BellBendCOLPEm Resource

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Sent: Tuesday, February 16, 2010 4:06 PM
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Cc: BellBendCOL Resource; Colaccino, Joseph; Tatum, James; Segala, John; Hearn, Peter
Subject: Bell Bend COLA - Request for Information - Final Letter No. 84 (RAI No. 84) - SBPA - 3990
Attachments: Final RAI Letter 84 - SBPA 3990.doc

Attached is RAI No. 84 for the Bell Bend COL Application. Based our discussion today, we understand you have no questions on this RAI. You are requested to respond to this request within 30 days. If additional time is required to respond, please inform me of your proposed schedule to respond at your earliest opportunity.

If you have any questions, please contact me.

Michael A. Canova
Project Manager - Bell Bend COL Application
Docket 52-039
EPR Project Branch
Division of New Reactor Licensing
Office of New Reactors
301-415-0737

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Application Revision 1

2/16/2010

Bell Bend
Docket No. 52-039
SRP Section: 09.02.05 - Ultimate Heat Sink
Application Section: 9.2.5

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

09.02.05-1

The staff noted that Item 9-2 in Table 1.8-1 of the Bell Bend Final Safety Analysis Report (FSAR) was revised to refer to the essential service water system emergency makeup system (ESWEMS) instead of the ultimate heat sink (UHS). This is a departure from the standard supplement that was provided by the reference combined operating license application for the Calvert Cliffs plant and it does not reflect the interface requirement that is specified in Tier 2 of the U. S. EPR FSAR, Table 1.8-1, for this item. This change was not recognized and addressed by the applicant. Consequently, the applicant needs to revise Table 1.8-1, Item 9-2, in the Bell Bend FSAR accordingly or recognize and address the proposed change as appropriate.

09.02.05-2

During its review of the information related to the site-specific UHS support systems in Bell Bend FSAR Table 3.2-1, "Classification Summary for Site-Specific SSCs," the staff found that additional information is needed and the Bell Bend FSAR needs to be revised accordingly to address the following items in accordance with GDC 1 requirements:

- While Bell Bend FSAR Table 3.2-1 indicates that non-safety-related piping is Seismic Category II, this designation is not clearly indicated on Bell Bend FSAR Figure 9.2-3. Also, the description in Bell Bend FSAR Section 9.2.5.3 indicates that some piping is used that does not satisfy American Society of Mechanical Engineering (ASME) specifications, but this information is not adequately described in Bell Bend FSAR Section 9.2.5, or indicated in Table 3.2-1 or on Figure 9.2-3.
- Bell Bend FSAR Table 3.2-1 indicates that the intake screens are non-safety-related, Seismic Category II. However, the descriptive information in the Bell Bend FSAR is not sufficient to demonstrate that the screens are not needed to ensure that the ESWEMS will not be adversely impacted by large debris. If the screens must be relied upon in this manner, they should be designated as safety-related, Seismic Category I. Also, Bell Bend FSAR Section 9.2.5.identifies this item as "bar screens" and the descriptive information in Bell Bend FSAR Chapter 3 refers to this as "steel gratings." Consistent terminology should be used throughout the Bell Bend FSAR to avoid confusion.
- Bell Bend FSAR Table 3.2-1 indicates that instrument and controls in the ESWEMS pumphouse are safety-related. This is not consistent with Figure 9.2-3 which indicates that the intake bay level and temperature instruments are non-safety-related. This inconsistency needs to be corrected. Also, in order to avoid

confusion, all instruments for the site-specific UHS support systems should be identified on Table 3.2-1.

- Bell Bend FSAR Table 3.2-1 is incomplete in that it does not provide classification designations for the site-specific parts of the blowdown and chemical treatment systems, and the classification designations for the ESWEMS strainer motors are also missing.

09.02.05-3

Additional information is needed to identify the location for each train of the skid-mounted chemical treatment system. Furthermore, the impact of chemical treatment system failure on safety-related equipment needs to be considered and addressed in accordance with GDC 2 requirements. Also, this information needs to be reflected in the Bell Bend FSAR.

09.02.05-4

The UHS must be capable of dissipating residual heat during normal operation and accident conditions over the life of the plant in accordance with GDC 44 requirements. The descriptive information (including figures) related to the site-specific parts of the UHS support systems was reviewed by the staff to assess the adequacy of these systems to perform their UHS support functions. In addition to the information referred to in RAIs 9.2.5-02 (ID 3990/15468) and 9.2.5-03 (ID 3990/15469**)**, the staff found that some of the information is incomplete, inaccurate, or inconsistent. Consequently, the applicant needs to address the following items in this regard and revise the Bell Bend FSAR as appropriate:

- Information specific to the certified design is comingled with site-specific information. For example, the description includes discussion about the design and functioning of isolation valves for the UHS support systems which is specific to the U. S. EPR certified design. In order to avoid future confusion about the licensing basis for Bell Bend, the description needs to clearly identify the information and design attributes that are site-specific versus the information and design attributes that are specific to the U. S. EPR certified design. Any deviations from the certified design need to be properly identified and addressed.
- The descriptive information does not explain the criteria that were used in establishing the appropriate pipe sizes (such as limiting flow velocities).
- The descriptive information does not provide design details such as system operating temperatures, pressures, and flow rates for all operating modes and alignments.
- The figures do not show the displays for the indications (e.g., local, remote panel, control room), and the instruments that provide input to a process computer and/or have alarm and automatic actuation functions.
- The descriptive information does not include a listing of alarms.
- The figures do not show relief valves; and specific set points for relief valves, alarms, and automatic functions such as filter backwash are not indicated. Also, the bases for these set points need to be explained in the system description.

- The design basis and site-specific parts of the blowdown system are not adequately described, figures showing important design details are not provided, and the consequences of failures on safety-related equipment are not addressed.
- The applicant did not explain the methods for determining the maximum water loss rate and total water loss from the cooling tower basins for the post-accident period from 72 hours to 30 days, including leakage, strainer flush, and blowdown assumptions, and the establishment of the most limiting meteorological conditions and the correlation with the heat load to yield the maximum evaporation rate. Also, Bell Bend FSAR Section 9.2.5 indicates that the worst-case 30 day period is depicted in Table 2.3-1, but this table does not provide information of this nature.
- The applicant did not explain the basis for the emergency makeup water flow rate determination, including limiting temperature requirements and excess margin that is available to accommodate expected degradation in system performance and uncertainties that exist in the analysis.
- The maximum normal makeup and blowdown rates are based on a wet bulb temperature of 81 °F (27 °C). This is not conservative in that high dry bulb temperatures coincident with low relative humidity (as opposed to coincident wet bulb temperature) will result in maximum evaporation rates. Also, the methodology for calculating the evaporation rate and water inventory that is required must either be the same as that approved for the U. S. EPR standard plant or identified as a departure and justified accordingly; and therefore the calculation methodology needs to be addressed.
- The maximum normal makeup and blowdown rates are based on maintaining three cycles of concentration in the cooling tower basin. The number of cycles of concentration that are appropriate is dependent on the effects of the equilibrium basin water conditions on cooling tower performance (i.e., scale buildup and fouling) and the basis for allowing three cycles of concentration needs to be explained and justified.
- Bell Bend FSAR Figure 9.2-3 indicates that the ESWEMS auto strainer debris flush lines and the ESWEMS recirculation return lines are non-safety-related Seismic Category II. However, the description in Bell Bend FSAR Section 9.2.5 does justify the conclusion that these functions are not necessary to ensure the long-term operability of the cooling towers (in which case, they would have to be designated as safety-related, Seismic Category I).
- Bell Bend FSAR Section 9.2.5.2-4 indicates that the chemical treatment system can be aligned to either the normal makeup system or to the ESWEMS. However, this is not consistent with U. S. EPR Figures 9.2.1-1 (Sheet 3) and 9.2.5-1, which only show a connection to the normal makeup water system.
- Bell Bend FSAR Section 9.2.5.3 indicates that the intake bay bar screens are designed to seismic class II standards. This is incorrect in that the proper designation is seismic category, not seismic class.
- Bell Bend FSAR Section 9.2.5.3 indicates that the intake bay bar screens have a large enough face area such that flow blockage is not a concern. The applicant needs to justify this determination, and provide the maximum differential pressure for the bar screens as well as the basis for this determination and a description of the method for monitoring the differential pressure across the screens.
- Bell Bend FSAR Section 9.2.5.3 indicates that the worst case environmental conditions for evaluating evaporation from the ESWEMS retention pond are described in Section 2.3.1.2.12. The staff found that this is incorrect in that no such section exists.

- Bell Bend FSAR Section 9.2.5.3 indicates that the ESWEMS retention pond inventory is based on two ESWS trains running, but this is not consistent with the description provided in Section 9.2.5.4.2 which indicates any or all ESWS trains may be operated. Consequently, this must be factored into the design-basis assumptions for establishing the minimum required 30 day water inventory in the ESWEMS retention pond.
- Bell Bend FSAR Section 9.2.5.5 indicates that the ESWEMS is designed and built for protection against seismic and missile hazards. This description is incomplete and not consistent with the design criteria described in Bell Bend FSAR Chapter 3.

09.02.05-5

The site-specific parts of the UHS support systems are necessary to ensure that the required heat removal capability of the ESWS (including cooling towers) is maintained in accordance with GDC 44 requirements. The staff reviewed the description in Bell Bend FSAR Section 9.2.5 to confirm that the UHS support systems are adequate in this regard. The provisions to blowdown and chemically treat the water in the UHS cooling towers must be adequate to maintain the ESWS water quality necessary for performing the heat removal function and minimizing degradation of piping and components, including those of the UHS cooling tower. Additional information is needed and the Bell Bend FSAR needs to be revised accordingly to address the following design-bases considerations that pertain to chemical treatment and the ESWEMS pumps:

- In addition to the minimum flow requirement, a description is need of other considerations that are pertinent to the design basis of the ESWEMS pumps, such as head losses that may exist through the bar screens and pump suction screens, fluctuations in the supplied electrical frequency, increased pipe roughness due to aging and fouling, fouled debris filters, and the actual amount of excess margin that is provided by the ESWS pump design.
- With respect to chemical treatment, additional information is needed to describe more specifically the water quality specifications that are necessary to ensure adequate performance of the ESWS (including adequate cooling tower performance). The maintaining of specifications during normal operating, shutdown, and post-accident conditions also needs to be described, recognizing that blowdown and chemical treatment are not assured functions.

09.02.05-6

The ESWEMS must be capable of performing its UHS support function of providing makeup water to the UHS cooling tower basin for the period beginning at 72 hours post-accident through the remaining 30 day period in accordance with GDC 44 requirements. In order to satisfy system flow requirements, the ESWEMS design must assure that the minimum net positive suction head (NPSH) for the ESWEMS pumps will be met for all postulated conditions, including consideration of vortex formation. The staff found that the NPSH requirement for the ESWEMS pumps is not specified and Bell Bend FSAR Section 9.2.5 does not describe the compliance of the ESWEMS design with the NPSH requirement for the ESWEMS pumps and does not identify the excess margin that is provided by the ESWEMS design for the most limiting assumptions. Consequently,

additional information is needed and the Bell Bend FSAR needs to be revised accordingly to specify the minimum NPSH requirement is for the ESWEMS pumps and to fully explain the compliance of the system design with minimum NPSH requirement (including consideration of vortex formation), and identify the excess margin available for the most limiting case. Sufficient information is needed to enable the staff to independently confirm that the design is adequate in this regard, including limiting assumptions that were used along with supporting justification.

09.02.05-7

The site-specific parts of the UHS support systems are necessary to ensure that the required heat removal capability of the ESWS (including cooling towers) is maintained in accordance with GDC 44 requirements. The staff reviewed the description in Bell Bend FSAR Section 9.2.5 to confirm that the UHS support systems are adequate in this regard. Bell Bend FSAR Table 2.0-1 shows that the 1% exceedance minimum ambient air temperature for the site is -15.1 °F (-26.2 °C), and that the 0% exceedance value is -23.7 °F (-30.9 °C). Therefore, low temperature operation and potential freezing is a consideration for the UHS support systems. U. S. EPR FSAR Section 9.2.5 indicates that cooling tower bypass flow is used to keep the water in the cooling tower basin within established limits and protect the ESWS from freezing. This will also protect ESWS blowdown flow from freezing, provided that ESWS blowdown is not secured during low temperature conditions. However, cooling tower bypass flow will not protect ESWEMS or the chemical treatment system from freezing. Bell Bend FSAR Section 9.2.5 does not address low temperature operation of the UHS support systems. Consequently, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to describe provisions that will be implemented to ensure that the UHS support systems will remain capable of performing their functions during low temperature conditions.

09.02.05-8

The ESWEMS must be capable of performing its UHS support function of providing makeup water to the UHS cooling tower basin for the period beginning at 72 hours post-accident through the remaining 30 day period in accordance with GDC 44 requirements. System design features, operating procedures, and surveillance testing must provide adequate assurance that the ESWEMS safety function will not be compromised due to damaging waterhammer transients. The ESWEMS description was reviewed to confirm that the applicant has adequately addressed waterhammer considerations. Because all four safety-related trains are normally in standby, there is a potential for them to drain back to the retention pond over time and create a large air void in the ESWEMS piping. If this occurs, an automatic actuation of the ESWEMS trains could result in a waterhammer. Any loop seals in the ESWEMS that are caused by component design or piping configuration would tend to result in a much more severe waterhammer event. The ESWEMS description does not adequately consider and address waterhammer vulnerabilities (such as this) and does not demonstrate that the system design features, operating procedures, and periodic surveillance testing provide adequate assurance that the ESWEMS safety functions will not be compromised by waterhammer events. Consequently, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to address waterhammer considerations. Also, if system valves are

relied upon to prevent back-leakage, the ESWEMS description in the FSAR needs to fully explain and justify the maximum amount of back-leakage that is allowed, and specify the leakage acceptance criteria that will be established in the in-service testing program for these valves and the basis for this determination.

09.02.05-9

The ESWEMS must be capable of performing its UHS support function of providing makeup water to the UHS cooling tower basin for the period beginning at 72 hours post-accident through the remaining 30 day period in accordance with GDC 44 requirements. Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," was issued to address the observed degradation over time of service water systems. The GL called for implementation of programmatic controls, surveillance, and routine inspection and maintenance to assure that the performance capability and integrity of service water systems are adequately maintained over time. Because the ESWEMS is an extension of the ESWS for Bell Bend, the provisions of GL 89-13 apply. However, the staff noted that Bell Bend FSAR Section 9.2.5 does not explain the application of the provisions of GL 89-13 to the ESWEMS. Consequently, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to provide the provisions specified by GL 89-13 for implementing the operability and reliability of the ESWEMS over the life of the plant.

09.02.05-10

The ESWEMS must be capable of performing its UHS support function of providing makeup water to the UHS cooling tower basin for the period beginning at 72 hours post-accident through the remaining 30 day period in accordance with GDC 44 requirements. During a recent review of industry operating experience, the staff found that some licensees were experiencing significant wall thinning of pipe downstream of butterfly valves that were being used to throttle service water flow. In order to assure that this will not occur in the ESWEMS, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to describe the extent that butterfly valves will be used to throttle ESWEMS flow and the provisions that are credited to prevent consequential pipe wall thinning from occurring.

09.02.05-11

The ESWEMS must be capable of performing its UHS support function of providing makeup water to the UHS cooling tower basin for the period beginning at 72 hours post-accident through the remaining 30 day period in accordance with GDC 44 requirements. Over time, debris such as spalled concrete, tools, miscellaneous hardware and objects, and large amounts of silt have accumulated in intake bays at some operating nuclear power plants. These items can be drawn into the suctions of the ESWEMS pumps (which take water from the intake bay) and pose a hazard for pump operation. Typically, screens are provided to protect the pump suctions from this sort of hazard. The staff noted that there is no discussion in FSAR Section 9.2.5 to address this vulnerability. Consequently, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to describe the protection of the ESWEMS pumps from the intrusion

of debris that can accumulate in the intake bay and the prevention of the excessive accumulation of silt such that pump performance will not be degraded over extended periods of time.

09.02.05-12

The ESWEMS is a safety-related system and in accordance with GDC 45 requirements, it must be designed so that periodic inspections of piping and components can be performed to assure that the integrity and capability of the system will be maintained over the life of the plant. The staff finds the design to be acceptable if the FSAR describes inspection program provisions that will be implemented and are considered adequate for this purpose. While Bell Bend FSAR Section 9.2.5.6 indicates that periodic inspections will be performed, the staff considers the information that was provided to be incomplete and inadequate. In particular, it does not (1) specify programmatic requirements and procedural controls that will be implemented for performing inspections; (2) describe the extent and nature of inspections that will be conducted; (3) address the major ESWEMS components and structures, such as pumps, valves, strainers, intake bay and bar screens, retention pond, and associated piping (including buried piping); (4) consider and address industry experience; and (5) address the specific provisions of GL 89-13. Consequently, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to address these considerations such that the continued operability and reliability of ESWEMS is assured over the life of the plant commensurate GDC 45 requirements.

09.02.05-13

The ESWEMS is a safety-related system and in accordance with GDC 46 requirements, it must be designed so that periodic pressure and functional testing of components can be performed to assure the structural and leak tight integrity of system components, the operability and performance of active components, and the operability of the system as a whole and performance of the full operational sequences that are necessary for accomplishing the ESWEMS safety function in accordance with GDC 46 requirements The staff finds the design to be acceptable if the FSAR describes pressure and functional test program requirements that will be implemented and are considered adequate for this purpose. While Bell Bend FSAR Section 9.2.5.6 indicates that periodic testing will be performed, the staff considers the information that was provided to be incomplete and inadequate. In particular, it does not (1) specify programmatic requirements and procedural controls that will be implemented for performing inspections; (2) describe the extent and nature of inspections that will be conducted; (3) address the major ESWEMS components and structures, such as pumps, valves, strainers, intake bay and bar screens, retention pond, and associated piping (including buried piping); (4) consider and address industry experience; and (5) address the specific provisions of GL 89-13. Consequently, additional information is needed and the Bell Bend FSAR needs to be revised accordingly to address these considerations such that the continued operability and reliability of ESWEMS is assured over the life of the plant commensurate GDC 46 requirements.

09.02.05-14

The staff reviewed the site-specific TS requirements that are proposed for ESWEMS in Part 4 of the COL application to confirm that they adequately reflect the information provided in Bell Bend FSAR Section 9.2.5 and to confirm that the TS Basis accurately represents the TS requirements that are proposed. The staff found that the proposed TS requirements appear to be incomplete and not entirely consistent with Standard Technical Specification requirements. Consequently, additional information is needed and the Bell Bend FSAR and TS requirements need to be revised accordingly to address the following items:

- If long-term cooling capability of the ESWS (heat exchangers and cooling towers) relies upon certain water quality specifications, TS requirements need to be established to specify appropriate actions and surveillance requirements to ensure that the heat removal function can be performed over the 30 day post-accident period as assumed. This is related to **RAI 9.2.5-05 (ID 3990/15471).**
- While the pond level requirement that is proposed is consistent with the description in Bell Bend FSAR Section 9.2.5, the basis for this level has not been adequately described in FSAR Section 9.2.5. This is related to **RAI 9.2.5-04 (ID 3990/15470)**.
- The basis for the existing surveillance requirement that specifies a minimum makeup water flow rate of 300 gpm needs to be described in Bell Bend FSAR Section 9.2.5. This is related to **RAI 9.2.5-04 (ID 3990/15470)**.
- Because the ESWEMS is normally in standby mode, the frequency of surveillance flow testing should be commensurate with systems that are normally in standby mode; once every 24 months is not appropriate. Also, in addition to periodically verifying valve positions, surveillance requirements are needed to periodically verify that the system has not drained, and to confirm that instrumentation and set points for actuation of automatic functions and annunciation are within calibration.
- A surveillance requirement is needed to periodically inspect and clean the intake bay bar screens, and to inspect for silt buildup.
- The description of the ESWEMS that is provided in the background section to replace the first set of bracketed information is incomplete in that it does not include the recirculation valve, instruments and controls, and associated piping.
- The description of the ESWEMS that is provided in the LCO section to replace the bracketed text needs to be revised to include the strainer.

09.02.05-15

In accordance with 10 CFR 52.80(a), COL applicants must propose inspections, tests, analyses, and acceptance criteria (ITAAC) that provide reasonable assurance that if the ITAAC are performed and the acceptance criteria met, the facility has been constructed in conformity with the combined license. The NRC staff reviewed the ITAAC proposed in Part 10 of the Bell Bend COL application for ESWEMS, as listed in Table 2.4-19. The staff found that in general the proposed ITAAC are incomplete. A more comprehensive review of the design basis information and important design details and features associated with the ESWEMS (including pumphouse and pond) is needed to establish a complete list of ITAAC that when completed, will provide reasonable assurance that the ESWEMS as constructed will be in conformance with the Bell Bend combined license in accordance with the requirement specified by 10 CFR 52.80(a). Though not intended to be a complete list, the following are examples of issues that were identified by the staff:

- A figure and tables are not provided to uniquely identify the SSCs being inspected, and to clearly specify the arrangement; mechanical design features; I&C design features, displays, and controls; and electric power design features.
- Physical separation is only specified for each mechanical division, but physical separation should also be specified for electrical divisions as well.
- The required flow for the bar screens (Item 14) needs to be specified; and the basis needs to be explained in FSAR Section 9.2.5.
- The capability to provide makeup water (Item 17) needs to specify the limiting conditions that are required.
- Pump NPSH (Item 18) needs to be confirmed by test results against quantitative acceptance criteria, based most limiting conditions of maximum flow, lowest level that will be achieved in the pond after 30 days post accident, and maximum temperature (analysis can be used for temperature correction).
- The dimensions of the pump well (especially depth relative to pump suction and overall height) need to be confirmed.
- Recirculation line discharge back to the pond needs to be confirmed.
- The ITAAC do not stipulate that the ESWEMS is accessible for performing periodic inspections as required by GDC 45.
- No ITAAC are provided to address design requirements for the bar screens and strainers.
- No ITAAC are provided to address design requirements for strainer motors and corresponding power supplies.