA Maintenance and Upgrade Program

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

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

This COL Item is addressed as follows:

<u>A PRA maintenance and update program is included in the U.S. EPR FSAR. The information contained in this section is a supplement to that program to support the additional needs of an operating nuclear plant.</u>

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[1] AREVA NP E-mail from Ronda Pederson to Getachew Tesfaye, "Response to US EPR Design Certification Application Request for Additional Information RAI No. 172 (1926), FSAR Ch. 19 dated February 12, 2009 (ML 090440032)

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

- Not later than the date of initial fuel loading, the site specific PRA will be upgraded to contain Level 1 and Level 2 analyses, and to include those events and modes for which NRC-endorsed consensus standards on PRA existed one year prior to scheduled fuel loading.
- The PRA will be upgraded every four years until permanent cessation of operations. The upgraded PRA will include initiating events and modes of operation contained in NRC-endorsed consensus standards in effect one year prior to each upgrade.
- Not later than the date on which a site specific application for a renewed license is submitted, the PRA will be upgraded to cover all modes and all initiating events.

~~The PRA will be periodically updated, as necessary, according to update methods described below. When reviewing pending design changes and proposed model improvements, effect on core damage frequency (CDF) and large release frequency (LRF) will be estimated. Based on estimated effect, one of the following update methods will be used:~~

1. ~~If the cumulative effect of pending changes is judged to either increase CDF to 1.0E-06 per year or greater, or increase LRF to 1.0E-07 per year or greater, then a PRA model revision will be made in a timely manner, regardless of the next routine update-cycle schedule.~~
2. ~~If the cumulative effect of pending changes is judged to not meet the above conditions, then the PRA model will be revised during the next scheduled update.~~

~~The PRA Configuration Control Program performs the following key functions:~~

1. ~~Monitors PRA inputs and collects new information.~~
2. ~~Maintains the PRA consistent with the as-built, as-operated plant.~~
3. ~~Periodically upgrades the PRA to maintain consistency with developments of new methodologies, or to accommodate new requirements in scope and capability.~~
4. ~~Ensures that the cumulative effect of pending changes is considered when applying the PRA.~~
5. ~~Evaluates the effect of changes on previously implemented risk-informed decisions that used the PRA.~~
6. ~~Maintains configuration control of computer codes used to support PRA quantification.~~
7. ~~Documents the PRA Program, including changes and updates.~~

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

Question 19-9:

The risks posed by external events should be assessed from a probabilistic risk assessment (PRA) perspective and should be screened against the NUREG-0800 Standard Review Plan (SRP) Chapter 19 screening criteria. The Regulatory Guide 1.200 Revision 2, dated March 2009, Table 2 on Page 10 states that "It is recognized that for those new reactor designs with substantially lower risk profiles (e.g., internal events CDF below 1E-6/yr) that the quantitative screening value should be adjusted according to the corresponding baseline risk value."

With the baseline U.S. EPR internal events core damage frequency (CDF) and large release frequency (LRF) known to be 5E-7/yr and 3E-8/yr, it is not practical to screen out the external events using the quantitative screening criteria that are higher than the baseline risk values. Furthermore, the staff notes that the American National Standards Institute (ANSI), American Nuclear Society (ANS) ANSI/ANS-58.21-2007 allows external hazard screening, however, the screening criteria described therein are for the current generation of operating plants.

The COL application should take into consideration the baseline risk values of the EPR design and please revise the external events evaluation using an appropriate PRA screening value, or justify an alternative from a PRA perspective.

Response to Question 19-9:

The quantitative screening criteria used in FSAR Section 19.1.5.4 will be revised to reflect the guidance in Regulatory Guide 1.206 that the external event hazard screening threshold for new reactor designs should be adjusted. The quantitative screening threshold will be lowered to 1E-07 per year using demonstrably conservative analysis. The FSAR screening values in the Bell Bend Nuclear Power Plant external events evaluations satisfy the new threshold, and are as follows:

- <u>Airplane Crash: Screening CDF= 9.9E-08 per year</u>
- <u>High Winds and Tornado: Screening CDF= 7.7E-08 per year</u>
- <u>External Flooding: Screening CDF= <1.0E-08 per year</u>

A screening evaluation is very different from a detailed analysis as it is performed by applying demonstrably conservative assumptions. Some of the major conservatisms in the Bell Bend Nuclear Power Plant external events calculations are summarized below:

<u>For Airplane Crash Hazard:</u>

- The crash frequency of all aircraft was used in combination with the consequence of large commercial aircraft and military jets (the frequency of these would be less than 1/3 of total frequency)
- Aircraft crash frequencies used are inherently conservative
- Complete destruction is assumed for non-hardened buildings, and no credit is given for non-hardened buildings shielding other buildings.

For Tornado Hazard:

- All tornados with top wind speeds greater than the non-safety design rating wind speed are assumed to result in complete destruction of all non-safety buildings.
- No credit is given for separation of buildings.

When all conservatisms are removed, the risk values that would be produced in a more detailed analysis are likely to be significantly lower than the screening threshold.

FSAR Impact:

The COL Application FSAR Section 19.1.5.4 will be revised to reflect the discussion above as shown below:

19.1.5.4 Other External Events Risk Evaluation

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

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

This COL Item is addressed as follows:

{The U.S. EPR FSAR scope of external event screening includes a high level assessment of high winds and tornadoes, external flooding and fires. This section provides supplemental information specific to the BBNPP site.

A progressive screening approach using the guidance in ANSI/ANS-58.21-2007 (ANSI, 2007) was applied. This document provides a standard for the treatment of external events in PRA, referencing NUREG-1407 (NRC, 1991) and NUREG-0800 (NRC, 2007b). The quantitative screening threshold has been lowered to 1.0E-07/yr using demonstrably conservative analysis. An external event that meets the ANSI/ANS-58-21-2007 screening criteria, where the CDF threshold is adjusted to 1.0E-07/yr using demonstrably conservative analysis, is not considered to be a significant contributor to risk and is screened from further consideration. All of the external events listed in Appendix A of ANSI/ANS-58.21-2007 (ANSI, 2007) have been addressed.

19.1.5.4.1 High Winds and Tornado Risk Evaluation

...The screening core damage frequency associated with the bounding scenario is the plant impact CCDP (8.8E-04) multiplied by the event frequency (8.7E-05/yr). The core damage frequency (CDF) for this scenario is approximately 7.7E-08/yr~~, which meets the ANSI/ANS-58.21-2007 screening criteria~~. As described in Section 19.1.5.4, external events can be screened if the core damage frequency, calculated using a demonstrably conservative analysis, has a CDF less than 1.0E-7/yr.

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

- Bounding consequence assumptions, including no credit is taken for separation of buildings. It is unlikely that all structures assumed to fail would fail.
- No credit for operational precautions taken when severe weather is anticipated.

It is concluded that BBNPP satisfies the screening criteria set forth in NUREG-0800, RG 1.76, and, ANSI/ANS 58.21-2007. High winds can be screened directly based on the BBNPP design basis. A quantitative PRA analysis was performed to evaluate the risk associated with tornadoes (including tornado missiles). The results of this demonstrably conservative analysis show that the contribution to CDF from tornado winds and tornado generated missiles is less than 1.0E-07/yr ~~about 7.7E-08/yr~~. As a result, high winds, tornadoes and tornado missiles can be screened from the PRA for BBNPP.

19.1.5.4.2 External Flooding Evaluation

The Normal Heat Sink (NHS) is the only SSC modeled in the PRA which may not be located above PMP grade. Failure of the NHS would cause a Loss of Balance of Plant (loss of Closed Cooling Water or Auxiliary Cooling Water). Assuming that external flooding occurs that causes the NHS to fail, thereby causing a Loss of Balance of Plant, the conditional core damage probability would be 1.2E-07/yr. Combined with a potential flood hazard frequency, this is likely to result in a CDF of less than 1E-08 per year.

This remains a demonstrably conservative analysis because the frequency of external floods that cause a Loss of Balance of Plant are low and it is likely that sufficient time would be available for a controlled shutdown.

Therefore, the applicable SRP screening criteria in NUREG-0800, SRP Section 2.4.10 (NRC, 2007b), are met for the different types of external flooding events. ~~, and that the risk posed by~~ As described in Section 19.1.5.4, external events can be screened if the core damage frequency, calculated using a demonstrably conservative analysis, has a CDF less than 1.0E-7/yr. Therefore, external flooding can be screened for BBNPP.

19.1.5.4.4 Aircraft Crash Hazard Risk Evaluation

...Target sets that were retained for the analysis are: (1) Safeguard Building 1 (or 4) and (2) Turbine and Switchgear Building. Aircraft crash frequencies into these two target sets are estimated using the methodology of DOE Standard 3014-2006 (Reference [5.2.12]). Bounding aircraft crash scenarios are developed for the two target sets defined. The most limiting failures of all the components in the affected building are assumed. ~~This is a very conservative approach since the aircraft crash frequency is dominated by events involving general aviation planes which are unlikely to cause extensive damage.~~ This is a demonstrably conservative approach since:

- Bounding consequence assumptions, including an unisolable steam line rupture, main feed lines intact and continuing to feed, and EFW cross-connect valves open.
- Aircraft crash frequencies used are inherently conservative, including non-crash incidents such as damage to aircraft while landing and in-flight turbulence injuries. Detailed methods usually use fatal accidents instead of accidents as a measure of crashes.

The assessment is judged to be a conservative and bounding approach for screening purposes to satisfy Section 3.5.1.6 of NUREG-0800. The core damage frequency associated with the conservative aircraft scenario is 9.9E-08/yr.

Conclusion for Detailed Airplane Crash Hazard Assessment

As described in Section 19.1.5.4, external events can be screened if the core damage frequency, calculated using a demonstrably conservative analysis, has a CDF less than 1.0E-7/yr. Also, ~~T~~the NUREG-0800 acceptance criterion for airplane crash hazard is met when the frequency of a release exceeding 10 CFR 100 (CFR, 2007) limits is realistically less than 1E-07/yr. The total CDF (CDF bounds large release frequency) from airplane crash into the BBNPP, using a demonstrably conservative analysis, is calculated to be 9.9E-08/yr. Based on a comparison of this analysis to NUREG-0800 and ANSI/ANS-58.21-2007, it is concluded that the BBNPP design satisfies the ANSI/ANS 58.21-2007 screening criteria for this external event. As a result, aircraft crash has been screened from the PRA.

19.1.5.4.5 Industrial and Transportation Accidents Risk Evaluation

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

The risks posed by potential industrial and transportation accidents to the BBNPP site are evaluated against the SRP screening criteria as defined in NUREG-0800, Section 2.2.3. As described in Section 19.1.5.4, external events can be screened if the core damage frequency, calculated using a demonstrably conservative analysis, has a CDF less than 1.0E-7/yr. ~~The following approach is used: if the postulated hazard does not adversely affect the operation of the plant, or if the hazard has a frequency of less than 1.E-07/yr using realistic modeling assumptions, the hazard may be screened.~~

Bounding combinations of chemicals, volumes and locations were identified for further analysis, which were bounding for all of the hazards identified. These bounding chemicals are provided with the assumed quantity and location of the chemical. Other combinations are bounded and are not described. Following is a summary of the evaluation of these chemicals and the results.

Highway Hazards

In Section 2.2.3, an evaluation is made of the risks posed by an accident involving hazardous material occurring on the major roads within five miles from the plant site. These are:

- Route 11 (Salem Blvd)
- ~~Route 339 (Mifflin Nescopeck Highway)~~

- Route 93 (Berwick Hazleton Highway)
- Route 3036 (River Road)
- Route 239 (Wapwallopen Rd)
- Interstate 80

BBNPP is located approximately 1.1 miles from Route 11. Hazards on all other roads are bounded by the hazards from facilities. For each type of event and for the largest amount of hazardous material susceptible to be involved in that event, the minimum separation distance (i.e., safe distance) is calculated. The results are summarized in FSAR Chapter 2.2. In each case, either the largest minimum separation distance is found to be less than the actual distance, or a quantitative risk assessment was used to show that the rate of exposure to a peak positive incident overpressure in excess of 1 psi (6.89 kPa) was less than 1.0E-07 per year when based on realistic assumptions using demonstrably conservative analysis. Therefore, it is judged that highway hazards would not adversely affect the safe operation of BBNPP have been screened from the PRA.

Pipeline Hazards

There are three pipelines within five miles of the BBNPP site reactor building. These pipelines include:

- Transco Natural Gas Pipeline
- UGI Natural Gas Pipeline
- Sonoco Gasoline Pipeline

The minimum distance from the Transco 42" natural gas pipeline to the center of the BBNPP reactor building is 1.89 miles. The minimum distance from the UGI 12" natural gas pipeline 0.44 miles. The minimum distance from the Sonoco 6.625" pipeline is 2.03 miles. For the pipelines, a worst case break of the pipeline is assumed at the nearest approach of the pipeline to BBNPP. All of the pipelines are assumed to have an infinite pressure source. The results are summarized in FSAR Chapter 2.2. In each case, either the largest minimum separation distance is found to be less than the actual distance, or the analysis shows that more than 2 minutes elapses between the time of hazard detection and reaching the Immediately Dangerous to Life and Health (IDLH) threshold, or a quantitative risk assessment was used to show that the rate of exposure to a peak positive incident overpressure in excess of 1 psi (6.89 kPa) was less than 1.0E-07per year when based on realistic assumptions using demonstrably conservative analysis. Therefore, it is judged that pipeline hazards would not adversely affect the safe operation of BBNPP have been screened from the PRA.

Railroad Hazards: There are two railroads within five miles of the BBNPP reactor building:

- North Shore Railroad
- Canadian Pacific Railroad

The North Shore Railroad is located approximately 1.3 miles south of the site at its nearest approach. The Canadian Pacific Railroad is located approximately 1.7 miles south at its nearest approach. For each type of event and for the largest amount of hazardous material susceptible to be involved in that event, the minimum separation distance (i.e., safe distance) is calculated. The results are summarized in FSAR

Chapter 2.2. In each case, either the largest minimum separation distance is found to be less than the actual distance, or the analysis shows that more than 2 minutes elapses between the time of hazard detection and reaching the IDLH, or a quantitative risk assessment was used to show that the rate of exposure to a peak positive incident overpressure in excess of 1 psi (6.89 kPa) was less than 1E-07 per year ~~when based on realistic assumptions~~ using demonstrably conservative analysis. Therefore, ~~it is judged that~~ railroad hazards ~~would not adversely affect the safe operation of BBNPP~~ have been screened from the PRA.

Nearby Facilities Hazards: There are three facilities within five miles of the BBNPP reactor building:

- Susquehanna Steam Electric Station (SSES)
- Heller's Gas and Custom Made Fireplaces
- Deluxe Building Systems (DBS)

The distance between the BBNPP reactor building and the SSES is between .7 and 1.1 miles. The distance between Heller's Gas and the BBNPP reactor building is 1.93 miles and the distance from Deluxe Building Systems to BBNPP is 4.63 miles. For each type of event and for the largest amount of hazardous material susceptible to be involved in that event, the minimum separation distance (i.e., safe distance) is calculated. The results are summarized in FSAR Chapter 2.2. In each case, either the largest minimum separation distance is found to be less than the actual distance, or the analysis shows that more than 2 minutes elapses between the time of hazard detection and reaching the IDLH, or a quantitative risk assessment was used to show that the rate of exposure to a peak positive incident overpressure in excess of 1 psi (6.89 kPa) was less than 1.0E-07 per year ~~when based on realistic assumptions~~ using demonstrably conservative analysis. Therefore, ~~it is judged that~~ nearby facilities hazards ~~would not adversely affect the safe operation of BBNPP~~ have been screened from the PRA.

19.1.5.4.6 Other External Events Risk Evaluation

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

Three types of external events from Table 19.1-201 are addressed in this section. These are turbine generated missiles, collisions with the intake structure, and lightening strikes.

Turbine Missiles: NUREG-0800, Section 3.5.1.3 provides acceptance criteria for turbine missile hazard based on the frequency of a turbine failure resulting in the ejection of turbine rotor (or internal structure) fragments through the turbine casing. The acceptance criteria are 1.0E-04/year for favorably oriented turbines and 1.0E-05 per year for unfavorably oriented turbines. A favorable orientation is one that excludes the containment and all, or mostly all, safety-related structures, systems or components (SSCs) from the low trajectory missile (LTM) pathway. Meeting these criteria provides confidence that the frequency of unacceptable damage from turbine missiles ~~is less than or equal to 1.0E-07/yr~~ has been screened from the PRA.

The conclusion of frequency of unacceptable damage from turbine missiles less than or equal to 1.0E-07/yr above is based on assumptions stated in the SRP acceptance criteria of Section 3.5.1. The use of these assumptions results in a demonstrably conservative value due to the improved redundancy of the U.S. EPR design, for example, the presence of four safety trains for most systems.

The BBNPP design requires a favorably oriented turbine with respect to containment. Detailed analyses and assessments show that the probability of turbine rotor failure resulting in ejection of the turbine rotor fragments through the turbine building casing is less than 1.0E-04 for a favorabley oriented turbine with respect to containment. Therefore the risk to BBNPP from a turbine missile from the BBNPP turbine is within the NRC acceptance criteria as provided in NUREG-0800, Section 3.5.1.3.

Collisions with intake structure

BBNPP is located a few thousand feet from and about 200 feet above the Susquehanna River. There are no safety-related structures located near the shore line. In addition, the Susquehanna River is not used as a navigable waterway for other than small recreational boats, which do not constitute any hazard potential to the intake structure.

As discussed above in Section 19.1.5.4.2, the conditional core damage probability associated with the failure of the NHS would be 1.2E-07. Combined with a potential frequency for collisions with intake structures, this is likely to result in a CDF of less than 1.0E-08 per year. This remains a demonstrably conservative analysis because the frequency of collisions with intake structures that cause a Loss of Balance of Plant are low and it is likely that sufficient time would be available for a controlled shutdown. The NHS also provides long-term makeup to the safety UHS. However, each train of the safety UHS can provide sufficient plant cooling for 72 hours. Therefore, this dependency does not impact the risk from collisions with intake structures. Collisions with intake structures have been screened from the PRA.

Lightning Strikes

The most likely result of a lightning strike to BBNPP would be a loss of offsite power. Based on the recorded lightning frequency for the area of BBNPP, the impact of lightning strikes should be well represented by the loss of offsite power initiating events analyzed in the BBNPP PRA. The BBNPP PRA model calculates a CDF from loss of offsite power of approximately 1.0E-07 per year. Since lightning strikes result in only a fraction of the loss of offsite power events, lightning strikes are judged to ~~not present a significant hazard to BBNPP~~ have a CDF less than 1.0E-07 per year using demonstrably conservative analysis. As such, lightning strikes have been screened from the PRA.}

Question 19-10:
BBNPP FSAR Section 19.1.5.2 states that "The flooding frequency from site-specific systems, such as the Circulating Water System, the Closed Cooling Water System and the Auxiliary Cooling Water System, was not derived using design information. Instead the U.S. EPR FSAR internal flooding frequency for the turbine building is based on a conservative generic frequency, which is judged to include contributions from all of these site-specific systems."

Please provide justification for the position that the generic frequency for flooding of the turbine building of the U.S. EPR FSAR remains bounding for the BBNPP site-specific frequency of flooding of the turbine building.

Response to Question 19-10

The U.S. EPR internal flooding PRA utilizes a generic flooding frequency for the turbine building of 3.3E-02/year, obtained from NUREG/CR-2300, Table 11-9, published in 1983. The frequency is applied to a flooding scenario which disables all equipment located within the turbine building. The generic flooding frequency was selected because the detailed piping layout of the fluid-carrying systems housed in the turbine building has not been established and was not necessary for design certification. The generic frequency is judged to be bounding for any modern plant. If applied to the current fleet, it would correspond to more than 3 expected major turbine building flooding events each year.
The detailed piping layout in the turbine building has not been developed for BBNPP and is not necessary for a COL. Site-specific differences in piping layout would not change the conclusion that the use of this generic frequency is conservative for a modern nuclear plant. Therefore, the generic turbine building flooding frequency used for the US EPR plant is conservative for BBNPP turbine building flooding.

FSAR Impact:

The BBNPP FSAR will not be changed as a result of this question.

Question 19-11:

Section 19.1.5.1.2.4 of the BBNPP FSAR states that "The BBNPP horizontal Ground Motion Response Spectra GMRS is above the envelope of the European Utility Requirements (EUR) ground motions for frequencies greater than about 21 Hz. In the vertical direction, the BBNPP final GMRS exceeds the EUR design envelope for frequencies greater than about 23 Hz.... Based on a similar evaluation of these low-frequency and high-frequency exceedances performed for the BBNPP site, it is expected that the BBNPP specific seismic margin evaluation for the U.S. EPR will demonstrate compliance with the requirement of plant HCLPF at least as great as 1.67 times the CSDRS."

Please provide additional information demonstrating how the evaluation mentioned in the statement above was made and also describe how the BBNPP GMRS exceedances are justified.

Response to Question RAI 19-11

As stated in Reference 1 (below):

> "AREVA has subsequently evaluated the U.S. EPR GMRS and determined that it can be expanded to encompass the site-specific GMRS at BBNPP. AREVA will incorporate the new analysis in a future revision to the U.S.EPR FSAR. BBNPP will then incorporate the U.S.EPR GMRS by reference in the BBNPP COLA."

The responses to U.S. EPR FSAR RAIs 155 and 161 are currently being developed by AREVA. The responses will provide a revised seismic analysis using revised CSDRS which envelopes the BBNPP GMRS. By incorporating the BBNPP GMRS into the U.S.EPR FSAR, the exceedances will be eliminated and no additional analysis is required.

Reference Cited in Response:

1. Rocco R. Sgarro letter to U.S. Nuclear Regulatory Commission Document Control Desk, "Bell Bend Nuclear Power Plant Submittal of Additional Information Related to Site Specific Ground Motion Response Spectra BNP-2009-133", Docket No. 52-039, dated June 29, 2009.

FSAR Impact:

The BBNPP FSAR will be revised to eliminate reference to the exceedances. This change to the BBNPP FSAR will take place following the U.S. EPR FSAR change to the CSDRS.

Question 19-12:
With regard to the high winds and tornado quantitative evaluation, Section 19.1.5.4.1 of the BBNPP FSAR indicated that the BBNPP FSAR Level 1 PRA Loss off Offsite Power event tree model is used to evaluate the conditional core damage probability. Please provide additional detailed information describing the treatment of offsite and onsite power recovery, and also describe how the BBNPP site-specific tornado strike frequency of 8.7E-5/yr was derived, using the NUREG/CR-4461 information.

Response to Question 19-12

The treatment of offsite and onsite power in the tornado quantitative screening evaluation performed in FSAR Section 19.1.5.4.1, High Winds and Tornado Risk Evaluation, is as follows:

- Offsite power recovery is not credited. The tornado scenario always assumes an unrecoverable loss of offsite power.
- The emergency diesel generators (EDG) are housed in buildings which are designed to withstand tornado wind loads. These components are not affected by the tornado and are modeled with the same reliability as in the internal-events PRA and without credit for recovery.
- The station blackout diesel generators (SBODG) are housed in the switchgear building, which is assumed to be lost. The SBODG are assumed failed and non recoverable for the duration of the scenario.

The tornado strike frequency of 8.7E-5/yr is developed following NUREG/CR-4461 methodology.

- The tornado point strike frequency given by NUREG/CR-4461 for the 2° latitude by 2° longitude square which includes the BBNPP site is 2.3E-4/yr.
- The conditional probability given a tornado strike of a maximum wind speed exceeding 96 mph (design wind for non-safety structures) is calculated using the Weibull distribution shown in formula (4-8) of NUREG/CR-4461 and the parameters for that same 2x2 square. It is equal to 0.296.
- The point strike frequency for tornadoes with a maximum wind speed exceeding 96 mph is calculated by multiplying the two numbers above and is 6.9E-5/yr.
- The calculation described in the three bullets above is repeated to evaluate the “life-line term”, i.e. the increase in frequency due to the dimensions of the target (see NUREG/CR-4461, Section 4.2). A 300’ characteristic dimension is used (corresponding to an approximate length of the turbine building). The 300’ structure strike frequency for tornadoes with a maximum wind speed exceeding 96 mph is found to be 1.8E-5/yr.

The total tornado strike frequency is the sum of the point strike frequency and the finite structure strike frequency. It is equal to 6.9E-5/yr + 1.8E-5/yr = 8.7E-5/yr.

FSAR Impact:

The BBNPP FSAR will not be changed as a result of this question.

Question 19-14:

Section 19.1.5.4.5 of the FSAR, "Highway Hazards," states that "Hazards on all other roads are bounded by the hazards from facilities." Please provide additional information specifying which roads, hazards, facilities and bounding values have been taken into consideration in order to reach this conclusion. Also clarify whether other highways/roads (Routes 339, 93, 3036, and 239) have been evaluated, and identify, in detail, the approach used to screen out the hazards and the rationale supporting that approach.

Response to Question 19-14:

The Industrial and Transportation Accidents Risk Evaluation of FSAR Section 19.1.5.4.5 is based on information from FSAR Section 2.2, "Nearby Industrial, Transportation and Military Facilities."

FSAR Section 2.2.1 specifies the roads, hazards, and facilities taken into consideration. As stated in FSAR Section 2.2.1, the following highways were identified for further evaluation:

- Interstate 80
- Interstate 81
- U.S. Route 11
- Pennsylvania State Route 93
- Pennsylvania State Route 239

Routes 339 (Mifflin Nescopeck Highway) and 3036 (River Road) were erroneously included in the bulleted list in FSAR Section 19.1.5.4.5. FSAR Section 19.1.5.4.5 will be revised to be consistent with Section 2.2.1 regarding the industrial and transportation facilities identified for further evaluation.

As stated in FSAR Section 2.2.2.5, when considering the locations of the facilities that may receive shipments of hazardous materials and the locations of the major roads (namely, I-80, I-81, U.S. Route 11, SR 93 and SR 239), it seems likely that normal delivery routes would exist along U.S. Route 11 for locations in the immediate area near BBNPP or in Shickshinny. Delivery routes along the other major roads appear to deliver shipments to facilities away from BBNPP.

The hazard from delivery routes along U.S. Route 11 are shown in Table 2.2-3. As the delivery routes along the other major routes are assumed to be further from BBNPP than the facilities that they deliver, the hazard from these roads are bounded by the hazards from facilities.

The screening approach used to screen out the hazards is taken from U.S. NRC Regulatory Guides (RG) 1.78, 1.91 and 1.206. The following tables provide additional screening information requested by this question:

- Table 2.2-3, Hazardous Chemical Railway, Road, or Waterway Freight – defines transportation materials, IDLH, methods and amounts for U.S. Route 11
- Table 2.2-7, Hazardous Material, Transported Chemicals, Disposition - describes the process used for disposition
- Table 2.2-8, Explosion Event Analysis - the screening is based on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance

- Table 2.2-9, Flammable Vapor Cloud Events (Delayed Ignition) Analysis - the screening is performed based on the on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance; or maximum explosive concentration

FSAR Impact:

BBNPP FSAR, Section 19.1.5.4.5 will be revised as described in the response as indicated above and as shown below:

Highway Hazards: In FSAR Section 2.2.3, an evaluation is made of the risks posed by an accident involving hazardous material occurring on the major roads within five miles from the plant site. These are:

- Route 11 (Salem Blvd)
- ~~Route 339 (Mifflin Nescopeck Highway)~~
- Route 93 (Berwick Hazleton Highway)
- ~~Route 3036 (River Road)~~
- Route 239 (Wapwallopen Rd)
- Interstate 80

BBNPP is located approximately 1.1 miles from Route 11. Hazards on all other roads are bounded by the hazards from facilities. For each type of event and for the largest amount of hazardous material susceptible to be involved in that event, the minimum separation distance (i.e., safe distance) is calculated. The results are summarized in Section 2.2. In each case, either the largest minimum separation distance is found to be less than the actual distance, or a quantitative risk assessment was used to show that the rate of exposure to a peak positive incident overpressure in excess of 1 psi (6.89 kPa) was less than 1.0E-07 per year when based on realistic assumptions. Therefore it is judged that highway hazards would not adversely affect the safe operation of BBNPP.

Question 19-15:

For each identified pipeline in Section 19.1.5.4.5 of the FSAR, "Pipeline Hazards," Please provide additional detailed information indicating the approach used to screen out the hazards, and the rationale supporting use of that approach. If the quantitative risk assessment was used, describe how the exposure frequency was calculated.

Response to Question 19-15:

The screening approach used to screen out pipeline hazards in FSAR Section 19.1.5.4.5 is summarized in the following Section 2.2 tables, which provide descriptions of pipelines and details of the screening process:

- Table 2.2-9, Flammable Vapor Cloud Events (Delayed Ignition) Analysis - the screening is performed based on the on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance; or maximum explosive concentration
- Table 2.2-10, Toxic Vapor Cloud Analysis – the screening is performed based on the peak concentration and time to reach the odor and IDLH threshold concentration.
- Table 2.2-11, Description of Pipelines

Quantitative risk assessment was not used to evaluate pipeline hazards in FSAR Section 19.1.5.4.5.

FSAR Impact:

The BBNPP FSAR will not be revised in response to this question.

Question 19-16:

Section 19.1.5.4.5 of the FSAR, "Railroad Hazards," states that "In each case, either the largest minimum separation distance is found to be less than the actual distance, or the analysis shows that more than 2 minutes elapses between the time of hazard detection and reaching the IDLH, or a quantitative risk assessment was used to show that the rate of exposure to a peak positive incident overpressure in excess of 1 psi (6.89 kPa) was less than 1.0E-07 per year when based on realistic assumptions." Please provide additional detailed information describing which specific approach was used for screening, identify the approach (es), and provide the rationale(s) supporting each approach used

Response to Question 19-16:

The screening approach used to screen out railroad hazards in FSAR Section 19.1.5.4.5 is summarized in the following Section 2.2 tables, which provide details of the screening process:

- Table 2.2-7, Hazardous Material, Transported Chemicals, Disposition – describes the process used for disposition
- Table 2.2-8, Explosion Event Analysis – the screening is performed based on the on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance
- Table 2.2-9, Flammable Vapor Cloud Events (Delayed Ignition) Analysis - the screening is performed based on the on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance; or maximum explosive concentration
- Table 2.2-10, Toxic Vapor Cloud Analysis – the screening is performed based on the peak concentration and time to reach the odor and IDLH threshold concentration

Quantitative risk assessment was not used to evaluate railroad hazards in FSAR Section 19.1.5.4.5.

FSAR Impact:

The BBNPP FSAR will not be revised in response to this question.

Question 19-17:

For Section 19.1.5.4.5 of the FSAR, "Nearby Facilities Hazards", please provide additional detailed information identifying the approach (es) used for screening out the Susquehanna Steam Electric Station, Heller's Gas, and Deluxe Building Systems, and provide the rationale(s) supporting each approach used.

Response to Question 19-17:

The screening approach used to screen out the nearby facilities hazards in FSAR Section 19.1.5.4.5 is summarized in the following Section 2.2 tables, which provide details of the screening process:

- Table 2.2-6, Hazardous Material, Nearby Facilities, Disposition – describes the process used for disposition
- Table 2.2-8, Explosion Event Analysis – the screening is performed based on the on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance
- Table 2.2-9, Flammable Vapor Cloud Events (Delayed Ignition) Analysis - the screening is performed based on the on the distance to 1 psid pressure (minimum separation distance) as compared to actual distance; or maximum explosive concentration

Quantitative risk assessment was not used to evaluate nearby facility hazards in FSAR Section 19.1.5.4.5.

FSAR Impact:

The BBNPP FSAR will not be revised in response to this question.

Question 19-18:

Please provide additional detailed information regarding the basis used for screening "High Summer Temperature" hazards in Table 19.1-1 of the FSAR. Please verify that all safety-related components and other components modeled in the PRA, including HVAC systems, are designed to withstand the maximum air temperature during summer. Additionally, revise Table 19.1-1 to clearly document the rationale supporting the basis used for screening these factors.

Response to Question 19-18:

As stated in FSAR Table 19.1-1, a maximum ambient air temperature of 115 degrees Fahrenheit is assumed for buildings within the power block. BBNPP system design basis parameters, including maximum air temperature, are provided in FSAR Table 2.0-1. Power block (DC-scope) HVAC systems and BBNPP HVAC systems are designed with consideration of this outdoor temperature, and provide an acceptable operating environment.

The BBNPP FSAR, Table 19.1-1 for high summer temperature will be revised to match the Reference COL (R-COL) FSAR entry.

FSAR Impact:

BBNPP FSAR, Table 19.1-1 will be revised as described in the response as indicated above and as shown below:

External Event Hazard	Evaluation
Hail	The impact of hail is bounded by events such as tornado missiles.
High Tide	Not applicable to the BBNPP site as it is inland from the ocean.
High Summer Temperature	A maximum ambient air temperature of 115 °F is assumed for buildings within the power block. HVAC systems are designed with consideration of this outdoor temperature. The safety-related ESWS is designed for at least 27 days of operation without offsite makeup.
Hurricane	Hurricane flooding impacts are addressed in Section 19.1.5.4.2 and hurricane winds are bounded be the analysis in Section 19.1.5.4.1.

Question 19-19:

Please provide additional detailed information regarding the basis for screening "Low Winter Temperature" hazards in Table 19.1-1 of the FSAR. Also verify that all safety-related components and other components modeled in the PRA, including HVAC systems, are designed to withstand the minimum air temperature during winter. Additionally, revise Table 19.1-1 to clearly document the rationale supporting the basis used for screening these factors.

Response to Question 19-19:

As stated in FSAR Table 19.1-1, a minimum ambient air temperature of -40 degrees Fahrenheit is assumed for buildings within the power block. BBNPP system design basis parameters, including minimum air temperature, are provided in FSAR Table 2.0-1. Power block (DC-scope) HVAC systems and BBNPP HVAC systems are designed with consideration of this outdoor temperature, and provide an acceptable operating environment.

The BBNPP FSAR, Table 19.1-1 for low winter temperature will be revised to match the Reference COL (R-COL) FSAR entry.

FSAR Impact:

BBNPP FSAR, Table 19.1-1 will be revised as described in the response as indicated above and as shown below:

External Event Hazard	Evaluation
Low Winter Temperature	A minimum ambient air temperature of -40 °F is assumed for buildings within the power block. HVAC systems are designed with consideration of this outdoor temperature. Generally, there is adequate warning of icing on the ESWS so that remedial action can be taken.
Meteorite/Satellite Strike	All sites have approximately the same frequency of occurrence. Low probability event.