Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

December 21, 2011

Mr. Michael J. Caverly
VP-Financial Nuclear Development
PPL Bell Bend, LLC
Two North Ninth Street
Allentown, PA 18101

Re: Bell Bend Nuclear Power Plant; BNP-2011-126;
Project Response Status and Filing of Joint Permit Application;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Caverly:

Susquehanna River Basin Commission (Commission) staff has reviewed the "Project Response Status and Filing of Joint Permit Application" for the Bell Bend Nuclear Power Plant (BBNPP) submitted in the referenced correspondence. Our comments below pertain to the Joint Permit Application (JPA) Binder 3, Appendix B, Section 7, Subsections 3, 4, 5, and 6. Additionally, responses to other sections of Enclosure 1 to BNP-2011-126, Response Summary and JPA Cross-Reference, will be under separate cover.

1. In Section 3, the response provided in BNP-2011-071 was sufficient to satisfy the Commission regarding dilution of acid mine drainage from Nescopeck Creek.

2. In Section 4.3, first paragraph, there is a statement that the CORMIX model has no calibration parameters. The Commission is concerned that the CORMIX model does not accurately model the heated effluent from the Susquehanna Steam Electric Station (SSES) diffuser. As noted in Table 4-2, there is significant discrepancy between the observed distance to the 0.5°F isotherm and the distance to the 0.5°F isotherm computed by the CORMIX model. This comment was previously transmitted in a letter dated September 23, 2011. A sensitivity analysis should be performed to assess the potential plume dimensions using a range of input parameters and environmental conditions (depth, velocity). This section should include a description of how the difference in modeled/observed results were applied to the scenario simulations in Section 4.5 (Thermal Plume Size and Configuration Estimates).

   In the third paragraph, the plume edges were defined by one standard deviation from the centerline. The Commission questions this assumption based on the configuration of the diffuser, which is 120 feet long with 72 ports. Additionally, the data set used for the standard deviation calculation should be described.

The Commission will correlate our response to BNP-2011-202, dated October 31, 2011, regarding the CORMIX model, pending resolution of the above comment.

3. In Section 4.4, the Commission considers summer low flow conditions to be the most critical because they represent flows in the range where a passby flow is most likely to be required. In Table 4-3, we question the water temperatures in the summer low flow scenario. Based on the sonde temperature recordings in Section 5.0, the 62.3°F water temperature for the Susquehanna River and the 62.4°F temperature for the SSES blowdown are inappropriately low. The summer low flow scenario should be based on worst case, most likely in the July to August time frame, and the temperatures should be peak temperatures which are over 90°F as indicated by the sonde measurements in Section 5.0. Additionally, we question the blowdown flow rate and blowdown temperature attributed to BBNPP as measured on September 23, 2004. For BBNPP, the calculated peak values should be used. The SSES blowdown flow rate for the summer low flow scenario should not be the December mean, as listed in Table 4-3. The peak summer blowdown should be used. It appears as though the information in the table is reversed for SSES blowdown temperature. The inputs to the model should be verified for correctness and the model input/output should be provided. The Commission requires Tables 4-3 and 4-4 be revised based on resolution of the above comments.

4. In Section 4.5, Figures 4-10 and 4-11 should be revised to add a 0.5°F isosurface to more fully depict the thermal plume from the blowdown effluent.

5. In Section 4.6, the Commission considers summer low flow conditions to be the most critical with regard to potential impacts; therefore, the summer low flow end of the near field should be used for dissolved oxygen (DO) calculations.

6. In Section 4.7, Figure 4-13, the vertical axis is labeled Fahrenheit; however, the values appear to be Celsius.

7. In Section 5, the design of the study does not allow for full evaluation of the objectives outlined in this section and in Section 9 of the Aquatic Impact Studies Workplan transmitted by BNP-2010-103, dated April 29, 2010. The location of the sondes, the defined critical period for young-of-year (YOY) smallmouth bass (SMB), and the use of different temperature and DO concentrations in the analysis should relate directly to the purpose of the study. As noted below, the Commission requires additional study before modification of our standard passby flow guidance can be considered.

   The stated purpose of the study was to evaluate whether stressful water quality conditions occurred in 2010 in microhabitats and main channel habitats during the critical period for juvenile SMB, and to assess if consumptive water use may exacerbate these conditions in microhabitats concomitant with depth changes. Juvenile SMB spend the first 2 to 3 months in backwater microhabitats where they may be stressed by high temperatures and low DO leading to infection by the

bacterium *Flavobacterium columnare* as reported by Chaplin et al. (2009). Adult fish in main channel habitats do not appear to be affected by the bacterium, likely due to the availability of more favorable water quality during the summer (typically cooler and better oxygenated); therefore, it is not clear why main channel habitats were evaluated since YOY SMB do not use these areas during the critical period. Evaluation of additional backwater or shoreline habitats where YOY SMB have been observed would have yielded more data from these more critical habitats.

The critical period for YOY SMB is defined in the current study differently than in Chaplin et al. (2009). Based on the life history of SMB in the Susquehanna River, the critical period for YOY SMB (the first 2 to 3 months after swim-up) was estimated as May 1 through July 31 (Chaplin et al.; 2009), while the current study evaluated the critical period as July 1 through September 30. The rationale for the use of this time period is not provided, and it is likely YOY SMB move from the microhabitats in August.

Reference to temperature and DO concentrations that may be stressful to YOY SMB are given as greater than 84°F and less than 5.0 milligrams per liter (mg/L) in Section 5.1, although temperatures greater than 87°F and DO less than 4.0 mg/L are evaluated throughout the rest of the study. Regardless of Pennsylvania Department of Environmental Protection (PADEP) water quality criteria, temperature and DO concentrations that are critical to YOY SMB survival should be evaluated to understand the potential for stressed and diseased fish.

8. In Section 5.1, last sentence, it is important to note that at low flows in the Q7-10 range, many areas of the river become characterized as backwater or shallow shoreline because of the damming effect of emerging rock strata, reduced flow, and reduced water depths. The Commission requires a more rigorous review of the study area to determine the size and location of these backwater areas during low flow conditions. This determination will help assess the magnitude of the potential impact to YOY SMB caused by reduced flow due to BBNPP consumption.

9. In Section 5.2, Table 5-1, details should be provided to indicate if these temperatures are daily averages or an instantaneous maximum limit.

10. In Section 5.3, the statement that BBNPP consumptive water use is "approximately 1% of the average flow" is not relevant. At the Q7-10 flow of 843 cubic feet per second (cfs), the BBNPP consumptive use of 43 cfs constitutes approximately 5.1% of the river flow individually, and much greater when considered cumulatively with other known consumptive uses upstream.

    In Section 5.3, first paragraph, the primary objective is stated in the last sentence; however, it would be more appropriate to include in Section 5.1. It should not be limited to backwater areas, but also include shoreline areas where flows and depths are lower and use by YOY SMB has been documented.

On page 67, the analytical approach presented, increased duration of potential exposure, is not comprehensive. Data from more than 2 years must be analyzed to draw valid conclusions regarding the increased duration of potential exposure. Periods of low flow, such as the early 2000's and mid-1960's, should also be analyzed to assess the impact. Additionally, analysis is required for the time period from July 1 through September 30, evaluating the increased magnitude of the impact, defined as temperature over 87°F and DO less than 4 mg/L, on YOY SMB caused by increased temperature and decreased DO resulting from BBNPP consumptive use. Additionally, a similar analysis should be performed using 84°F and 5 mg/L DO as limiting criteria to be consistent with Section 5.1 and the Chaplin et al. (2009) study. The sonde data presented in Sections 5.5.1 and 5.5.2 would indicate there are days that the additional 0.5°F will result in the maximum temperature for the day exceeding 87°F. Similarly, there are additional days that the DO is less than 4 mg/L because of the BBNPP consumptive use. Both effects will potentially increase stress on juvenile SMB. Finally, the period being analyzed should be expanded to include May and June to determine if there are impacts to SMB fry.

11. In Section 5.4, the two sondes located at the Environmental Lab are out of the study area and produce data that are not relevant to the purpose of the study. Similarly, the two sondes located at the Berwick Test Track Ramp are out of the study area and produce data that are not relevant to the study. Additionally, the data are not relevant because the flows in that area of the river do not meet the criteria of "backwater" defined in Section 5.1.

    In Section 5.4, second paragraph, using paired sondes in this study with one of the pair in deeper water does not address the objective of this study. Placing additional sondes in backwater or shoreline habitats would provide more relevant data. A location closer to the area of interest where YOY SMB have been observed in the past should be used, allowing for a more complete assessment of these microhabitats within this shallow water area of the river.

    In Section 5.4, fifth paragraph on page 70, the need for determining the relationship between the upstream and downstream locations has not been provided in the objectives and, therefore, the rationale for the upstream location and downstream location is not justified. To fully evaluate potential impacts of consumptive use on YOY SMB habitat, microhabitats primarily within the riffle portion of the study area where YOY SMB have been documented should be evaluated.

    On page 72, the Pennsylvania State Water Quality Criteria provides useful parameters for analysis; however, the purpose of the study is broader than meeting these criteria. The objective of the study, as defined in Section 5.1, is to analyze the impact of the consumptive use of water by BBNPP on juvenile SMB and SMB fry and, therefore, other parameters should be analyzed, such as those defined in the Chaplin et al. (2009) study.

On page 73, the analysis on Figure 5-6 indicates that water temperatures in 2010 were warmer than the historical average. The text should explain the data collection method and location(s) of the temperature recordings. To draw valid comparisons with the 1974 to 2009 time frame, the collection method and location should be consistent. Chaplin et al. (2009) indicates that a difference of 0.8°C in water temperature was noted in 2008 compared to the historical record (1974 to 1979), consistent with warming trends in other parts of the world. Based on this, the data from 2010 also should be compared to the more recent record (2006 to 2009). It should be noted that, if this indicates a warming trend, the impact of the BBNPP consumptive use on SMB in the future will be exacerbated because of the increased stress caused by natural conditions.

12. In Section 5.5, Table 5-5, the most extreme temperature and DO recordings were at Sonde #1 at Goose Island. Additional data should be obtained from similar areas in the study area to determine the extent and magnitude of the temperatures and DO levels.

In Section 5.5.1, first paragraph, because temperatures greater than 84°F were indicated as being stressful to YOY SMB in Section 5.1, this analysis should include the frequency of temperatures exceeding 84°F as well.

In Section 5.5.1, in the next to last sentence, what is the basis for the statement that the reduced 0.5-inch water level results in an approximate <0.5°F water temperature change?

In Section 5.5.1, in the last sentence, the statement, "These potential changes are small in comparison to natural diurnal T and DO changes." may be valid; however, the changes in temperature and DO caused by BBNPP consumptive water use will most likely cause the peak temperature in the diurnal cycle to be higher and the lowest DO level in the diurnal cycle to be lower, causing additional potential stress to YOY SMB. The incremental increase in extreme temperatures and incremental decrease in DO levels should be noted.

The temperature and DO data should be analyzed to determine any relationship with flow data. These data could then be used to assess the effect of a 43 cfs withdrawal on temperature and DO, especially in juvenile SMB habitat.

In Section 5.5.1, Figure 5-7, the figure on the bottom panel of page 76 needs to be resized to be consistent with the other graphs in this section.

In Section 5.5.2, because DO concentrations less than 5.0 mg/L were indicated as being stressful to YOY SMB in Section 5.1, this analysis should include the frequency of hourly observations below this concentration as well.

In Section 5.5.2, it should be noted that the lowest DO levels were recorded at Sonde #1 at Goose Island. As noted above, additional data are required to determine the extent and magnitude of the low DO levels.

In Section 5.5.2, Figure 5-10, the July period for Sondes #5 and #6 includes the number of observations above each bar. The other graphs in this section should be consistent with the format used for Sondes #5 and #6.

In Section 5.5.4, second paragraph, it is noted that YOY SMB vacated areas when temperatures exceeded 87°F occasionally in July, but more often in August. These observations support the critical period for evaluating YOY, which is identified by Chaplin et al. (2009) as May 1 through July 31. Additionally, the observations from the SMB chronology indicate YOY SMB were observed with fungus at water temperatures of 84°F and higher, indicating the need to evaluate this temperature range.

13. In Section 5.6, first paragraph, it appears that in areas where water temperature was approaching 90°F and SMB were not observed in early July, these fish may have moved out prematurely because the observations from the appendix indicate other backwater and shoreline areas that were slightly cooler still held YOY SMB. This warrants further consideration of the statement that fry had migrated to deeper river water since they had reached juvenile size.

    In Section 5.6, fourth paragraph, it is indicated that deviations in water temperature and DO from the Pennsylvania State Water Quality Criteria were of short duration and limited to shallow inshore locations. These shallow inshore locations are the critical habitats for YOY SMB that are of concern in this area. The fact that diseased and dying fish were observed indicates these were likely stressful conditions. This is understated in these conclusions.

    In Section 5.6, the statement in the fifth paragraph that "the incremental effect of the 43 cfs BBNPP consumptive water use, which showed no significant change or increase in the stressors." cannot be supported by the data collected and the analysis performed in this study. Chaplin et al. (2009) demonstrated that SMB in the Susquehanna River have been declining most likely due to the stressors noted in this study: increased temperatures and decreased DO. Additional study is required to determine the magnitude and extent of the effects of BBNPP consumptive water use on SMB. Backwater and shallow shoreline areas within the study area should be identified and sondes located appropriately to gather the required data. Four of the six sondes in this study, two at the Environmental Lab and two at the Berwick Test Track Ramp, were not located in the study area and, therefore, it is inappropriate to utilize these data to draw conclusions. Data are required from other backwater areas within the study area, such as the backwater areas in the Rocky Island vicinity.

14. In Section 6.1, the analysis of the impact of BBNPP consumptive water use on downstream users was based on Q7-10 flows. Because flows less than Q7-10 were

not analyzed, the Commission cannot accept a passby flow requirement less than Q7-10.

In Table 6-1, two downstream water users are listed, Cherokee Pharmaceuticals withdrawing 34.392 million gallons per day (mgd) and Danville Municipal Authority withdrawing 2.000 mgd on average, indicating the potential BBNPP consumptive use to impact their operations. These evaluations must be completed before conclusions can be drawn regarding the impact of BBNPP consumptive use on downstream users.

In Table 6-2, for four of the seven downstream dischargers listed in the table, the impact of BBNPP consumptive water use is indeterminate. The analyses on these downstream dischargers must be complete before conclusions can be drawn regarding the impact of BBNPP consumptive water use on their operations. In some cases, as noted, the analysis should include input from PADEP.

The Commission recognizes that PPL Bell Bend, LLC (PPL) does not control actions or inaction of the downstream users with regard to requests that they perform an impact analysis; however, the Commission does require a level of effort analysis by PPL to address the potential impacts of the consumptive use of water by BBNPP on the downstream users. Reporting on responses from the downstream users requires some analysis by PPL to assure that the responses are adequate. In Table 6-2, apparently some of the downstream operations that discharge water into the river have conferred with PADEP to assist with their internal analysis. This may be an option for PPL when analyzing these impacts.

If you have any questions regarding the above, please feel free to contact Paula Ballaron at (717) 238-0423, extension 222.

Sincerely yours,

James L. Richenderfer, Ph.D., P.G.
Director, Technical Programs

cc: Gary Petrewski; PPL
Michael Canova; USNRC
Patricia Vokoun; USNRC
Amy Elliott; USACE, Baltimore District
Susan Weaver; PADEP
Eugene Trowbridge; PADEP
Mark Hartle; PFBC
Tom Shervinskie; PFBC
Jennifer Kagel; USFWS
Larry Miller; USFWS
Jamie Davis; USEPA